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Adaptive Rowing: A Guide

Foreword

My first encounter with Simon Goodey was back in 2006 at an event notorious among all rowers, the British Indoor Rowing Championships, Birmingham. Up until 18 months prior to this competition, which was in no doubt to form a pivotal change in my life, I was a fit and active 20 year old rugby player, about to complete my degree with high hopes of joining the Royal Marines. This was all to change in February 2005 when I suffered a spinal injury leaving me paralysed from the waist down. The ensuing 18 months were in no doubt the most challenging I had to face, seeing my legs atrophy and body deteriorate whilst stuck in hospital, let alone having to adjust to my new surroundings from the confines of a wheelchair, something I initially resented, but have learnt to accommodate with time. Nevertheless, I was determined to get my fitness back as much as possible and rowing was the perfect outlet.

After initially using the Functional Electrical Stimulation (FES) assisted rowing trying to explore ways to improve my chances of recovery, I soon got the rowing 'bug' pushing myself to break certain times and distances, however it was at the Indoors in 2006 I was offered the opportunity to explore rowing on the water with Simon. I initially had reservations about getting out on the water, having no knowledge of the boats, let alone that the sport was due to receive Paralympic status in 2008. Simon's relaxed and encouraging manner soon put me at ease and I was surprised by his appreciation of many of the issues the average wheelchair user faces, both physically and psychologically. The feeling of freedom getting out on the Royal Albert Dock and seeing my chair disappear in the distance was unforgettable, with the satisfaction knowing I was challenging my body physically in a new way. This was the beginning of a journey with the involvement and help of many people to target and win a Paralympic gold medal, however the importance of what the sport has achieved and what it can give those with disabilities carries a far greater significance, which cannot be underestimated.

This book provides a wealth of material that has been developed since the establishment of adaptive rowing and forms the foundations the sport is based on, whilst providing an educational resource for those working or planning to work with individuals with a disability in the sport of rowing. The book successfully amalgamates work across a vast spectrum and in doing so successfully breaks down some of the preconceptions and barriers around disability and demonstrates the possibilities for both the individual and expectations and limitations from a coaching and support role across the broad disability spectrum. I have no doubt that this resource will form the basis for greater understanding, appreciation and hopefully encourage participation in this fantastic sport, enabling it to enhance and further the lives of many.

Tom Aggar

World and Paralympic Champion

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Preface

Adaptive Rowing provides meaningful opportunities for individuals with a disability to enjoy participating in the sport. Supported by a range of technical and coaching resources, these rowers can reach their potential and improve their fitness.

This is a resource for coaches, coach educators, school teachers and individuals with a disability who wish to access rowing. It details classification, equipment, rigging, and coaching considerations for various diagnostic groups, as well as considering the therapeutic values of rowing, injury management and prevention.

People with disabilities have previously been excluded from rowing due to inadequate facilities and equipment. However with changes in legislation and societal expectations many of these issues have been addressed, such as access to water and the provision of suitable equipment. Moreover a framework exists with development pathways from grass roots right through to Paralympic competition.

Adaptive implies that the equipment is 'adapted' to the user, rather than the activity being 'adapted' to them. Many adaptive rowers can be integrated into mainstream rowing clubs through inclusive practice, which is discussed in this guide.

Rowing offers someone with a physical disability the opportunity to leave their wheelchair on the dockside and perform an effective upper body and cardiovascular exercise. For rowers with a visual impairment, coxed boats help build confidence which may enable the individual to progress to single sculling. Rowers with an intellectual impairment can learn to master the repetitive nature of the rowing stroke.

Coaching considerations and guidelines are explained at all levels, working towards the common goal of creating more inclusive opportunities for people with a disability.

Rowing is a sport for all which challenges preconceptions about the capabilities of individuals with a disability.

I have acknowledged various international contributions from experts in the field of adaptive rowing, which without their support this guide would not have come to fruition.

Simon Goodey

Introduction - History

Rowing – A Sport for All

In the 1970s a number of adaptive rowing programmes sprang up in Australia, Great Britain, Germany, the Netherlands and the USA. In 1995 an exhibition of adaptive events was hosted at the World Rowing Championships in Tampere, Finland. Following this, between 1996-2000, FISA (Fédération Internationale des Sociétés d'Aviron) held a number of adaptive rowing seminars in Berlin, London, Rotterdam and Philadelphia.

Figure 1: Philadelphia Rowing Programme For The Disabled (PRPD). Host club for the Bayada Regatta, which has grown into the oldest and largest adaptive rowing regatta in the world.

© Philadelphia Rowing Programme For The Disabled

In 2001 FISA formed an Adaptive Rowing Commission to work on establishing a classification system and a pathway to Paralympic accreditation. The World Rowing Championships in 2002 was the first time that adaptive rowing events were integrated into the championship programme.

FISA then informed the International Paralympic Committee (IPC) that it would apply for the inclusion of rowing in the 2008 Paralympic Games.

As part of the IPC application approval process, FISA was required to demonstrate that adaptive rowing was widely practiced in a minimum of 24 countries and three regions (America, Africa, Europe, Middle East, Asia or Oceania) by 2005. This also required the national federations of at least 24 countries to have participated in international competition or regularly held national championships. FISA asked these national federations to sign the Seville Protocol as a statement of support for adaptive rowing in their countries.

The sport continued to develop with adaptive events at the 2003 World Rowing Championships in Milan, and the 2004 World Rowing Senior and Junior Championships in Banyoles, Spain. The discipline reached its highest level in 2007, during the World Rowing Championships in Munich, when 116 adaptive rowers competed in 58 boat classes.

Adaptive rowing was accepted into the programme of the 2008 Paralympic Games in 2005. The sport was admitted as a member of the IPC and its inclusion in the Games has boosted participation, given rowers more incentive to take up competitive rowing and broadened worldwide public exposure of the sport.

What differentiates adaptive rowing from other disability sports is that it is governed by the same organisations as able-bodied rowing. FISA and British Rowing work in close collaboration with the IPC to manage this Paralympic discipline, as it does with all rowing disciplines. Rowing is the only IPC sport that has an inclusive World Rowing Championships.

Defining Terminology

People First Language

When referring to a person with a disability, their name or a pronoun should come first followed by a description of their disability. It is important to identify the impairment, but not imply it has 'modified' the person, thus providing guidance on which terms to use and which are inappropriate. See the table below for examples.

The social model of disability means that whilst someone's impairment (e.g. a spinal cord injury) is an individual property, 'disability' is something created by external factors such as a lack of wheelchair access to their workplace. 'People First Language' recognises that individuals with disabilities are people first and foremost. It emphasises each person's value, individuality, dignity and capabilities.

people with disabilities an adult/a child who has a disability a person with a disability	the handicapped the disabled
people without disabilities typical kids	normal people/healthy individuals atypical kids
people with intellectual and developmental disabilities he/she has a cognitive impairment a person who has Down's syndrome	the mentally retarded; retarded people he/she is retarded; the retarded he/she's a Down's kid; a Mongoloid; a Mongol
a person who has autism	autistic
people with a mental illness a person who has an emotional disability with a psychiatric illness/disability	the mentally ill; the emotionally disturbed insane; crazy; demented; psycho a maniac; lunatic
a person who has a learning disability	he/she is learning disabled
a person who is deaf he/she has a hearing impairment loss a man/woman who is hard of hearing	the deaf
person who is deaf and cannot speak a person with a speech disorder uses a communication device uses synthetic speech	is deaf and dumb mute
a person who is blind a person who has a visual impairment man/woman who has low vision	the blind
a person who has epilepsy people with a seizure disorder	an epileptic a victim of epilepsy
a person who uses a wheelchair people who have a mobility impairment a person who walks with crutches	a person who is wheelchair bound a person who is confined to a wheelchair a cripple
a person who has quadriplegia people with paraplegia	a quadriplegic the paraplegic
he/she is of small or short stature	a dwarf or midget
he/she has a congenital disability	he/she has a birth defect

Access & Inclusive Rowing Provision

Figure 2: Redgrave & Pinsent Rowing Lake (Sheriff's Boathouse) Caversham. High-performance training centre for Great Britain Olympic and Paralympic teams.

Figure 3: London Regatta Centre embarkation ramp designed for manual wheelchair users.

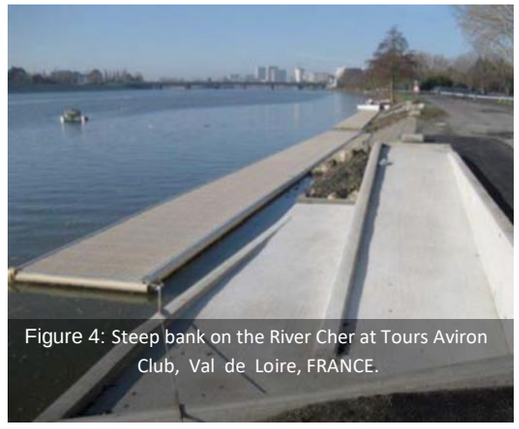


Figure 4: Steep bank on the River Cher at Tours Aviron Club, Val de Loire, FRANCE.

Figure 5: Concrete pathway with railing designed for wheelchair users, ambulant with assistive devices (crutches) and elderly club members requiring additional support.

Access to rowing can be facilitated with some thought and consideration. In addressing the potential for the inclusive provision of rowing, the following broad groups of people have been considered:

- People who use wheelchairs and ambulant people with a physical impairment
- People with a visual impairment
- People with a learning impairment
- People with a hearing impairment

Inclusive participation will only work if the right attitude exists within the club towards individuals with a disability. This attitude is far more important than any disability awareness or equity training.

Whilst access to the water or gym can be facilitated by appropriate equipment and practice, access around the clubhouse and to the 'rowing environment' is just as important. Clubs need to encourage rowers with a disability to join all club activities including social and committee occasions.

GLOSSARY
Ambulant: (medical definition) capable or strong enough to walk.

Access is much more than just providing ramps and having doorways with sufficient width for wheelchairs. This can mean including information in the appropriate sensory format as well as access to a socially welcoming environment. Always remember to accommodate the needs of people with mobility difficulties (not just wheelchair users), visual impairments, hearing impairments and learning disabilities. Their needs can vary but are just as important.

By providing access to adaptive rowing, a club will often improve the access of other groups in the community such as the young or elderly, and parents with pushchairs.

On the whole adaptive rowers practice their sport in an environment which has originally been designed and developed for able-bodied people. Often it is the features of an environment which creates the unnecessary barriers. For example the lock on the club door; why are so many locks placed at chest level of an average ambulant person, when they are of equal use at a lower level where they are accessible to someone in a wheelchair?

The facilities that enable individuals with a disability to row can be devised so that special features are not glaringly obvious. For example, a clear and well-lit notice board will be seen equally well by people with a visual impairment, as it will by the rest of the club members. This type of small change can make a huge practical difference. Aim to provide an inclusive environment so that the activities and facilities within the clubhouse are accessible to all club members irrespective of ability.

People often say: 'we would improve our provision, but we can't afford it'. Not all changes require large amounts of money and if we want to fulfil our desire to provide inclusive sport, we can find ways. A number of grants are available which British Rowing can advise on www.britishrowing.org

Many modifications and adaptations can be made by having a club plan that resolves to address access barriers every time a change or renewal is reviewed as part of the usual cycle of repairs and maintenance. Incorporating these adaptations is often no more expensive than a straight restoration of the original item.

It is important to remember that not all rowers with a disability will require any equipment adaptations or encounter any accessibility issues. This makes this group of rowers the easiest to cater for, and clubs should be encouraged to do so. Often it might simply be providing the rower with a bigger, more stable boat to enable them to get onto the water and ensuring that coaches are aware of the rower's specific needs.

Inclusive Practice

It is important for everyone in a rowing club to adopt the right attitude towards the inclusion of individuals with a disability. This often requires more thought than just addressing the physical barriers, and is essential to the success of the club's inclusive policy and practice.

> "Look first at my strengths, not at my weaknesses"

Clubs should not feel that this is a daunting exercise but rather engage with those members of the community who either have a disability or who work with people with a disability. Their knowledge and expertise can provide an essential support network for clubs wishing to embrace an inclusive policy.

There are four key elements to the successful delivery of inclusive rowing:

- Consultation
- Communication
- Coaching
- Club Administration

Consultation – Individuals with a disability often know how best to address issues of communication. It is important to consult them before making any assumptions about club strategy. This consultation will enable the club to determine the best practices for recruiting and developing adaptive rowing.

Communication – Club information given on notice boards and in newsletters should be available to club members in a sensory format that is appropriate to their needs. This is not necessarily expensive and can be something as simple as large print; Braille, audiotape, and/or language appropriate.

Coaching – Clubs with members who have a disability should ensure their coaches have some disability awareness training. For further information please contact your local British Rowing Coaching & Development Team Leader www.britishrowing.org/education&training

All coaches in British Rowing clubs are required to adopt and implement the organisation's Safeguarding policies for Vulnerable adults and Children, these can be downloaded from www.britishrowing.org/safeguarding or are available to members in hard copy from the British Rowing office (0208 237 6700). Particular attention is also drawn to the associated guidance document WG3.9 *'Protecting Children and Young People with Disabilities'.*

It is good practice to encourage members with a disability and involve them in coaching if they wish to be involved.

Club Administration – The majority of rowing clubs have an administrative structure managed by its members. Individuals with a disability should be encouraged and enabled to contribute to club administration through its various committees. This means they are consulted on all areas of club management, are part of the decision-making process, take on responsibilities and generally make a contribution to the club's organisation.

Depending on the needs of the individual, this might require giving extra thought to how the committees function. This may mean ensuring that meetings are held in a room that is physically accessible (appropriate for a person using a wheelchair). If the club member has a visual impairment this may mean presenting minutes in Braille/audiotape. Alternatively, a member with a hearing impairment may need an interpreter who can use appropriate sign language.

If the club has members with an intellectual disability, consider appointing an enabler, who will help them to understand both the procedures of meetings and the content of an agenda.

Adaptive Access Audit

The following audit has been developed as a checklist for clubs wishing to open their facilities to inclusive participation. It enables the user to assess which areas meet the needs of adaptive rowers with various impairments and where improvements can be made.

The Access Audit should include:

- Location
- Car parking
- Footpaths
- Steps
- Access to the boathouse
- Access to water
- Sanitary/shower facilities
- Signage and information
- Equity

Audit Strategy

The audit should follow the normal journey of a club member as they arrive at, enter, move around, use and leave the club. This journey should start at the club perimeter, progress through car parking areas, pedestrian routes, building entrances, reception areas, and cover topics such as communication, delivery, horizontal and vertical circulation routes, internal spaces, facilities and exits.

The audit should be carried out by a suitably competent individual with some understanding of the issues relating to adaptive rowing. Obtain feedback from a person with a disability about how they would navigate around the club or contact your local British Rowing Coaching Team for advice. www.britishrowing.org

ROWING CLUB – EXTERNAL

	APPROACH ROUTES	N/A	Yes	No	Identified in Action Plan
1	Is the club within convenient walking distance of a public highway?				
2	Is the club within convenient walking distance of public transport?				
3	Is the club accessible by public transport, such as a bus and train?				
4	Are there bus routes with low floor access ramps for wheelchair users?				
5	Is the local train station fitted with lifts for wheelchair users?				
	CAR PARKING				
6	Is accessible parking provided for wheelchair users?				
7	Are sufficient dedicated accessible parking spaces provided?				
8	Is accessible parking clearly marked and signposted?				
9	Are there parking bays available with adequate transfer space for wheelchair users?				
10	Is accessible parking suitably surfaced and level for wheelchair users?				
11	Is accessible parking well lit, visible and safe?				
12	Are there suitable and safe ‘set down’ and ‘pick up’ points?				
13	Are there spaces close to the club and/or boathouse?				
	FOOTPATHS				
14	Are there paths without steps?				
15	Are paths wide enough?				
16	Are the edges of pathways clearly defined by colours/tactile surface?				
17	Are there ramps and handrails where necessary?				
18	Is the ramp slip resistant?				
	STEPS				
19	Are there steps?				
20	Are the steps of appropriate dimensions?				
21	Do the steps have a tactile surface for advanced warning of change in level?				
	ACCESS TO BOATHOUSE				
22	Is the boathouse entrance door wide enough for wheelchair users?				
23	Is the boathouse adequately lit?				
24	Are the boathouse bays wide enough to avoid projections (e.g. riggers)?				
25	Is the floor space clear of obstacles (e.g. riggers, seats)?				
26	Are the boats easy to remove and replace in the boathouse (consider sliding racks/trolleys)?				
27	Are oar and sculling blades easy to remove and replace in the boathouse by wheelchair users?				
28	Are lifejackets located at an appropriate height for wheelchair users?				
29	Does the club have equipment including boats, seating that is appropriate to the rowers needs?				
	ACCESS TO WATER				
30	Is the boating area accessible for wheelchair users?				
31	Is there an accessible shoreline?				
32	Is there an embarkation pontoon with access ramps for wheelchair users?				
33	Is the pontoon access ramp of the appropriate gradient?				
34	Does the pontoon have the appropriate transfer height to boats?				
35	Is the pontoon stable?				
36	Is there adequate room for assisted moving, handling and transfer to the boat?				
37	Is there a hoist for moving, handling and transfer to boat?				
38	Is the hoist sling appropriate to the rowers needs?				

	APPROACH ROUTES	N/A	Yes	No	Identified in Action Plan
39	Is the entrance door to the club clearly colour contrasted or distinguishable from the surrounding facade?				
40	If there is a glass door, is it visible in its closed position through transoms?				
41	Does the door have large pull handles?				
42	Does the glass door have glazing manifestation bands or logos 1.5m above floor level?				
43	Does the entrance door provide a clear opening for wheelchair users?				
44	Are floor surface areas easily negotiable by wheelchair users?				
45	Is there a lift to upper floors?				
46	Does the lift provide a clear opening width?				
47	Are the lift doors adequately colour contrasted from the surrounding wall?				
48	Is there a platform stair-climber lift?				
	SANITARY FACILITIES - TOILETS				
49	Is there a WC for rowers with a disability (accessible toilet)?				
50	Is there a WC with sufficient room for a left and right transfer?				
51	Is there a washbasin of appropriate height for wheelchair users?				
52	Are there hand drying facilities at an appropriate height for wheelchair users?				
53	Is the floor slip resistant and colour contrasted from the walls?				
54	Are all the sanitary fittings and grab-rails colour contrasted from the walls?				
55	Is the route to the WC accessible to wheelchair users without obstructions?				
56	Are any sanitary dispensers identifiable to rowers with a visual impairment?				
	SANITARY FACILITIES - ACCESSIBLE SHOWERS/CHANGING ROOMS				
57	Are changing rooms clearly identified by visual and tactile information?				
58	Are the shower controls at the appropriate height and easily identifiable to users with a visual impairment and users with limited hand function?				
	SIGNAGE				
59	Are entry/exit points to the club and parking area clearly identified?				
60	Is signage current, consistent and relevant throughout?				
61	Are direction and information signs at consistent heights?				
62	Is all signage kept simple with approved pictorial symbols where appropriate?				
63	Is signage tactile?				
64	Is written information available in appropriate language and sensory formats?				
65	Is all signage unobstructed and clearly visible from both a seated and standing position?				
66	Is there an audible emergency alarm system supplemented by a visual / tactile system?				
67	Are ground floor emergency exit routes level and accessible to all, including wheelchair users?				

Classification

British Rowing's objective for adaptive rowing is to provide inclusive opportunities for rowers with a disability to compete at British Rowing events. The organisation is responsible for the classification of adaptive rowers who wish to compete at a national level.

Classification groups together rowers of similar levels of functional ability to ensure competition is as fair as possible.

The History of Classification

During the 1940s, Dr. Ludwig Guttmann founded Paralympic Sport as an extension of the rehabilitation process. In these early years, classification was based on medical diagnosis and reflected the structure of a rehabilitation hospital, with separate classes for people with spinal cord injuries, amputations and neurological or orthopaedic conditions.

Athletes were assigned a class based on their medical diagnosis and competed in that class for every sport. An athlete with a complete L2 spinal cord injury (resulting in lower limb paralysis but normal arm and trunk power) would compete in a separate wheelchair race from a double above-knee amputee due to their different medical diagnoses. The fact that the impairments led to similar activity limitation in wheelchair propulsion was not considered in the classification because it was based on medical diagnosis.

Sport drives Classification

As the Paralympic Movement matured, sport was no longer considered an extension of rehabilitation and became stand alone. Beginning in the 1980s, this change in focus drove the development of what became referred to as 'functional classification'.

The criteria of functional classification were no longer determined by diagnosis and medical evaluation, but how an impairment affected an individual's athletic performance and how that impact may be significant in one sport and a relatively minor in another.

The early functional classification was comprised of fewer classes than the existing medical system, meaning it was favoured by event organisers as it significantly reduced the complexity of event organisation. An administrative decision made by the bodies responsible for the 1992 Paralympic Games, stipulating that all sports contested at the Games had to use sports specific functional classification, finally cemented the move towards functional classification systems.

At this time many sports had not begun to develop functional systems, so senior Paralympic classifiers from a diverse range of backgrounds (medical doctors, therapists, athletes and coaches) led the development of functional systems of classification.

Today most Paralympic sports use the functional classification systems, with the notable exception of the International Blind Sports Federation (IBSA) which continues to base its classification on medical grounds.

The Future

The future for functional classification looks bright. The IPC has stated that it:

'continues to be committed to the development of evidence-based classification systems, so that athletes who enhance their competitive performance through effective training will not be moved to a class with athletes who have less activity limitation (as they would in a performance classification system), but will be rewarded by becoming more competitive within the class they were allocated'.
© International Paralympic Committee (IPC)

Rowing Classification

British Rowing has adopted the standards for the classification of rowers (devised by FISA).

The system 'places adaptive rowers in groupings with other rowers of similar ability to provide competition as fair as possible'. (Dr Michael Riding, Chief Medical Officer IPC, 2001).

British Rowing accepts that the respective classifications encompass a wide range of disabilities and therefore there will be rowers with disabilities greater than the minimum, who will be at a disadvantage competing in that respective class.

Eligibility

A rower is eligible for adaptive competition if they are classified and issued one of the three British Rowing sport classes. These may include rowers with:

Physical disabilities which lead to sufficient loss determined during the functional classification test.
Intellectual disabilities
Visual impairments

Sport Class

British Rowing recognises three (3) sport classes for adaptive rowing: PR3, PR2, PR1

Legs, Trunk and Arms (PR3)

The PR3 class includes rowers who have the minimum disability and are able to use a sliding seat with their legs for the stroke as well as trunk and arms.

Trunk and Arms (PR2)

The PR2 class incorporates rowers who can be seated in a boat but are unable to use a sliding seat due to a loss of lower limb function.

Arms & Shoulder (PR1)

The PR1 class incorporates rowers with minimal or no trunk function and require a degree of postural support using a fixed seat.

British Rowing (BR) Classifiers

There are two types of classifier who work to determine the level of athletic function each adaptive rower can achieve. These are:

BR Medical Classifier: a medical doctor, doctor of osteopathic medicine, or physiotherapist.

BR Technical Classifier: a person with extensive practical knowledge of rowing, such as a coach, sport scientist, former rower, physical educator or similarly qualified person.

Sport Class Status

Upon completion of the classification process, a rower will receive one of the following sport class statuses:

New (N) Status

'N' status is allocated to a rower who has not been classified by the British Rowing National Classification Panel (two approved classifiers; one medical and one technical). An 'N' status rower may not compete at a FISA event, or the Paralympic Qualification Regatta or Paralympic Games Regatta.

Confirmed (C) Status

'C' status can only be allocated by a FISA International Classification Panel, none of whom shall be from the athlete's national federation. A 'C' status rower is eligible to compete in all FISA, Paralympic events and international regattas permitted by their sport class and status.

Review (R) Status

'R' status is allocated by the British Rowing National Classification Panel to a rower whose class status may change (due to a change in disability or the classification process). 'R' status rowers may be required to undergo a further classification evaluation once a year prior to competing at a British Rowing event.

Application Process for rowers seeking a British Rowing Classification

Before the classification process can begin, all applicants need to complete, sign and submit the following to British Rowing:

- British Rowing Classification Application Form
- Declaration of Medical Conditions that may require an Emergency Measures Form
- British Rowing Consent for Adaptive Rowing Classification Form
- Documentation from a medical doctor, stipulating the cause and extent of a rower's disability and the date of the disability.

Rowers with a visual impairment or an intellectual disability must also include documentation to demonstrate that they have met the appropriate classification requirements set by British Rowing.

Legs, Trunks and Arms – PR3

Eligible LTA rowers may typically have a minimum disability equivalent to one of the following:

- Amputee
- Neurological impairment equivalent to incomplete lesion at S1
- Cerebral Palsy Class 8 (CPISRA).
- Visual impairment
- Intellectual impairment: INAS-FID April 2005 criteria.

The PR3 class incorporates five specific categories which relate to three disability groups:

- PR3-ID – Legs, trunk and arms - Intellectual disability
- PR3-B1, PR3-B2, PR3-B3 – Legs, trunk and arms - Visual Impairment (Please refer to the PR3 Visual Impairment section on page 17 for an explanation of B1, B2 and B3)
- PR3-PD – Legs, trunk and arms - Physical disability

PR3-ID: Intellectual Disability

National

Intellectual Disability (ID) classification is a non-sport specific classification. Rowers with a physical disability need to undergo a medical and technical (bench test, ergometer test and on-water observation) evaluation prior to classification. However, ID rowers are not required to do this for national competition.

An intellectual disability must be evident during the developmental period, which is from conception to 18 years.

The British Rowing Intellectual Disability registration documentation must be completed and submitted by the closing date for entries for the event at which the rower wishes to compete. At this time the completed documentation will be checked by a British Rowing Classifier (either medical or technical). These checks can be performed at distance, so the rower does not need to be present. Once the documentation has been verified, the sports class and racing licence will be issued by British Rowing.

GLOSSARY
Ergometer: a machine used to simulate the action of rowing for the purpose of exercise or training, and measures the amount of work performed.

The British Rowing LTA-ID classification process requires one of the following supporting documents to be submitted along with the registration documentation:

- Statement of Educational Needs (SEN)
- IQ assessment (of 75 or lower) carried out before 18 years of age
- Letter containing a statement from the rower's GP or Registered Psychologist. This might include information regarding how the rower's ID affects their daily life and how they respond to certain situations, and particularly for the sport of rowing, environmental demands.

Intellectual Disability – International

For those rowers with an Intellectual Disability wishing to progress into international competition, the UK Sports Association for People with a Learning Disability (UKSA-FID) criteria need to be met.

Stage 1

The rower is to:

- Complete an International Sports Federation for Persons with an Intellectual Disability (INAS-FID) Primary Eligibility Application Form
- Submit an approved Intelligence Quotient (IQ) test & formal test of Adaptive Behaviour (AB) - no more than 5 years old
- Submit a statement from a professional who carried out the IQ & AB re: age of Onset Pre-18
- Complete the Training History & Sport Activity Limitations (TSAL) on-line questionnaire, although not part of evidence

Evidence must be provided in 2 areas. Acceptable evidence includes:

- A Statement of Educational Needs or equivalent referring to the intellectual disability.
- An IQ assessment done before the age of 18 that may be inadmissible for IQ because it is too old, but could be used to prove the age of the rower,
- A letter from the rower's GP or Psychologist who is registered with the Health Professions Council. Any letter from a GP or Psychologist should include:
  - Reference to the professional's knowledge of the rower
  - The rower's special school,
  - Their Statement of Educational Need,
  - Any IQ reports conducted whilst under the age of 18.

The letter should also include the rower's name and justification for their statement in support of Age of Onset pre-18. The statement needs to be explicit, referring to the specific documents assessed to aid the professional's conclusion and worded along the lines of "In my professional opinion including my assessment of documents x, y and z [name of rower] has an intellectual disability that was evident before age of 18'.

The rower will be classified as PR3-ID under the following conditions if:

1. The rower has a significant impairment in intellectual functioning (IQ of 75 or lower)

This would be indicated by an IQ score of 75 or lower on a professionally administered IQ test (e.g. Wechsler Intelligence Scale for Children [WISC], Wechsler Intelligence Scale for Adults [WAIS]) or SON-R IQ tests. Please check the UK Sports Association for People with a Learning Disability (UKSA) website for a list of approved IQ assessments.

This is the first criteria and should be completed and signed, by a person qualified to conduct psychometric assessments – e.g. a psychologist registered with the Health Professions Council (HPC) or in the case of SON-R by an accredited assessor. A full copy of the test results, the full scale IQ and narrative needs to be included with the documentation. If an IQ figure is present in another pre-existing report, for example Statement of Educational Needs (SEN), include the full report and any assessments attached to that report.

2. There is evidence of pre-existing reports

- Special Education
  Evidence for this would be a full copy of a Statement of Educational Needs (SEN), obtained from a teacher or educational psychologist.
- Special Accommodation
  Evidence for this would be a letter from the accommodation provider e.g. respite care home. The letter should be an original, on headed notepaper with an original signature from the principal. It must include the rower's name; date of birth, address and confirmation that special accommodation is being provided and for what duration. Special accommodation must be provided by a statutory provider.
- Special Employment
  Evidence for this would be a letter from the employer or employment provider. The letter should be an original, on headed notepaper with an original signature from the Director or line manager. It must include the rower's name; date of birth, address and confirmation that special employment is being provided and for what duration.
- Statutory Financial Support
  Evidence for this would be received from the Department of Health e.g. Attendance or Carers allowance, Disability Living Allowance or equivalents. Full letters need to be submitted (not just the first page) and the letter needs to show that the individual is currently receiving this financial support.

Stage 2

FISA is currently working on an evidence based classification test for possible future inclusion of rowers with an intellectual disability into the Paralympic Games.

This will include on-site testing focusing on how ID affects performance. Sport intelligence will be evaluated against minimal disability scores and rowers must meet minimal disability to be eligible to compete.

The UK Sports Association for People with Learning Disability (UKSA) is the only official Great Britain member of INAS-FID (International Sports Federation for Persons with an Intellectual Disability) recognised by UK Sport and a member of British Paralympic Association, the national disability specific sports organisation for people with ID in the UK.

UK Sports Association for People with Learning Disability
Telephone 0207 490 3057 info@uksportsassociation.org
www.uksportsassociation.org

GLOSSARY

Wechsler Intelligence Scale for Children: is an individually administered intelligence test for children between the ages of 6 and 16 inclusive that can be completed without reading or writing. The WISC takes 65-80 minutes to administer and generates an IQ score which represents a child's general cognitive ability.

Wechsler Intelligence Scale for Adults: intelligence quotient (IQ) tests are the primary clinical instruments used to measure adult and adolescent intelligence.

PR3-VI: Visual Impairment

Vision classification has two important roles:

1. To determine a rower's eligibility to compete based on their visual impairment
2. To group visually impaired rowers for competition i.e. to ensure that they compete equitably based on the International Blind Sports Association (IBSA) system.

Vision and visual impairment can be assessed using different factors, such as visual acuity, visual field, contrast sensitivity, motion detection, colour vision, dark adaption and dynamic visual acuity.

Visual acuity is generally measured by tests that determine the smallest detail that can be seen up close and in the distance. For example individuals with a visual acuity of 100% are able to discriminate two points at a distance of 100 metres. Individuals with a visual acuity of 10% must approach 10 metres to be able to discriminate these two points.

The World Health Organization (WHO) defines visual impairment in terms of visual acuity and visual field. Similarly the IBSA classification system is based on visual acuity and visual fields. According to the WHO, visual impairment is the generic term divided into blindness and low vision.

The functional limitations of a visual impairment are:

- The loss of visual acuity in which the sharpness and clarity of near vision is reduced. This type of impairment is the most common. Whilst reading may be difficult and the world may appear unclear, vision for moving about is less restricted.
- The loss of sight with the visual field in which there is narrowing of peripheral vision. In this case, the person may be able to read, but moving around can be compromised because of the restricted field of vision.

The official IBSA three class system consists of:

B1: From no light perception in either eye to light perception, but inability to recognise the shape of a hand at any distance or in any direction.

B2: From ability to recognise the shape of a hand to a visual acuity of 2/60 and/or monocular visual field of less than 5 degrees.

B3: From visual acuity above 2/60 to visual acuity of 6/60 and/or monocular visual field of more than 5 degrees and less than 20 degrees.

NOTE: Not eligible – visual acuity over 6/60 and/or monocular visual field of more than 20 degrees.

Note: All classifications will be in the best eye with best correction.

PR3-B1, PR3-B2, PR3-B3 Visual impairment

Prior to any British Rowing competition, a rower with visual impairment must have been classified by an ophthalmologist or optometrist in one of the B3 (PR3-B3), B2 (PR3-B2) or B1 (PR3-B1) classes. The British Rowing forms must be completed with supporting documentation and submitted by the closing date for entries for the event. Prior to competing at the World Rowing Championships, Paralympic Qualification Regatta, or the Paralympic Games, all visually impaired rowers must undergo a classification by an IBSA Classifier. This may occur prior to or at the event during the classification evaluation period.

The following charts are used to determine the degree of visual impairment:

VISUAL ACUITY CHART

Right eye No Correction	Left eye No Correction	Right eye With Correction	Left eye With Correction
NLP (No Light Perception)	NLP	NLP	NLP
LP (Light Perception)	LP	LP	LP
HM (Hand Movement)	HM	HM	HM
CF (Count Fingers)	CF	CF	CF
1/60	1/60	1/60	1/60
2/60	2/60	2/60	2/60
3/60	3/60	3/60	3/60
4/60	4/60	4/60	4/60
5/60	5/60	5/60	5/60
6/60	6/60	6/60	6/60
6/36	6/36	6/36	6/36
6/24	6/24	6/24	6/24

FIELD OF VISION IN DEGREES

Right eye No Correction	Left eye No Correction	Right eye With Correction	Left eye With Correction
0 – 5'	0 – 5'	0 – 5'	0 – 5'
5 – 10'	5 – 10'	5 – 10'	5 – 10'
10 – 15'	10 – 15'	10 – 15'	10 – 15'
15 – 20'	15 – 20'	15 – 20'	15 – 20'
20 – 25'	20 – 25'	20 – 25'	20 – 25'
25 – 30'	25 – 30'	25 – 30'	25 – 30'
30 – 35'	30 – 35'	30 – 35'	30 – 35'
35 – 40'	35 – 40'	35 – 40'	35 – 40'
40 – 45'	40 – 45'	40 – 45'	40 – 45'
45 – 50'	45 – 50'	45 – 50'	45 – 50'
> 50'	> 50'	> 50'	> 50'

British Blind Sport

Pure Offices, Plato Close, Tachbrook Park, Leamington Spa, Warwickshire, CV34 6WE.
Tel 01926 424247 Email: info@britishblindsport.org.uk
Website www.britishblindsport.org.uk

GLOSSARY

Ophthalmologist: A medically trained doctor who commonly acts as both physician and surgeon. They examine, diagnose and treat diseases and injuries in and around the eye.

Optometrist: A medical professional trained to prescribe and fit lenses to improve vision, and to diagnose and treat various eye diseases.

PR3-PD - Physical Disability

The minimum physical disability for this classification is the full loss of three fingers on one hand, at least a tarsal metatarsal amputation of the foot or the loss of ten points on one limb or fifteen points across two limbs when assessed.

Trunk And Arms – PR2

Eligible TA rowers may typically have a minimum disability equivalent to at least:

- A bilateral impairment around knee amputation or significantly impaired quadriceps
- A neurological impairment equivalent to a complete lesion at L3 (lumbar) level, or an incomplete lesion at L1
- A combination of the above e.g. one leg with around knee amputation and one leg with significant quadriceps impairment
- A classification from the International Sports Federation for Rowers with Cerebral Palsy (CPISRA) as eligible for CP Class 5.

Figure 6: GB PR2 (Mixed double)

Arms And Shoulders – PR1

Eligible AS rowers have no or minimal trunk function (i.e. shoulder function only). An AS class rower is able to apply force using their arms and/or shoulders predominantly, although they will likely have poor sitting balance.

Eligible rowers may typically have a minimum disability equivalent to at least one of the following:

- Cerebral Palsy Class 4 (CPISRA)
- A neurological impairment with a complete lesion at T12 (thoracic) level, or an incomplete lesion at T10 level.

Figure 7: GB PR1 rower, Rachel Morris

Process for Classification of rowers with a Physical Disability

A classification panel will assess rowers with a physical disability according to the process described in the British Rowing Adaptive Rowing Classification Manual. The process involves four steps:

1. Bench Test – directed by the Medical Classifier with the Technical Classifier in attendance.
2. Ergometer Test - directed by the Technical Classifier with the Medical Classifier in attendance.
3. On Water Observation - This is directed by both the classifiers during training and/or competition (depending on assessments of Bench Test and Ergometer Test).

Figure 8: Physiotherapy plinth (left), diagnostic apparatus (middle) and bench test (right)

4. Process – Medical evaluation

The goal of the medical evaluation is to determine whether the rower meets the minimum disability for adaptive competition.

This test is completed to the standards of manual muscle testing as described in *Daniels and Worthingham's Muscle Testing: Techniques of Manual Examination*, (Hislop H, Montgomery J, 2007).

Classifiers will use a 0-5 scale for the muscle and co-ordination tests and a 0-10 scale for FROM (Functional Range of Motion) tests, as noted on the Functional Classification Assessment Chart, a copy of which is part of the application form. The +/- scale will not be used for the purpose of this test.

If a rower has an amputation, a score of 0 is entered for the affected joint.

Figure 9: Rower with prosthesis completing ergometer test

Assess Functional Range of Motion, Strength or Coordination (ROM)

Test muscle strength and document points 0-5 on assessment chart. If a rower has a central nervous system disorder, do not assess strength. Rather, assess coordination and document points 0-5 on assessment chart.

GLOSSARY

Prosthesis: An artificial substitute or replacement of a part of the body such as a leg.

Position for muscle testing

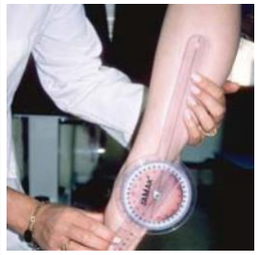

Seated

- Shoulder flexion and extension
- Elbow flexion and extension
- Wrist flexion and extension
- Finger flexion and extension
- Knee extension
- Ankle dorsiflexion
- Hip flexion

Prone

- Hip extension
- Knee flexion
- Ankle plantar flexion

Position for range of movement (ROM) testing




Seated

- Shoulder flexion and extension
- Elbow flexion and extension
- Wrist flexion and extension
- Finger flexion and extension
- Knee extension
- Ankle dorsiflexion
- Ankle plantar flexion

Prone

- Hip flexion
- Knee flexion
- Hip extension

All joint motions and strengths must be tested and these scores recorded. Failure to do so will result in an incomplete and therefore a non-valid classification.

A rower who meets the minimum disability requirements for adaptive rowing (a loss of 10 points in one limb, or 15 points across 2 limbs, a full loss of three fingers in one hand or a tarsal metatarsal amputation) will be classified as eligible for the LTA class, at a minimum, subject to satisfactory completion of the ergometer and (if needed), on-water assessment. Subject to additional testing, they may also be eligible for TA and/or the AS class.

If any rower does not meet the minimum disability, he/she will be deemed as 'not eligible' to compete as an adaptive rower and the process will end.

Figure 10: A full loss of three fingers in one hand

90 degree Squat Test

The purpose of this test is to assess whether a rower has reasonable functional strength in the quadriceps and other leg muscles to perform the sliding motion in the boat and provide enough power to propel the boat through the water.

Process:

- The rower will stand without external assistance. If they use a prosthesis or orthosis, the test is completed with and then without the device. This is to ensure that the rower is classified with their best functionality.
- The rower will perform a squat, with both or one leg as able, flexing the knee(s) to a 90° degree angle.
- They will then return to a full standing position. This is conducted to assess the strength of the quadriceps group of muscles.
- Minimal balance assistance may be given for safety.

If the rower is able to complete the test (this is a pass) then their place as a PR3-PD rower is likely to be confirmed, subject to assessment on the rowing ergometer and on-water observation, if necessary.

If the rower is unable to complete this test, (including a rower in a wheelchair or with significant leg weakness preventing them from participating in the test) regarded as a fail, they may be considered for the TA or AS class. If the test is failed, the reason for failing must be documented clearly.

Figure 11: 90 degree squat test

Figure 12: Long Sit Test

Long Sit Test

This test is used to assess whether a rower has the ability to lean forward and return to an upright position with enough strength to assist the movement of the boat through the water.

If the rower uses a prosthesis or orthosis, this test is performed with and then without the device

Process:

- The rower will sit in a long sit position on the plinth with their legs as straight as possible.
- They will then lean the trunk forward to approximately a 30-45° angle without using their arms for support.
- This position should be held for 3 seconds before the rower returns to the upright position without using their arms.
- The rower will then lean backward to approximately a 30°C angle at the trunk, holding this position for 3 seconds and then return to an upright position without using their arms.
- If the rower is able to complete these tests, they should repeat them whilst the assessor provides minimal resistance.

GLOSSARY

Prosthesis: is an artificial device extension that replaces a missing body part.

Orthosis: is a device that supports or corrects the function of a limb or the torso.

If apparent hamstring tightness exists, the rower should repeat the entire test seated on a fixed seat on the ergometer to eliminate the effects of hamstring tightness.

If the rower is able to complete all of the above, (a pass) then they are likely to be classed as PR2 , subject to further confirmation in the ergometer test and on-water observation.

If the rower is unable to complete all of the above, (a fail), they may be considered for the PR1 class, subject to further confirmation in the ergometer test and on-water observation. If the test is failed, the reason for failing must be documented clearly.

Figure 13: Long Sit Test performed on the ergometer

Adaptive rowers have a variety of diagnoses for example:

Amputee (arm or leg, congenital or traumatic)

Poliomyelitis

Spinal Cord Injury (complete or incomplete)

Spina Bifida

Cerebral Palsy

Other (peripheral nerve injury, musculoskeletal trauma, brain injury, multiple sclerosis)

Prosthetic and Orthotic involvement in Classification

If a rower has an amputation, they must be classified with and without their prosthesis, although they will be issued the more functional class. Similarly rowers who use an orthosis must be classified with and without their orthosis and will be issued the more functional class. The rower's prostheses and orthosis may not cause the rower to be issued a less functional sport class than if they row without the device

Figure 14: Prosthetic

Figure 15: Orthosis

Figure 16: Rower with both prosthetic and orthosis

Rowing outside of an assigned class

Rowers may compete in a more functional class than their assigned sport class, but not lower. For example, a rower classified as TA may compete in LTA events, but may not compete in AS events.

Process - Technical Evaluation

This will be completed by a British Rowing Technical Classifier with a British Rowing Medical Classifier present.

The role of the British Rowing Technical Classifier is to assess the rowing motion when conducted on an ergometer. Such tests should be able to confirm or refute the bench test classification for the PR3-PD, PR2 or PR1 Sport Class.

Figure 17: Technical evaluation of rower on ergometer

The evaluation consists of the following tests:

1. Ergometer with sliding seat
2. Ergometer with fixed seat
3. Ergometer seat clamps
4. Appropriate strapping to complete test
5. Appropriate cushion to prevent tissue breakdown
6. Any other necessary equipment for the individual rower

Ergometer Assessment

The rower's sitting balance will be assessed prior to carrying out a functional assessment on the ergometer (the long sit test). If the rower demonstrates even fair trunk function, sitting balance and leg function then the assessment should be carried out on a standard sliding seat. If the rower's sitting balance is compromised, a postural support seat may be used, appropriate to their needs.

1. If the rower uses a prosthesis or orthosis, the tests shall be performed with and then without the device.
2. The sliding seat test may be eliminated if it is unsafe for the rower to perform, i.e. they have poor sitting balance, complete paraplegia or significantly poor leg strength.
3. If the rower is not able to complete the above test on the sliding seat, due to their disability, a fixed seat will be added to the ergometer. The classifier should begin to assess the rower performing with the least amount of assistance possible (e.g. without a chest strap) but must ensure that the rower is not liable to fall.
4. The rower will be asked to take enough strokes to represent their rowing ability, e.g. 5 with arms and shoulders, 5 with arms and trunk, 5 at ¼ slide, 5 at ½ slide, 5 at ¾ slide and 5 at full slide. Classifiers may also request more detailed procedures, i.e. distance rowed over a certain time, average power, etc.
5. The assessment of rowers with central nervous system impairments should begin at low stroke rates and progress to higher rates similar to that of race paces. They may demonstrate a somewhat fluid or normal stroke performance at low rates, but this may be unsustainable at higher rates, resulting in decreased coordination of stroke mechanics. Conversely, rowers who demonstrate predominately mild tone impairments or athetosis, may perform the cyclical nature of the rowing stroke with more fluidity than anticipated.

The ergometer assessment should continue for sufficient time to ensure that the classifiers have reviewed the typical performance the rower would be anticipated to achieve during a race. When classifying those new to rowing, the review status may be appropriate to allow reclassification following training and/or increased fitness.

GLOSSARY

Athetosis: a symptom of a central nervous system disorder that causes people to have slow, sinuous, writhing movements.

6. The rower will be observed from the side, rear and front for linear motion on the ergometer. The classifier will check if the rower is able to achieve good compression and obtain 90 degrees of flexion at the knees and trunk against or close to thighs. The rower will be asked to row at full slide for a minimum of 2 minutes if needed to assess rower's ability to maintain power and slide length.
7. They will also be observed for any decrease in coordination that occurs during the rowing stroke at higher rates with a change in power output and/or reduced slide length.

Considerations for rowers with diagnosed central nervous system impairment:

Observation during PR3 (sliding seat) ergometer assessment

1. Classifiers should watch for difficulty in one or both legs in alternating between full flexion (as in compression at the catch) and full extension (as in the finish).
2. This difficulty may be further demonstrated at higher stroke rates as in race rates (rating over 30 strokes per minute) due to resulting increased muscle tone (this makes people appear to have spastic movements) with an increased velocity of movement. This may also be seen in a significant decrease in stroke length with increasing stroke rate.
3. Specifically, decreased compression may occur at the catch position due to decreased body swing, decreased knee flexion and ankle dorsiflexion occurring during the recovery.
4. The finish position may demonstrate decreased extension of the legs. These are both a result of the abnormal tone, not of decreased flexibility alone.
5. Decreased coordination between leg drive, body swing and arm pull resulting in decreased fluidity and inability to row at higher stroke rates may also be noted with or without the ability to accomplish the above positions.
6. An inability to maintain reasonably fluid stroke mechanics at higher stroke rates, along with decreased coordination during the slide portion of the stroke would direct classifiers to assess this rower for fixed seat rowing.

Observation during PR2 (fixed seat) ergometer assessment

1. During the assessment of the PR2 technique, the rowers' body-swing mechanics may demonstrate an inability to maintain body-swing resulting in decreased length of stroke possibly further seen while rowing at higher stroke rates.
2. Poor dynamic trunk control may also be demonstrated by an inability to maintain trunk movement into extension as arm pull is initiated resulting in trunk movement to the handle rather than the handle being brought to trunk during the drive.
3. Rowers with impaired trunk control may also demonstrate increased use of head movement to create body-swing movement. With very limited contribution of the trunk to the drive this rower would be more appropriate as PR1.

Likely Conclusions

It is important to always confirm that what is being observed concurs with the medical assessment, or can in some way be attributed to a physical disability. Keep in mind that the rower may not be representing his/her true ability. Also keep in mind that any inadequacies in the ergometer may be due to lack of training, rather than a physical disability appropriate to a particular class.

Sliding seat observations

1. If the rower is able to demonstrate full body swing and utilise at least 50% of the available slide and maintain power over 15-20 strokes, then PR3 sport class should be confirmed.
2. If the rower demonstrates a significant increase in power when the slide is used then PR3 sport class should be confirmed.
3. If the rower is able to demonstrate full body swing but is unable to achieve 50% of the slide, or the equivalent compression to that observed in the squat test, (e.g. incapacity to flex one knee) PR2 sport class should be considered.
4. If the rower is able to demonstrate full body swing, and utilise at least 50% of the slide but the power output either drops or increases only marginally over that achieved with the trunk and arms only then PR2 sport class should be considered.
5. In the cases of rowers with Central Nervous System (CNS) impairment an inability to maintain reasonably fluid stroke mechanics at higher stroke rates, along with decreased coordination during the slide portion of the stroke would direct classifiers to assess this rower for fixed seat rowing and consider the PR2 sport class.

Fixed seat observations

1. If the rower is able to swing from the hips with the trunk movement away from the backrest of more than 30 degrees and maintain the swing over 15-20 strokes and do this with enough force to propel the boat, then TA sport class would normally be confirmed.
2. If the rower is unable to swing his/her trunk more than 30 degrees without a strap and maintain it over 10-20 strokes then PR1 sport class should be considered. If a strap is applied and power output increases, then consider confirming AS sport class.
3. If the rower is unable to lean forward from the backrest and return safely without the support of a strap, consider confirming PR1 sport class.
4. Detailed documentation of the classifiers' findings is paramount to accurate classification, and should be as complete as possible. The British Rowing Technical Classifier should record a clear statement on the application form of the rower's functional ability as observed through the ergometer test, having regard to the PR1 functional objectives for each sport class as recorded above.

ON-WATER OBSERVATION (not obligatory)

The British Rowing Medical and Technical Classifiers will both observe the rower on the water, while training and/or racing, with their coach in attendance. The attendance of the rower's coach is strongly encouraged for this part of the assessment.

Objectives

The purpose of this observation is to confirm if the rower has been placed in the appropriate boat class with regard to British Rowing's functional objectives for each class.

The classifiers may request the rower to perform a range of movements or tests and shall also observe the rower during normal training and racing. This secondary observation may occur at a time when the rower is unaware that they are being observed. If the rower uses a prosthesis or orthosis, this test shall be performed with and then without the device.

CONCLUSION OF CLASSIFICATION

Once all necessary tests have been completed, the classifiers will jointly determine the 'final classification' and the recommended sport class and status will be noted on the application form and signed by both classifiers. The rower must be informed verbally within two hours of the determination of their sport class and sport class status and will be asked to sign their name on the form.

Both classifiers must agree on the class being issued, but if there is disagreement, the rower shall be issued the more functional sport class and given Review status. Both ways shall be documented, and the more functional sport class will be issued.

Once complete, all forms are to be forwarded to British Rowing:

BRITISH ROWING

Adaptive Rowing Head of Classification
British Rowing
6 Lower Mall
Hammersmith
London
W6 9DJ

Copies of all forms should be kept by the rower and/or club official.

Equipment & Regulations

Adaptive rowing uses specific equipment that is designed to enable the individual with a disability to row.

The World Health Organisation developed the *International Classification of Functioning, Disability and Health (ICF)* as a way of documenting and categorising the function of all individuals with and without disabilities *(World Health Organisation, 2002)*

This ICF model closely parallels the major categories of equipment that are used in rowing:

- Personal equipment - something that the rower wears designed to enhance body function such as prosthetic limb or orthosis
- Activity specific equipment - designed to enhance the performance of an activity or participation in a specific sport – Rowing postural support seat, pontoons, strapping, and hand gloves
- Environmental technology - used to modify the facilities or environment

Body function and structure - the functions that a body can perform based on physiology and anatomy – for example in rowing PR3; PR2; PR1.

Activity and participation - the activities or skills that can be performed and how those skills can be used to participate in rowing

Environment and context - the influence of factors external to the individual – for example in rowing, the water.

Boats

The international (FISA) boat classes rely on mixed gender with different disabilities in specific crew boats. At national level, British Rowing adaptive competition can include events, which can be mixed, single gender or open category in a range of boat types to help develop the sport.

PR3

Rowers classified in the PR3 category should use standard equipment (usually a four boat with coxswain [4+]) which complies with British Rowing's Rules of Racing (www.britishrowing.org/rules). For recreational rowing, fine boats or bigger more stable boats may be used depending on the PR3 rower's ability.

Figure 18: A standard bowloader (4+)

PR2

A standard adaptive PR2 boat (usually a double scull [2x]) has a fixed seat and may have stabilising pontoons. The hull, pontoons (where fitted) and seat fixing are part of the standard specifications. The seat itself and the rigger design of the standard boat are not restricted. PR2 rowers are required to comply with the strapping requirements as set out on page 32.

PR1

The standard adaptive PR1 boat (usually a single scull [1x]) has a fixed seat and must have stabilising pontoons, attached to the riggers no further inboard than the centreline of the swivel (oarlock). The pontoons must be fixed in position so that when the rower is seated in a balanced boat, both pontoons are horizontal and shall, at a minimum, touch the water. The hull, the pontoons and the seat fixing are part of the standard specifications.

Figure 19: A double scull (2x)

The seat itself and the rigger design of the standard adaptive AS boat are not restricted, except that the design of the seat must be compatible with the seat fixings and the design of the rigger must allow the stabilising pontoons to be correctly fixed. PR1 rowers are required to comply with the strapping requirements as set out on page 32.

Figure 20: A single scull (1x) with stabilising pontoons

Seating

Rowers with compromised sitting balance will require a degree of postural seating support on the ergometer and in the boat.

Figure 21: Wintech Seat in the boat

Figure 22: Wintech Seat on the indoor rowing machine

Figure 23: A Swift Seat in the boat

Figure 24: Adapt 2 Row Postural Support Seat & Complimentary Balance Seat

Figure 25: Clamps to mount adaptive rowing seat to indoor rowing machine

The indoor rowing machine can be adapted in a number of ways, such as removing the monorail for individuals to remain in their wheelchairs and still access the equipment. www.adapt2row.com

Figure 26: Indoor rowing machine adaptation for wheelchair user

Pressure Sore Prevention Products

A pressure sore is any redness or break in the skin caused by excessive and sustained pressure to the skin. This pressure prevents blood from reaching the skin which then dies. The nerves send messages of pain to let the brain know that a change in position is needed, but any damage to the spinal cord can prevent these messages from reaching the brain.

25-85% of individuals with spinal cord injuries develop pressure sores at some time in their lives, making this a relevant issue. A rower's predisposition to this type of injury is also based on other factors including their diabetic condition, age, weight, medication etc.

Prevention is better than cure and lessens the chances of developing a pressure sore whilst rowing. Rowers with a SCI or those with conditions which cause a loss of sensation are particularly susceptible to pressure sores due to direct sitting pressure and the potential shearing forces caused by rowing.

Shearing is also a kind of pressure injury. This happens when the skin moves one way and the bone underneath moves another.

Many rowers with a SCI will have their preferred method of skin protection which the coach should utilise in and out of the boat.

There are several products available to help reduce the possibility of developing pressure sores.

Akton Gel Pad ™

An Akton® Pad acts as a second skin helping to reduce shearing in the seating area. It adjusts to the shape of the body and will return to its original shape when not in use. Akton polymer won't leak, flow or bottom out and is a 'tissue equivalent'. It moves with the rower, not against them, to reduce pressure and shear, the two leading causes of pressure sores.

Vicair Allrounder™

The Academy Allrounder utilises the Vicair™ Dry-Air SmartCells™. These flexible air-filled tetrahedrons provide dynamic, stable support and can be adjusted by simply taking out or adding SmartCells™

It provides protection in the wheelchair, during transfer on the pontoon and in the boat. It also protects the ischial tuberosities and coccyx.

Jay Protector™

The Jay Protector ™ is a small pad filled with a patented gel. The pad fits inside a sling, which is strapped to the body to protect the rower's buttocks.

Roho™

These soft, flexible, interconnected air cells that comprise Roho products can be adjusted to provide a customized fit to a rower's sitting shape.

Strapping

Strapping is used to ensure that the rower is safely supported (restrained) in the seat and negates a degree of trunk flexion and knee flexion in the AS and TA class.

PR2 Strapping Requirements

Rowers shall be secured with a strap to prevent flexion and extension of the knee(s) during rowing. The strap must be secured under the seat or rails and over the thighs, as close to the knees as possible.

PR1 Strapping Requirements

Rowers shall use a strap around the torso just below the nipple line or the breasts, that must be secured to the back of the seat, and be tight enough to restrict trunk movement but not breathing. The strap should be attached to the seat no lower than the top edge of its supportive portion at the front of the torso. Straps can be assessed when the spine is straightened, by bearing the weight of the upper body through the arms while the buttocks and back remain in contact with the seat. If a bracket is attached to the strap it must not rotate at the point of attachment.

Additionally, the PR1 rower shall be secured with a strap to prevent flexion and extension of the knee(s) during rowing. The strap must be secured under the seat or rails, over the thighs and as close to the knees as possible.

General Strapping Requirements

a. All straps must be 50mm wide (minimum), of non-

GLOSSARY

Tetrahedrons: is a polyhedron composed of four regular triangular faces.

Ergometer: a machine used to simulate the action of rowing for the purpose of exercise or training, and measures the amount of work performed.

Ischial tuberosities: forms a bony area on which the human body rests when in the sitting position.

Coccyx: commonly referred to as the tailbone, is the final segment of the vertebral (spinal) column.

b.

c. elastic material, without mechanical buckles and be able to be released immediately by the rower with a single quick hand action when the free end of the strap is pulled.

d. The strapping must be of a colour that contrasts with the rowers' racing uniform so that it can be clearly seen.

e. All straps for each rower must be released in the same manner and direction.
   i. Trunk strapping must be quick release, in one direction
   ii. Thigh strapping must be quick release, in one direction

f. Any hand strapping must be able to be released immediately by quick mouth action.

g. Strapping should be made of a material which will not induce pressure marking or chafing.

IMPORTANT:
British Rowing recommends that all chest, leg and hand strapping is evaluated for safety, before it is used on open water, by conducting a controlled capsize drill in a swimming pool.

Figure 27: Single Release chest strap – Cinch style

Figure 28: Single Release lap strap – Cinch style

British Rowing Strapping Model

Active Hand Splints
(General Purpose Gripping Aid - AH1)

The General Purpose Aid

This aid functions by the tightening of a strap in the upper section, which gently pulls the hand into a fist shape, which forms a hook shape and allows rowers to ‘grip’ an ergometer, oar or scull handle. The wrist strap is adjustable and the aid is padded to reduce chafing.

Figure 29: : Active Hand Splints

Figure 30: Active Hand Splints used on the indoor rowing machine and in a boat

Looped Exercise Aids (AH3)

Ideal for use on the ergometer, these aids feature strong loops which can be slipped over the handle with an adjustable padded wrist strap. When not under tension, the aids easily slide on and off the handle, giving the rower the ability to ‘let go’ during rest periods.

www.activehands.co.uk/products

Figure 31: Looped Exercise Aids

Pontoons

Pontoons attached to adaptive boats provide a more stable platform for PR1 and PR2 rowers with additional lateral stability for rowing shells.

For reasons of safety and fairness during competition, the pontoon attachments should be no further inboard than the centreline of the swivel (oarlock). They must be fixed in position so that when the rower is seated in a balanced boat, both pontoons are horizontal and, at a minimum, touching the water.

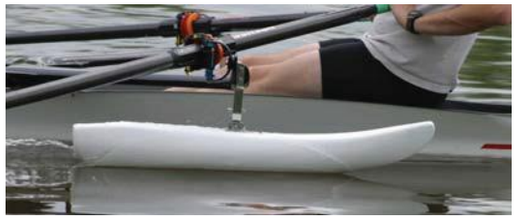


Figure 32: FISA Standard pontoons

IMPORTANT:
British Rowing recommends that caution is taken with rowers who rely on pontoon floats for stability when changing rigger spans. By bringing the pins towards the centreline of the boat, stability will be compromised.

Zero Vision Eyewear

In order to ensure fairness during competition, rowers are required to wear light eliminating eyewear. All eyewear must be checked to ensure it is a secure fit and that the goggles or mask provide complete light occlusion.

Figure 33: A variety of zero vision eyewear

Adaptations

Adaptations to enable an individual to row may not necessarily be expensive, but simply require some ingenuity in modify existing equipment.

Figure 34: Buoyancy bags modified as pontoon floats

Modified footplate for Fused Ankle Joint

At the catch position the foot is dorsiflexed on initial contact with the footplate, before plantarflexion occurs during the initial drive phase.

Adaptations to ergometer or boat footplates can facilitate this movement for rowers with fixed ankle joints including arthrodesis.

© Marko Rusev (B.Sc.ME)

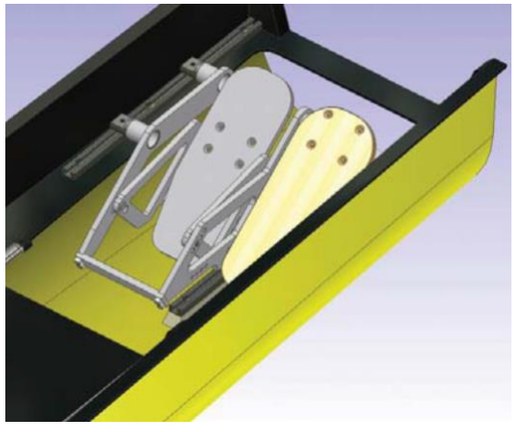


Figure 35: Foot stretcher when leg is at full extension

Figure 36: Brazilian Rowing Federation proudly exhibit their pontoon float made of solvent-welded waste pipe!

Figure 37: Articulated carbon hand prostheses for the rowing machine

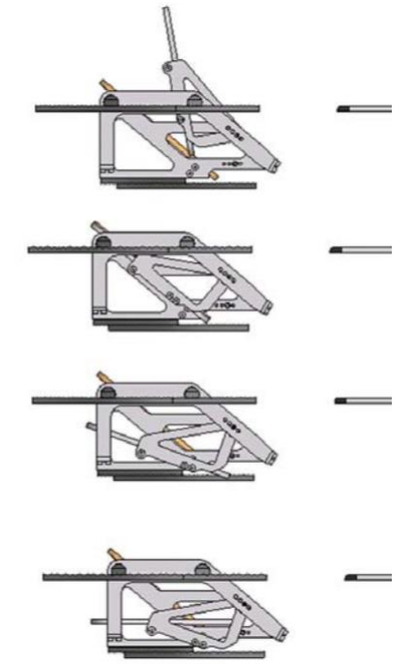
GLOSSARY

Dorsiflexed: is where the angle between the surface of the foot and the leg has decreased, so that the toes are brought closer to the shin.

Plantarflexion: is the movement which increases the approximate 90 degree angle between the front part of the foot and the shin, as when pushing down on a car pedal. The word "plantar" is commonly refers to the bottom of the foot.

Arthrodesis: is the artificial induction of joints between two bones via surgery. This is done to relieve intractable pain in a joint which cannot be managed by pain medication or other treatments. It is most commonly performed on joints in the spine, hand, ankle, and foot.

Slide elevation of the foot stretcher throughout the slide



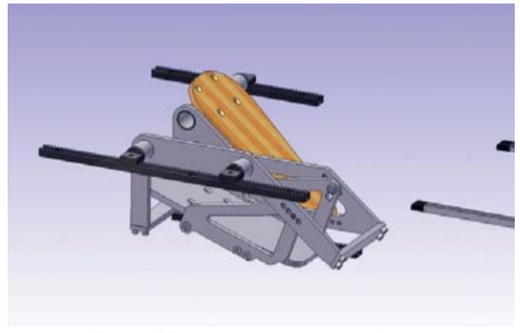


Figure 38: Catch position – knee flexed

Figure 39: Finish position – knee extended

Figure 40: Modified foot stretcher with retaining screws with soleplate removed and heel hinged.

Figure 41: Shimano foot stretcher for rower with Arthrodesis (Fused ankle joint)

Transfer Boxes

In order to transfer from a wheelchair to the floor/pontoon, an adaptation such as an upturned beer crate may suffice! Also see the transfer model provided on page 59.

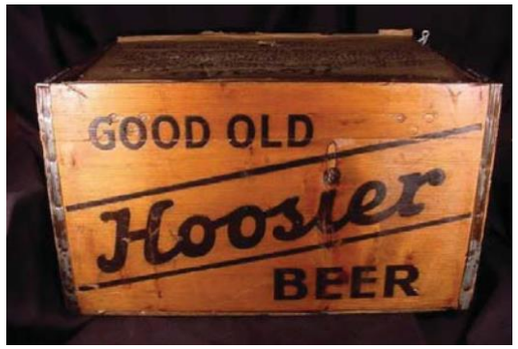


Figure 42: An upturned beer crate used as a transfer box

ErgChatter

ErgChatter is a free software tool designed for rowers with a visual impairment, which provides audible commentary for the PM3 or PM4 monitors. As the rower commences with their session, ErgChatter announces their performance data at regular intervals; when completing a timed workout, the data will be announced every 20 seconds, or whilst completing a set distance workout data will be announced every 100 metres.

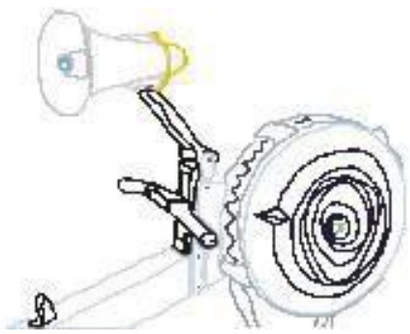


Figure 43: A megaphone fixed to the indoor rowing machine

Figure 44: ErgChatter being used by a person with a visual impairment on the rowing machine

The most recent version offers the following features:

- "Drag Mode" for setting the drag factor
- Improved update interval detection for distance based updates
- Ability to select pre-programmed workouts from the computer keyboard
- Support for interval workouts
- 15 second timed workout update intervals
- Support for heart-rate monitors
- Ability to turn off extended start up and shut down chatter

www.concept2.com/us/service/software/thirdparty/ergchatter/default.asp

Rowperfect

A new programme has been released, called RPVI for those with visual impairments. It is text-based software that can be understood by a screen-reader utility such as Dolphin 'SuperNova'. This results in a custom set of parameter cells which are read aloud, every 2 to 15 seconds. AVI can only be used to record data; the programme does not contain any analysis functionality.

Rigging Considerations for Adaptive Boats

PR3

When considering rigging a boat for PR3rowers many of the principles applicable to standard fine boat rigging still apply.

Considerations should be given to:

- A mixed gender crew (strength, height, stroke length)
- A mix of disabilities within the boat (physical, visual, learning)
- Mobility range of the rower
- Use of orthotics or prosthetics for amputees and the effect of these on their stroke length and balance

PR2 & PR1

Considerations should be given to:

- Mixed gender crews (strength, height, stroke length)
- Mobility range of the rower
- Implications with amputees on balance
- Oar/scull - consider shorter overall length
- Reduced inboard length with no 'cross-over' in PR1 and no/minimal in PR2 boats
- Oarlock heights set level
- Additional sitting height of the rower with seat padding/cushion
- Seat back rake angle set at up to 90 degrees
- Backrest; TA rowers should be encouraged to maximise their function and row without it if possible
- Sitting balance; TA rowers with good sitting balance should be encouraged to row without pontoons

What we can learn from able-bodied sliding seat rowing with regards to input of body parts into rowing power?

- Legs produce nearly half of the power output
- The trunk produces nearly one third of the power
- Arms produce nearly one quarter of rowing power
- Amplitudes of all three segments are nearly equal to each other.

(Dr Valery Kleshnev 2006)

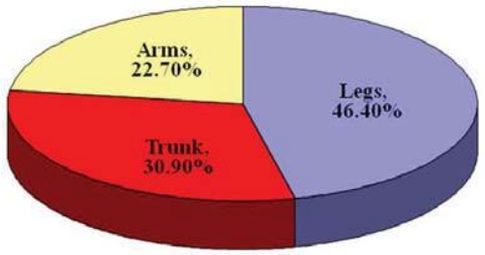


Figure 45: Kleshnev's pie chart indicating the proportional representation of power provided by different parts of the body.

Utilisation of work-capacity of the body parts

Trunk muscles utilise only about 55%, legs use up to 95% of their power. Arms' utilisation is about 75%.

(Dr Valery Kleshnev 2006)

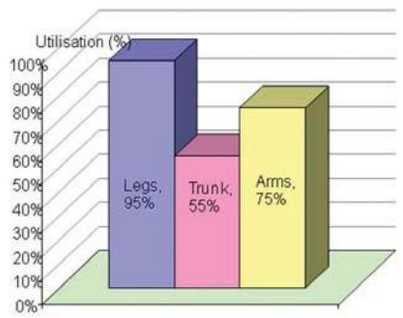


Figure 46: Kleshnev's graph indicating work capacity of the body parts

A typical range of reach for an able-bodied rower is 1500 mm which equates to a stroke arc of around 100 degrees through standard rigging.

The reach of a PR1 sculler, who is strapped to the seat, is restricted to up to 600mm, and if the rigging is similar to that used by an able-bodied rowers, the result is a stroke arc of around 40 degrees.

The overall stroke length can be determined using an ergometer, by measuring the distance the handle moves. Knowing this length will enable you to place the rower in the correct position in respect to the pin so that the correct ratios of the stroke before and behind the pin can be achieved.

A PR2 sculler has their legs strapped down, meaning the reach is achieved by extending their arms and through the body swing. The body swing can be exaggerated and a total stroke length of 1000mm can be achieved. On a standard rig this would equate to an arc of 67 degrees.

By adjusting the span and the inboard for an adaptive rower, two things can be achieved:

- Increased stroke arc overall – aim for up to 90 degree arc.
- Distribution of the stroke arc achieved with the optimum position in relation to the pin at 55/45 degree ratio

Figure 47 shows some examples of the achievable arcs (including those currently used in adaptive competition) and different rigging configurations for fixed seat boat. These include overall oar length and ever relations.

Figure 47: Achievable arcs and rigging configurations

Overall degree	40°	60°	90°
Half span	80	80	62
Overall length	278	278	252
Inboard	80	76	58
Lever relation	3,47	3,66	4,34
(average for open class 1x = 3,31)			
Distribution to work	50/50	55/45	55/45
Reaches needed for the different arcs in cms.			

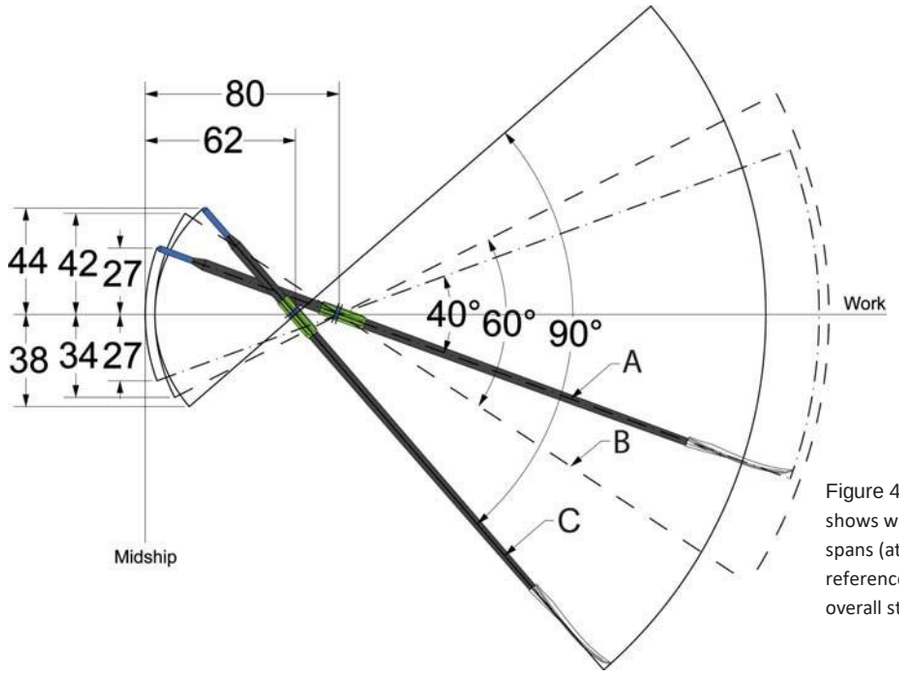


Figure 48: Figure above shows wide and narrow spans (at mid-point reference) with effect on overall stroke arcs.

There are further options for individual adaptations which alter power and stroke rate. The widest arc can provide long, accelerated strokes which are extremely effective, but require a higher application of power. The longer reach with a shorter inboard needs extensive use of the shoulders at the catch, but enables a longer release with the handles by the hips at the finish.

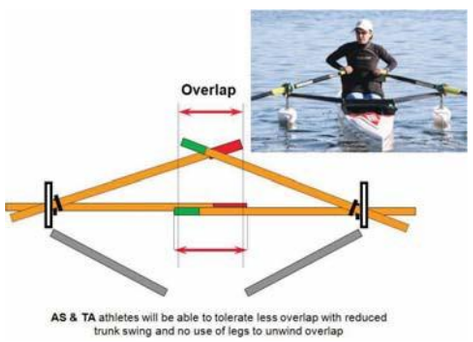


Figure 49: Current trends in adaptive rigging

Measurements

When evaluating any rigging parameter, a clearly defined protocol should be used

- How it feels
- How it looks
- Record speed measurements / timed pieces
- Check / double check
- Adjust one parameter at a time and evaluate

Further considerations

- Encourage a strength and conditioning programme that increases upper thoracic mobility as this allows the rower to use their shoulders effectively, which will increase the application of power throughout the stroke.
- Encourage rowers to feather the blades as it reduces air drag dramatically.

British Rowing recommends that the rigging chart (Figure 50) should be consulted alongside the rower's physiology and specific disability. Different rigging configurations will suit different rowers. It is recommended that a multi-disciplinary approach is adopted, involving collaboration between rower, coach and medical professionals.

Recommended Rigging Chart for PR1 & PR2 Boats		
	PR1 1x	PR2 2x
Span	140-145 cm	150-155 cm
O/A length	250-255 cm	275-278 cm
Inboard	65-76 cm	67-79 cm

Figure 50: British Rowing rigging chart

General Coaching Considerations

The coach should treat each rower as an individual, understanding their differences and abilities and so enabling them to reach their potential.

Guidelines

- Focus on the person first and their disability second.
- Obtain knowledge about the nature and degree of disability.
- Set realistic goals and objectives based on your knowledge of the rower.
- Ask them for information on what they can do and suitable ways to adapt activities.
- Establish a skill progression appropriate to the rower's ability.
- Do not underestimate the individual's ability by focusing on the disability.
- Adopt appropriate coach to rower ratios (likely to be smaller groups).
- Understand environmental factors that may affect a rower's ability to perform (i.e. temperature).

Visual Impairment (VI) Coaching Considerations

Someone with a visual impairment can take part and compete in rowing without major accommodations. There are a few principles that can assist a coach in providing the best possible learning environment.

Figure51: The international symbol for Visual Impairment

Figure 52: GB LTA Mixed 4+ wearing 'zero vision' eyewear

Motor Skills

Visual impairment can cause certain motor problems and difficulties in attitude, integration and body awareness, such as balance, coordination, posture and orientation difficulties. The numerous motor and physical qualities developed whilst rowing are indispensible to a rower with a visual impairment.

Balance

This is a fundamental element of water based rowing (as opposed to land based indoor machines) for an individual with a visual impairment.

Exercise

Improved control over strength, speed and flexibility, whilst providing an efficient cardiovascular workout can be used to combat the consequences of a visual impairment, such as a sedentary lifestyle.

Kinaesthetic Sensation

A visual impairment does not constitute a serious problem in performing the rowing movement. In practice a sighted rower does not constantly look at his/her blade or crew members, but relies on an instinctive 'feel' for the boat. Similarly a rower with a visual impairment is not prevented from feeling these physical sensations or their refinement.

The Psychological/Social Sector

A disability of any kind can entail isolation and a sedentary existence. Membership of a rowing club provides an opportunity to meet other people and exercise with them on an equal basis. As with the sighted population, someone with a visual impairment will gain greater self confidence, social awareness and friendships through rowing.

Many of the principles for effective coaching are summarised below:

1. Establish if the rower is visually impaired or blind

It is important to understand that there will be a range of sight loss amongst rowers who have a visual impairment (10% - 100% loss of visual acuity and/or visual fields).

2. Begin with an orientation to the rowing equipment

When coaching a rower with limited or no vision, begin with an orientation of the rowing environment, i.e. ergometers, rowing tank, clubroom, boathouse, pontoon/shoreline. Allow the rower to become aware of their surroundings through exploration with verbal descriptions, noting any potential hazards such as steps, riggers, and obstacles in the boathouse.

Figure 53: Example of a boat house with potential hazards for a visually impaired rower

It is worth remembering that individuals with congenital sight loss are most concerned with obstacles that are within a 0.5m perimeter. This will allow rowers to be as self-sufficient as possible

3. Use verbal descriptions to supplement demonstrations

Be as exact and descriptive as possible, ensuring your language is appropriate to the rower e.g. when describing the on water circulation pattern, rather than saying 'from that end to that end', describe an east/west or north/south clockwise/anticlockwise pattern.

Avoid using terminology or phrases that imply some visual references the rower may not be able to understand, such as 'square or feather the blade'. These can be confusing. Clearly describe the rowing oar together with the articulation to the swivel/oarlock and encourage the person to have a tactile reference. Explain the action of the blade together with the medium through which it moves – water. If a rowing tank is available this can be a valuable, safe introduction as it provides physical cueing and facilitation of the stroke mechanics.

4. Integrate those with and without visual impairments into crews

Integrate rowers with a visual impairment into 'mainstream' crew boats wherever possible, but also permit opportunities for training with other rowers with a visual impairment who may wish to take part in adaptive competition.

5. Classification

Understand the British Rowing, British Blind Sport, International Blind Sports Association classification principles and eligibility for adaptive rowing participation. Please refer to page 17 of the Classification section)

GLOSSARY

Ergometer: a machine used to simulate the action of rowing for the purpose of exercise or training, and measures the amount of work performed.

6. Challenge rowers with a visual impairment

Challenge rowers with a visual impairment just as you would any other rower. Involve rowers in all crew activities, including carrying the boat and working to set up the boat. This is particularly important if the rowers are integrated into mainstream rowing practice.

7. No two visual impairments are the same – acquired or congenital sight loss?

It is important for coaches to understand and distinguish between acquired and congenital sight loss and the likely implications. A rower who has acquired sight loss, but learnt to row or scull with some degree of vision is likely have an advantage over someone with congenital blindness, in respect to coordination and the ability to produce good rowing technique. Teaching the basic rowing stroke to someone with congenital sight loss will require more consideration with regards to choice of words, kinaesthetic feel and explanation of the rowing vocabulary.

8. Be Innovative

Coaches should be innovative and employ some of the principles that are used for a sighted rower. Consider attaching drinking straws to the saxboard of the boat so the rower can brush them with their hands in order to achieve the correct height and placement.

Figure 54: Examples of tactile markers for use on oar or scull handles

Use tactile markers on the oar or scull handles to indicate when the blade is 'square' to the water. These can be easily removed, once the rower has learnt the skill.

9. Visual impairment and single sculling

A rower with a visual impairment should be encouraged to single scull, provided that a simple risk assessment has been carried out. Safety boat cover should be provided and assistance with steering may be given using a radio link.

Intellectual Disability (ID) Coaching Considerations

Intellectual impairment or disability is an international term which encompasses moderate, severe and profound learning difficulties, and is equivalent to a Learning Disability (UK Social and Health Services). A mental impairment present at birth or acquired in early life tends to result in a standardised IQ score of less than 70 points. Although IQ testing may form part of the process, a diagnosis of ID is mainly made through assessment of adaptive skills. The WHO provides the following overview of groupings within ID - as Mental Retardation.

These definitions provide a convenient way of indicating the range of abilities but terms like 'mental age' are anachronistic and rarely used by professionals in the UK.

Mild
An IQ range of approx 50 to 69 (mental age from 9 - 12 years), means that these adults will be able to work and maintain good social relationships and contribute to society.

Moderate
An IQ range of approx 35 to 49 (mental age from 6 - 8 years), signifies the likelihood of marked developmental delays in childhood but most can learn to develop some degree of independence in self care and acquire adequate communication and academic skills. Adults will need varying degrees of support to live and work in the community.

Severe
An IQ range of approx 20 to 34 (mental age from 3 to under 6 years) is likely to require continuous support.

Profound
An IQ under 20 (mental age below 3 years) results in severe limitation in self care, continence, communication and mobility.

There are an estimated 200 million people with an intellectual disability worldwide. Intellectual disability is characterised by significant limitation in both intellectual functioning and adaptive behaviour - including the development of practical or motor skills. Individuals with an intellectual disability are routinely discounted and denied opportunities despite their ability to function safely and effectively in many areas.

At the 2003 Scientific Symposium, the *Multinational Study of Attitudes towards Individuals with Intellectual Disabilities* survey showed the general population lacks an appreciation of the capabilities of people with intellectual disabilities and have low expectations of what they can achieve and how they integrate. More alarmingly the survey showed that, despite overwhelming research to the contrary, a majority felt that people with intellectual disabilities should learn, work and play in an environment set apart from the general population.

1. Keep instruction short and concise

Use simple rather than complex sequences or instructions.

2. Allow sufficient time for a rower to respond to coaching

It takes 5-10 seconds for the individual to respond to direction.

3. A cognitive dysfunction means that an individual will require extra time to process information

This has particular implications for individuals with Down's syndrome, which is a cognitive dysfunction.

4. Break tasks down so that they are sequential and have attainable goals

Giving rowers a goal that is attainable will give them a great sense of achievement. It is important to break tasks down and keep them sequential. So consider rowing for 10 strokes and then resting and then rowing for 20 strokes and increasing the number of strokes each time.

5. Identify best the learning channel (visual, auditory, or combination) for your rower

Individuals all learn in different ways, regardless of their ability. You need to identify the best learning channel for each rower; some might prefer visual indicators, whilst others will have a preference for spoken instruction.

6. Utilise appropriate behaviour, coaching techniques and strategies

It may be necessary for coaches to adapt their coaching technique and behaviour to that appropriate for the rower. If something is not working, adopt a new strategy and be flexible in your approach.

7. Provide a non-threatening environment

The rower's safety comes first so providing a non-threatening environment is of the utmost importance. If a rower feels distressed in any way, this will impact negatively on their performance so coaches should always remain calm and positive.

Setting up a Rowing Programme for Children with Learning Impairments

Case Study by William A Vale: T.C.; B.Ed; DPSE (Special Needs), Charlton School, London, Greenwich
www.charlton.greenwich.sch.uk

This case study is written from a practical standpoint and it is hoped it serves the purpose of helping promoting a rowing programme for children with special needs.

Background:
Charlton School became involved in a rowing programme under the auspices of the London Regatta Centre in 2004.

Charlton School caters for 11 to 19 year olds who, broadly speaking, have educational needs such as Severe Learning Difficulties (SLD), Autistic Spectrum Disorder (ASD), Profound and Multiple Learning Difficulties (PMLD) and Emotional and Behavioural Difficulties (EBD).

From its earliest inception, two principles were maintained to aid the success of the programme:

1. Many of the school staff (teachers and learning assistants) involved in the project undertook training that familiarised them with the basic mechanics of the rowing stroke. This meant gaining the Indoor Rowing for Young People (IR4YP) Award, which focused on helping staff promote the benefits and enjoyment of rowing through quality coaching and appropriate skill acquisition on the ergometer. Up to this point six members of staff have undergone this training.
   www.britishrowing.org/education-training
2. Every opportunity to integrate the attainment of an individual's targets, through the rowing experience, should be used. It was strongly felt that the activity itself should support the school's target setting process.

Initial selection of Pupils and Parental/Guardian Involvement:
Initially the programme was aimed at those pupils judged to have the physical ability and confidence to progress to rowing on water. Consequently, an agreed minimum requirement was that pupils could swim and felt comfortable in water. This second criterion is quite subjective and so parents and guardians were consulted. The school also sought the opinions of other members of staff who conducted swimming lessons.

Parents and guardians were given detailed knowledge of the rowing environment and the different phases of development involved. If they so wished, they were invited to visit the London Regatta Centre, meet staff and discuss any concerns they had.

Each phase of the rowing activity phase was given its own specific risk assessment procedure. In addition to this when necessary, an individual risk assessment was completed for each pupil based on their physical ability or behavioural pattern. The coaching team were confidentially informed in advance of such factors so they could respond to any arising situations.

As the programme became established, staff confidence increased as the range of disabilities that could be accommodated grew. This meant that pupils of all ages and abilities were introduced to rowing. Most pupils aimed to row on the water as part of a crew, but this was not always appropriate for everyone. The level of challenge had to be meaningful and specific to each individual, based upon the knowledge and judgement of their coaches.

Phases of the Rowing Experience:

Phase One

Pupils develop basic technique on ergometers, assisted by coaches and trained school staff.

The London Regatta Centre has a range of Certificates of Achievement available to pupils attaining specific numbers of metres rowed on the machines. These proved to be very motivating and a source of great satisfaction when awarded as part of school assemblies.

Phase Two

Pupils progress to rowing in the indoor tank. (www.ianritchiearchitects.co.uk)

In the tank pupils are able to work on technique and applying it in group situations: pairs, fours and in some cases eights. There is an emphasis on maintaining a defined stroke count.

Phase Three

Pupils that could attain an appropriate standard of stroke at phase two are introduced to rowing on the water.

Large stable boats are utilised (www.britishrowing.org/explore-rowing)

Life jackets or buoyancy aids are worn and a safety boat was present at all times.

Pupils are able to progress from working in small groups in this environment to larger groups comprising four or more.

Note: A simple check list of technical proficiency was devised after a discussion between the London Regatta Centre and school staff. It was used during each phase to chart progress and isolate technical faults.

General Factors to be considered:

Detailed knowledge of the pupil

It is important to collect as much information as possible from different sources within the school and share this with the coaching team. The activity should be staffed with individuals who have a detailed knowledge of the pupil(s).

Behaviour management

Behaviour Management Plans (BMPs) should be the outcome of an in depth discussion with involved professionals and it is crucial that their recommendations are strictly adhered to for educational and legal reasons.

Risk Assessments

Risk assessments need to conform to the school and coaching team's agreed format, but should be conducted with reference to British Rowing's Row Safe: A Guide to Good Practice in Rowing.
www.britishrowing.org/row-safe

What represents challenge, advancement or success?

The success of any experiential programme depends on what you hope to achieve. Initially this can be difficult to judge. Pupils expecting to gain a great deal, physically, emotionally and socially, may derive little from the experience whilst others who are persuaded to 'give it a go' react very positively and make enormous strides. Whatever might be the case, it is important to set initial targets although these will differ tremendously within the context of complex special needs.

Apart from the technical rowing targets, teachers will want to make use of the rowing environment as a fertile background for pupils' individual education plans. With a little imagination, professionals can find a wealth of opportunities for 'staging' situations where specific targets can be met.

Parental/guardian involvement

It is crucial that parents and guardians are kept well informed of each phase of development and achievement. Their enthusiasm and support for the programme reflects the encouragement that helps spur pupils to their best efforts.

The long term aim of the programme was to stimulate pupils sufficiently to encourage them to join an established rowing club at the conclusion of their school years. This involved the co-operation of parents and guardians.

The government initiative Every Child Matters, (ECM) was launched in 2003. Its main aim is for every child, regardless of background or circumstances, to receive the support they need to:

- Be healthy
- Stay safe
- Enjoy and achieve
- Make a positive contribution
- Achieve economic well being.

www.dcsf.gov.uk/everychildmatters

Any rowing programme should embrace aspects of the five outcomes of ECM.

Exercise is known to reduce stress and anxiety in pupils with learning difficulties, especially those on the autistic spectrum. There is overwhelming evidence that physical exercise also supports academic learning and can improve the social skills in those with challenging behaviour. As a whole, the pupils learn important skills that can be transferred to everyday situations.

Participation in a rowing programme can present aspects of difficulty for pupils with special needs. Fine and gross motor skills, spatial awareness and the sequencing of movements are areas that can be addressed through rowing. Carefully constructed goals can be set to suit the individual's pace of learning and specific special needs. These should ensure that the pupil progresses whilst enjoying some form of meaningful success. Pupils who struggle with social interaction have the opportunity to take turns, wait, share and work as part of a team. Communication difficulties can be thoughtfully managed at individual levels, so that pupils can follow consistent instructions and feel safe and secure doing so.

Autism Spectrum

Autism and other learning difficulties often cause barriers to pupils' ability to interact socially and conform to a group culture. Feelings of isolation are not uncommon. Rowing provides opportunities to foster friendships within the context of a team, as well as learning the importance of team rules in a competitive situation. Whilst it is evident that some pupils are unable to fully participate in team situations due to severely impaired social skills, they can achieve some commendable success by being included in a rowing team where their personal space is respected. Every student is different and the strategy used for their successful participation will vary depending on the nature of their disability.

A progressive rowing programme provides each pupil with the opportunity to explore their potential and limitations. They will need careful assessment to ensure the complexity of their difficulties is properly addressed and the levels of staffing support the achievement of these goals. Rowing can be adapted to meet the needs of pupils in such a way that physical and mental wellbeing can be improved as well as offering opportunities to enjoy and achieve.

Some additional thoughts and comments:

1. An additional phase that could be added to the programme, for the most able rowers, is to take part in a regatta, inter-club competitions or in one case, an international qualifying event. Pupils could race together with a coach, providing memorable occasions and where integration becomes a reality.
2. As a result of the school's involvement with the London Youth Rowing (LYR) programme, a number of indoor machines were acquired for school use. This established rowing as an activity that the pupils did not merely participate in once a week.

   Having the machines also made it possible for all pupils to build up the distances they rowed and gain appropriate certificates. Rowing was then integrated into the school's P.E. curriculum to the extent that the P.E. department, alongside LYR, organised a school 'Rowing Day' that involved nearly every single pupil.
3. Another notable outcome of the programme was that several pupils attended the National Junior Indoor Rowing Championships (NJIRC) http://www.londonyouthrowing.com/events/njirc. From all over the country, highly motivated rowers compete at this prestigious event and the sense of occasion brought out some of our pupils' best performances.
4. We also need to note 'the beautiful outcome that was never expected'. On countless occasions pupils have surprised and delighted staff with an achievement that was not anticipated: an arm of friendship around another pupil on recognition of an achievement; a clatter of words from a normally silent pupil after twenty minutes gliding over the water. The list is endless and can not to be discounted even though it does not comprise official targets.

Conclusion:

Hopefully this demonstrates that a rowing programme can have a fitting place within a special school's curriculum. It offers a platform for devising plans that target specific and desired developmental outcomes. It offers opportunities for nurturing feelings of pride, self-esteem and other measurable dimensions: building rowing totals, technique, progress through phases, student and parental/guardian feedback.

Such a programme will also respond positively to our concerns about levels of obesity, an emphasis on healthy eating and maintaining fitness. Rowing represents challenges for both an individual and teams.

Perhaps, finally, it is pertinent to pose the following question: what can the rowing experience offer that makes it more appropriate than other experiences? Rowing is a unique form of mental and physical exercise that offers enormous potential for education professionals.

Down's Syndrome

The Down's Syndrome Association have some guidelines which are useful for coaches and anyone considering involving individuals with Down's Syndrome in rowing.

They are reproduced below with the kind permission of the Down's Syndrome Association.

DOWN'S SYNDROME ASSOCIATION
A Registered Charity
No. 1061474

What is Down's syndrome?

Key Facts and Figures

- Around one in every 1,000 babies born in the UK will have Down's syndrome.
- Although the risk of having a baby with Down's syndrome is more prevalent for older mothers, more babies with Down's syndrome are born to younger mothers.
- Down's syndrome is caused by the presence of an extra chromosome in a baby's cells. It occurs by chance at conception and is irreversible.
- Down's syndrome is not a disease. People with Down's syndrome are not ill and do not suffer from the condition.
- People with Down's syndrome will have a degree of learning difficulty. However, most people with Down's syndrome will walk, talk and many will read and write, go to schools and lead fulfilling, semi-independent lives.
- People with Down's syndrome can look forward to a life of 60+ years

Dispelling the myths

There are some general myths surrounding people with Down's syndrome which can be easily dispelled with factual and accurate information.

MYTHS	FACTS
People with Down's syndrome don't live long	People with Down's syndrome can look forward to a life of 60+ years.
Only older mothers have babies with Down's syndrome	Although older mothers have a higher individual chance of having a baby with Down's syndrome, more are born to younger mothers, reflecting the higher birth rate in this age group
People with Down's syndrome cannot achieve normal life goals	The vast majority of people with Down's syndrome learn to walk and talk, and many are now attending mainstream schools, passing GCSEs and living full, semi-independent adult lives.
People with Down's syndrome all look the same	There are certain physical characteristics that occur. People with Down's syndrome can have all of them or none. A person with Down's syndrome will always look more like his or her close family than someone else with the condition.
People with Down's syndrome are always happy and affectionate	We are all individuals and people with Down's syndrome are no different to anyone else in their character traits and varying moods.

Down's Syndrome Coaching Considerations

An investigation into physical activity in individuals with Down's syndrome was carried out by the Learning Disabilities Research Group at the University of Cambridge. It aimed to gain solid information regarding the health and lifestyle of people with Down's syndrome taking part in sporting activities. Some of the key findings are listed below.

- Around 50% of people with Down's syndrome have some form of heart condition.
- People with Down's syndrome have lower maximal heart rates which restrict cardiac output. Their cardiovascular capacity is similar to someone without Down's syndrome who is 30-40 years older with heart disease.

- People with Down's syndrome are often close to diastolic (very low) levels of blood pressure which causes physical weakness.
- Similar to heart failure patients, people with Down's syndrome have very low leg strength which significantly restricts their cardiac output.
- People with Down's syndrome are more likely to suffer from poor muscle tone, correlated lower muscle voluntary contraction and joint hypermobility as a result of abnormalities in chromosome 21.

Note: Not all may be present; any sign of any one of the above requires further investigation.

The information below should form part of a pre rowing activity screening process. If any of the symptoms are present, be cautious and refer the rower to their doctor to see if there are any medical indications to not taking part in rowing.

Atlantoaxial instability

This is characterised by excessive movement at the junction between the atlas (C1) and axis (C2) as a result of either a bony or ligament abnormality.

1 There should be no sign of progressive myopathy (a muscular disease in which the muscle fibres do not function for one of many reasons, resulting in muscular weakness).

Some signs of progressive myopathy are:

- An increase in muscle weakness
- A loss of sensation
- Onset of incontinence
- Alteration in muscle tone
- Decreasing coordination
- Diminishing kinaesthetic awareness
- Change in walking pattern
- Pins and needles.

2 The person should be able to bend their head (neck flexion) forwards sufficiently so that the chin rests on their chest.

Further information contact: www.downs-syndrome.org.uk

Figure 55: Atlantoaxial instability

GLOSSARY

Hypermobility: (sometimes called "double jointedness") describes joints that stretch farther than is normal

Chromosome 21: Chromosome 21 is one of the 23 pairs of chromosomes in human cells. The presence of a third copy of the 21st chromosome causes Down Syndrome.

Atlantoaxial instability: is characterised by excessive movement at the junction between the atlas (C1) and axis (C2) as a result of either a bony or ligamentous abnormality.

Atlas (C1): is the (first) vertebrae of the spine and supports the globe of the head.

Axis (C2): is the second vertebra of the spine and forms the pivot upon which the first vertebra (the atlas), which carries the head, rotates.

Myopathy: a muscular disease in which the muscle fibres do not function for one of many reasons, resulting in muscular weakness

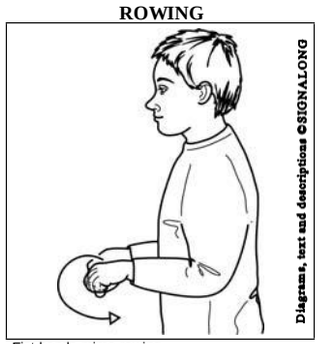
Use of Signage/Symbols in Rowing

SignAlong empowers children and adults with impaired communication skills to understand and express their needs, choices and desires by providing vocabulary for life and learning. SignAlong is based on British Sign Language (BSL), using unaltered BSL signs wherever possible. The difference between SignAlong manuals and other sources of signs is the way that they are presented.

SignAlong offers the widest range of illustrated signed vocabulary published in Britain. The charity works with others in the field and is part of the movement to promote total communication. In addition to publishing manuals and other visual communication resources, they provide a full training service, and will research signs which are not yet published. SignAlong also tries to put users in touch with other organisations. Special publications and individual signs with drawings and descriptions can be supplied, and they are prepared to license signs for use within organisations and services.

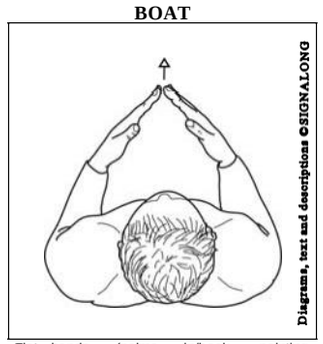
www.signalong.org.uk

John F Kennedy School, Newham, London and London Regatta Centre have worked with SignAlong to produce a series of 'rowing specific' signs (Figure 56 - Figure 67) using BSL signs where they already exist or creating new signs where no suitable alternative can be found.



Fist hands mime rowing.

Figure 56: Rowing

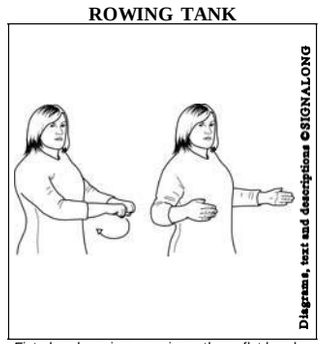


Flat hands (palms in/back, pointing forward/in) with fingertips touching move forwards.

Figure 57: Boat

Fists (palms down, pointing forward); working fist moves out.

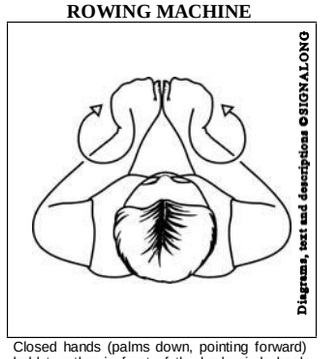
Figure 58: Oars



Fist hands mime rowing; then flat hands (palms in, pointing forward) held a wide distance apart; formation moves forwards.

Figure 59: Rowing Tank

ROWING MACHINE



Closed hands (palms down, pointing forward) held together in front of the body circle back while moving apart coming together to repeat action.

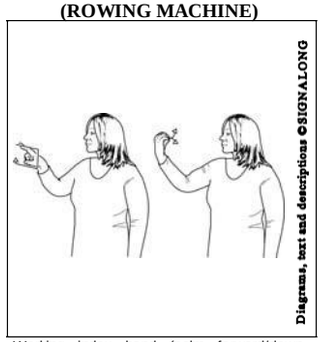
Figure 60: Rowing machine

HANDLE (ROWING MACHINE)

Fists (palms down, pointing forward) held a little way apart, formation moves back a small way.

Figure 61: Handle

MONITOR (ROWING MACHINE)



Working index hand (palm forward/down, pointing forward/up) traces the outline of a small screen; then working full "O" hand (palm back, pointing up) springs to open

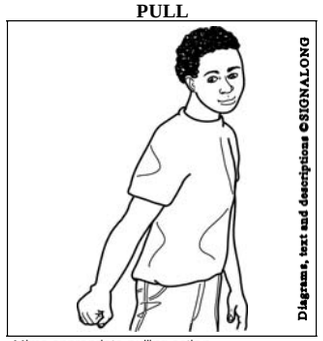
Figure 62: Monitor

LIFE JACKET

Working bent hand (palm in, pointing forward) rests on supporting flat hand (palm up, pointing in); formation moves back to body; then closed hands mime pulling on coat.

Figure 63: Life jacket

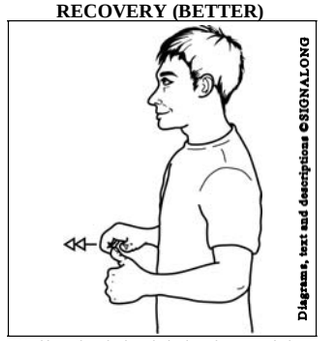
PULL



Mime appropriate pulling action.

Figure 64: Pull

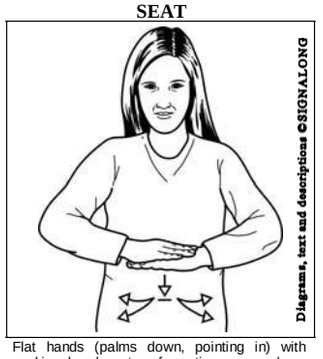
RECOVERY (BETTER)



Working thumb hand (palm down, pointing forward) brushes forwards along supporting thumb (palm in, pointing forward).
Repeat movement.

Figure 65: Recovery

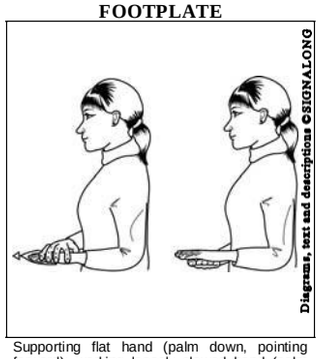
SEAT



Flat hands (palms down, pointing in) with working hand on top; formation moves down a short way to sign "sit"; then change to open hands (palms down, pointing forward) and move apart.

Figure 66: Seat

FOOTPLATE



Supporting flat hand (palm down, pointing forward); working loosely clawed hand (palm down, pointing in) moves over supporting hand and off fingers closing to full "O" hand signs "foot"; then working hand turns to palm up and contacts palm of supporting flat hand.

Figure 67: Footplate

Symbols

Symbols are a method of communication, which can be used to deliver effective rowing coaching, through the use of integrated text and graphics for individuals from the following groups:

- People learning English as a second language.
- People with memory difficulties, senile dementia or other brain damage .
- People with dyslexia, dyspraxia or spatial/time/organisational difficulties .
- People who are deaf or have a hearing impairment.
- Young children who have not yet started to read.
- People with Autistic Spectrum Disorders.

The Widgit Symbols (previously known as Rebus) are designed to support written information and provide a way to effectively 'translate' written text into a simple and easy to understand form.

The Widgit Symbols have a large vocabulary spanning standard curriculum topics, adult vocabulary and higher literacy levels. They have a schematic structure and include grammatical markers for expression.

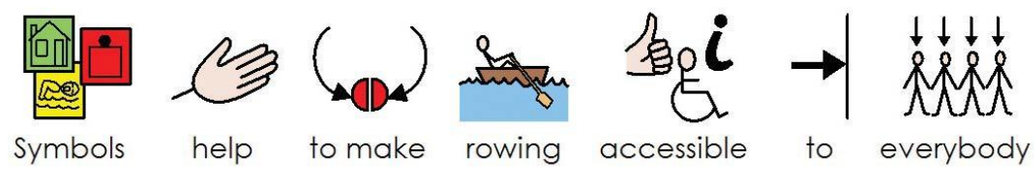


Figure 68: Widgit Symbols

The Sherborne @ Sunfield project is an adapted teaching approach for use with children with Autistic Spectrum Disorders. Sunfield is committed to the development of each individual child's abilities so that he or she may come to experience life as worthwhile.

Iconic Values of Visual Cues

There is overwhelming evidence to suggest that the implementation of the Sherborne Developmental Movement (SDM) programme, through structured teaching targeted at autistic pupils' visual learning strengths, significantly contributed to their engagement. Visual cues immensely reduced the need for verbal instructions and other prompting strategies by improving the pupils' levels of understanding of the expectations.

Widgit Symbols © Widgit Software 2002-2011
www.widgit.com

Figure 69: Widgit Symbol for rowing

Verbal – Symbols - Signs

Individuals may be given a combination of verbal, symbol and sign communication. Many of the instructions given can be broken down into simple steps to aid understanding and reach attainable goals. For example: getting onto an ergometer. Instead of simply asking a rower to get onto the ergometer, it can be broken down into a number of the steps:

1. 'Step over the slide'
2. 'Hold the seat'
3. 'Sit on the seat'
4. 'Put one foot on the footplate'
5. 'Put the foot through the foot strap'
6. 'Tighten the footstrap'
7. 'Put the other foot on the footplate'
8. 'Put the foot through the foot strap'
9. 'Tighten the footstrap'
10. 'Bend your knees'
11. 'Take the handle'
12. You are now ready to row!

Intellectual Disability Coaching Considerations

- It is important to use simple instructions and unambiguous language. Break coaching points into single tasks and ensure they are repeated frequently. Use cones or other landmarks to support instructions and use visual aids to demonstrate more complex instructions. The instruction could be, run from the 'long jump cover to the finish line' rather than 'sprint the last 100 metres'.
- It is important that rowers with a an intellectual disability (ID) are given age appropriate instructions. Don't be tempted to 'talk down' or coach an adult as a child.
- Rowers with ID can learn the rowing technique. They can take longer to learn it than a rower without an intellectual disability, and may find it impossible to execute certain drills/skills. Be patient, return to the skills and drills the rower can complete, and then build the others in trying different ways or step by step.
- Concentration for long periods of time can be difficult for people with an intellectual disability. Rowers with an ID will lose concentration if the coach spends too long explaining a drill/skill etc. It is best to show them.
- Once the rower has mastered a new drill or skill they will have to be taken through it again at regular intervals to aid memory retention.
- If left, some ID rowers will complete a very poor warm up as they may have forgotten the routine or simply do not appreciate its importance. The coach will need to monitor the warm up carefully, and should aim to develop a regular set routine.

- Rowers, with additional behaviour problems, can be very challenging. This often occurs if a rower becomes frustrated at not being able to do what is being asked or due to their disability they find it difficult to verbally express this frustration.
- Avoid situations or tasks that cause anxiety. Remain positive at all times, especially when things aren't going well. Concentrate on the things the rower is doing well and help to raise their self-esteem and confidence.
- Where unacceptable behaviour does occur, explore it carefully and tactfully to avoid further problems. For example, talk to the rower about why a situation occurred and why it is not acceptable.
- Many coaches collect feedback at the end of their session from their rowers. This is equally important for a rower with an ID, as it gives them a chance to share any frustration or difficulties they may be having. Be aware that they may not speak out in a whole group session, so feedback may need to be collected less formally i.e. whilst taking equipment back, during a cool down or stretching session.
- Coaches should take time to understand the rower they are coaching and where their performances might rank them. An average club rower may be a future world champion.
- One of the biggest problems a rower, with an intellectual disability, faces is not a coaching matter, but that of travel and independence. The inability to get to training or competition often results in them dropping out of sport. Coaches may feel transportation is not their role, but their help in such areas might be more important than anything they do at the club. Coaches should work with the rower to find a supporter or advocate who can help get them to and from training or competition when necessary, or make contact with the relevant organisations to try and arrange an escort or buddy (social services, Mencap etc).

There are several steps a rower must take before they are actually ready to begin any rowing exercises. Many individuals find it incredibly helpful to have instructions broken down into small elements, but as they become familiar with the routines and activities these instructions can be minimised.

Participants may have a range of learning and physical difficulties. This may also incorporate behavioural, communication and sensory difficulties. When writing a programme and working with rowers, take this into account and allow enough flexibility to ensure that the activities are understood and accessible to everyone.

Initially there is the journey to the 'rowing environment'; walking with a group, talking through road safety and increasing awareness of possible dangers. At the rowing venue the communication increases, warm up requires listening and an indication of readiness which relies on a combination of spoken language, symbols and signs. Use eye contact during partner work as it is an invaluable tool, which increases the rower's participation in group work. As they become familiar with the activities and what is expected of them, they will be encouraged to initiate communication to express what they want to do. At other times the programme can be been used to encourage movement for those with physical disabilities.

A programme for rowers with learning difficulties should be viewed as an evolving experience with a plan-do-review culture adopted to ensure it meets the needs of those it is designed for.

Rowing does not just benefit health through exercise, but improves co-ordination, sequencing, teamwork, competitive spirit, communication and self-awareness, allowing participants to gain a number of new or different experiences.

For further details please refer to - www.mencap.org.uk

For Information about Intellectual Disability please refer to the following resources:

UK Sports Association for People with Learning Disability

This organisation is the only sports organisation for people with intellectual disabilities that has a UK wide remit and the responsibility for classifying athletes with IDs.

UKSA is recognised by UK Sport and is the only official Great Britain representative member of INAS-FID. UKSA is also a member of the British Paralympic Association (BPA).
www.uksportsassociation.org

Special Olympics

The Special Olympics (SO) is the UK's largest provider of a year round sports training and competition programme for people with learning disabilities. SO is part of the Olympic family, but unlike the Paralympics they also work on community sport at all levels and for all abilities.
www.sogb.org.uk

Mencap

Mencap is the leading UK charity for people with an intellectual disability and their families. They have produced guidance on practical coaching techniques, some of which are detailed below:

Intellectual Disability and the Paralympics

Since the beginning of 2006, members of the FISA Adaptive Commission have been examining the possibilities for developing sport specific classification protocols for rowers with an intellectual disability (ID).

A study conducted by Professor Ben Johnson, (supported by the Italian and Greek Federations), identified measurable differences in the rowing mechanics of rowers with an ID, when compared with able-bodied rowers.

- ID rowers had difficulty in maintaining constant stroke rates, rhythm and length. They found also it hard to move from one rate to another.
- ID rowers found it difficult to learn and understand various sets of instructions and needed continual feedback from coaches in order to maintain a specific level of effort.

This study was limited to the small number of experienced ID athletes available, but it suggested some preliminary ideas for the design of ergometer based testing protocols for further investigation.

Figure 70: An LTA Mixed 4+ at the Paralympics

A study of the protocols being used in swimming and athletics resulted in the formation of pilot assessment protocol for rowing. This included ergometer tests examining movement skills, competition strategies such as starts and bursts, teamwork and the ability to follow others.

This protocol was tested at the 2009 World Championships in Poznan, and after detailed discussions at three separate meetings, in June 2010 the FISA Council decided to defer a decision about its use until after 2012.

This decision followed a survey of national federations which showed that there were not yet an adequate number of federations ready or able to prepare crews in time for 2012. It was felt that this would have significantly affected the credibility of the Paralympic regatta, which would have been the most important competitive event in the four year period for these rowers. The member federations also highlighted that a change would put additional strain on their stretched finances and human resources, right in the middle of the current quadrennium.

This decision should not be viewed as a step back from FISA's strong commitment to make the sport available for individuals with physical or intellectual disabilities, but rather is a reflection of the current state of the preparedness of athletes with an intellectual disability within the sport of rowing.

Physical Disability (PD) Coaching Considerations

Introduction

A rower's training is optimised by the coach approaching them as an individual with specific physical strengths and weaknesses which they must assess, train and monitor to allow them to reach their full potential.

A coach must fulfil the following four tasks as part of their coaching preparation and strategy:

- An individual assessment of the affected joint or impaired body part through discussion with the rower and observation during rowing and training.
- Personalising training plans and equipment for the rower to optimise performance, should they request this.
- Monitoring the rower's response to training.
- Assessing and managing the known possible injuries associated with rowing and training in partnership with the rower.

As you read through the following sections you will note an overlap of information. Please note these similarities as they will assist those working with people with various physical disabilities. For example issues of spasticity may be identified whilst working with rowers with cerebral palsy, spinal cord injury or multiple sclerosis. Skin issues will be of concern for rowers with an amputation or spinal cord injury; while muscle imbalance and altered joint function will be concerns common to all physical disabilities. Eventually, this information becomes so familiar to the coach that it will become no different than the coaching knowledge they have developed in areas such as exercise physiology and biomechanics.

Before rowers with a physical disability take part in rowing activity, a pre-activity screening process should be carried out detailing their medical history:

Medical History:

- Diabetes
- Heart Disease
- Cancer
- Stroke
- Recent Fracture
- Asthma
- Hypertension (high blood pressure)
- Autonomic Dysreflexia
- Dehydration
- Seizures
- Other .....

Transfers

Rowers who use wheelchairs may or may not require help when transferring from a wheelchair to a boat or ergometer (this will usually be determined by the lesion level of the spinal cord injury. Higher levels will require more assistance). Always ask the rower if they will need assistance before making any assumptions.

The basic transfer guidelines will vary depending on whether you are assisting transfer from a shore or pontoon.

Always ask the rower if they have a specific way they transfer safely from their wheelchair. If they do, let them use this. They should feel independent and comfortable at all times.

Figure 71: A wheelchair user getting ready to transfer

Figure 72: A wheelchair user lowering themselves onto the pontoon

Important points to remember:

- The majority of rowers will be able to transfer independently.
- Invite a coach or team member to assist the rower as required for their safety and comfort.
- If assistance with the transfer is required, allow the rower to direct the transfer.

Guidelines

1. Keep the trunk as straight as possible when lifting to minimise any strain on the spine.
2. Use the legs when lifting and not the back; the rower's feet should face the direction of movement.
3. Ask the rower how they would like to be lifted. They will have been assisted many times in a variety of situations, and are best placed to inform a coach how to lift in both a safe and dignified manner.
4. Always keep close to the rower during transfer.
5. Make sure you are transferring the rower to an appropriate seat with the correct skin protection surface, and beware of sharp projections.

(Please refer to the Equipment and Regulations section on page 27.)

GLOSSARY

Ergometer: a machine used to simulate the action of rowing for the purpose of exercise or training, and measures the amount of work performed.

The Three Stage Self-Transfer

It is a good idea to think of the transfer in three parts, regardless of whether a person is using a wheelchair, has difficulty walking or is visually impaired. Make rowers aware of any areas on the boat which might be a potential for injury during transfer, such as a rigger or footplate. Ensure that the rower has an appropriate cushion/pad on the seat and appropriate footwear to prevent the development of pressure sores.

Note: A transfer cushion is used during the transfer

Stage 1

1 Park the wheelchair closely to the transfer cushion, parallel to the boat and undo any wheelchair strapping.

2 Edge towards the front of the wheelchair, with your feet facing forwards.

Stage 2

3. Slowly and carefully swing your lower body down onto the cushion, using your trailing hand to push off from the wheelchair and then steady your body once you have reached the cushion.

4. Lean forwards to place a hand on the cushion to steady your upper body.

5. Swing your legs round to face the boat.

6. Place the hand nearest the rigger on the pontoon and the other hand on the seat, ready to move your body over to the seat.

Stage 3

7. Move your bottom over onto the seat, leaving your feet on the pontoon.

8 Move you feet over into the boat and place in the foot stretcher.

9. Strap each foot into the foot stretcher

10. Once your feet are strapped in, position yourself correctly and comfortably on the seat.

11 Do up the strapping on your seat, ensuring the strap sits just under the nipple line.

12 Receive the scull handles from your coach ...and once you are happy, row away!

Transferring with Two Helpers

Caution - This transfer technique works well in most situations. However, it may not be suitable for all rowers, particularly if they have weak or painful arms or shoulders.

1 The rower with a wheelchair should move to a position alongside and parallel with the boat. Ensure they leave sufficient space between the boat and the chair to sit on the pontoon. Put the brakes on.

2 Lift the back of the wheelchair, or remove the arm support on the transfer side

3 One helper should take the main body weight, while the other helper lifts the legs (Figure 73).

4 The rower grips his/her own wrists across the chest. Helper puts their hands under the rower's armpits and grips the rower's forearms. The helper in front of the rower grips them under their knees (Figure 74).

5 After a countdown, ('1... 2 ... 3 ... go') lift the rower onto the pontoon (Figure 75).

Figure 73

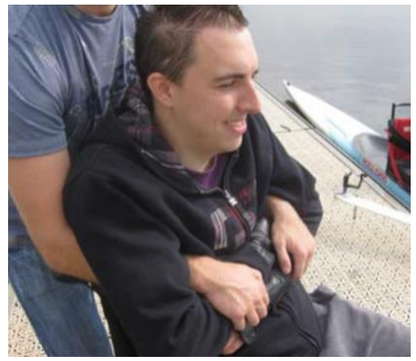
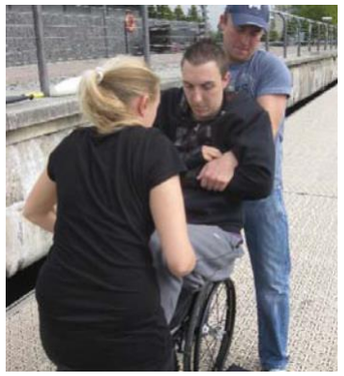


Figure 74



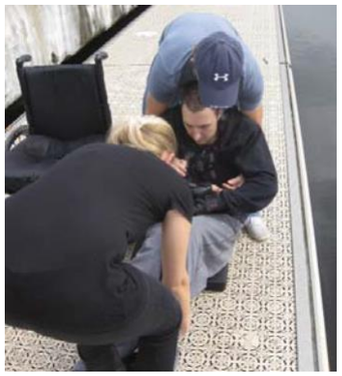


Figure 75

6. Helper positions themselves as close to the side of the boat as possible and lifts the rower's trunk onto the seat (Figure 76).
7. Helper transfers the rower's legs (Some rower's prefer to transfer their legs first) (Figure 77).
8. Ensure that the rower is safely strapped into the boat and comfortable (Figure 78).
9. Reverse this procedure to disembark.

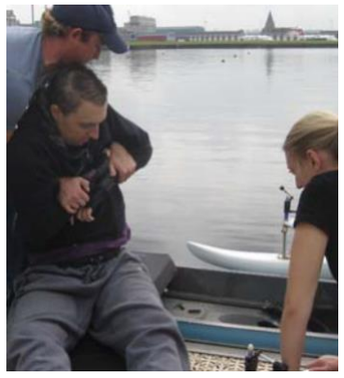


Figure 76


Figure 77

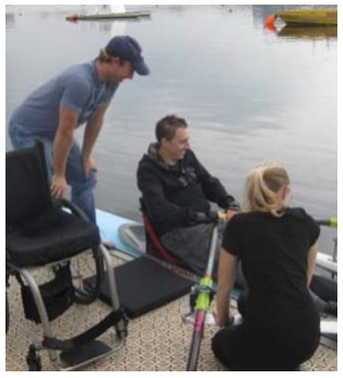


Figure 78

Important - To avoid injury to the lower back, helpers should use their stronger leg muscles by bending their knees during any lift.

Transfer Cushions

Transfer cushions are:

1. Essential for skin protection for those with no sensation due to paralysis.
2. Important for the comfort of someone with limited movement, sitting for long periods
3. Useful for someone with lack of trunk stability, or in need of support to maintain a particular position.

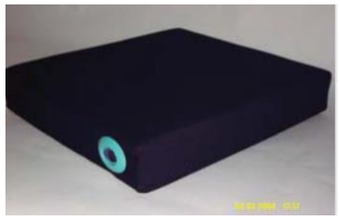


Figure 79: Transfer cushion

Aids to Transfer

If people with disabilities row regularly from the same venue, it may be worth investing in some permanent transfer aids.

Sliding boards

A sliding board is useful where the transfer gap is wide and the seat in the boat is at a similar height to the seat of the chair.


Figure 80: Sliding board

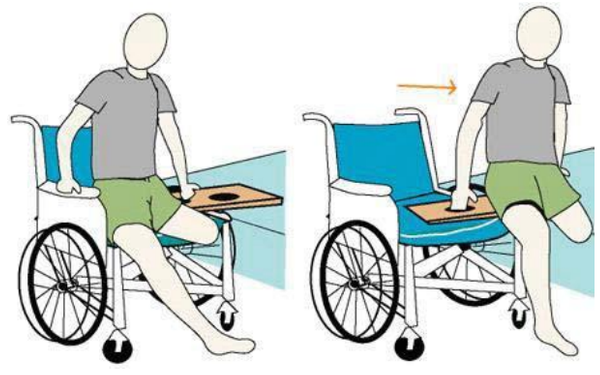


Figure 81: Using a sliding board

Hoists

A hoist can be installed on a stable dock, although this may be unsuitable for a floating pontoon. It is particularly useful if mounted on the outside corner of a dock where it can be used to access both the front and side.

Cranes for launching boats can also be used for transferring people, however they should be used with extreme caution and special attention paid to the type of sling used.



Figure 82: Hoist used in a rowing tank

Manual lifting can put helpers at risk of injury, but if mechanical lifting devices are not simple, at hand and practical, they will not be used. While the design of lifting devices and hoists is worthy of more research, human help remains readily available, flexible and portable.

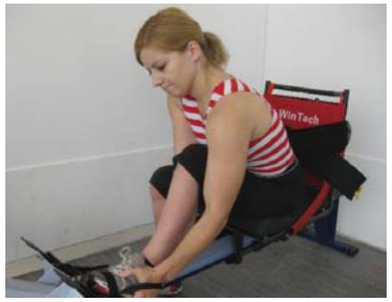
For information on electric hoists and slings – contact www.molift.co.uk

Ergometer Transfer

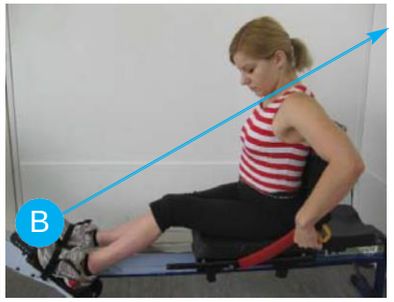
1 Park the wheelchair parallel to the indoor rowing machine and undo any wheelchair strapping. Place the foot nearest the indoor rowing machine on the opposite side of the monorail.

2 Slowly and carefully lower yourself onto the indoor rowing machine seat.

A. Be sure that the rower is aware and/or protected from any sharp edges that may injure them during transfer, such us the monorail.



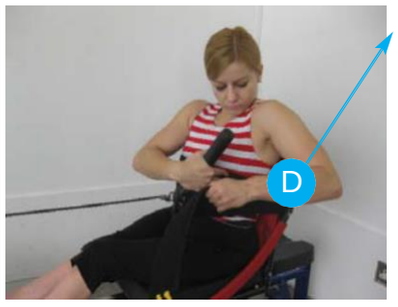
3 Strap each foot into the foot stretcher



4. Ensure that the strappings are accessible.

B. Ensure the feet are adequately protected to prevent pressure sores/marking.

5. Grab the handle of the indoor rowing machine and at the same time secure the strappings.



D. Use an appropriate interface cushion between the rower and seat to prevent pressure sores

C. All strapping should be manufactured from a soft material that will not cause chafing or marking (please refer to the Supplier List in the Appendix on page 120)

Amputees

During the classification process, rowers with a prosthesis will be examined with and then without their prosthesis to determine their sport class which is based upon best functionality.

Figure 83: An amputee with a prosthesis

For rowers who wear a prosthesis, consideration should be given to:

- Safety
- Comfort
- The potential impact on the mechanics of the rowing stroke
- Injury prevention

It is important for coaches to have some knowledge of the biomechanics of rowing and an understanding of the limitations as well as the adaptations available to enable someone with an amputation to row. This involves coordinating the motion of the prosthetic limb with that of the intact limb (e.g. the ankle joint flexion at the catch position).

The deficits in amputee rowing may become evident during the drive phase with reduced power through the prosthetic limb, which may lead to increased impact forces on this limb, combined with asymmetry in movement. Compensatory mechanisms will need to be employed to overcome these limitations described below.

Modifications

Rowing is relatively non-traumatic to the remaining limb because there is little vertical impact. If irritation does occur, it will most likely be from the trim lines of the socket as the rower goes through the full range of motion to complete a stroke. If rowers with below the knee (BK) amputations find their hamstrings are impinged upon, then the posterior trim lines can be modified, providing this does not compromise the integrity of the prosthesis.

When the prosthesis is only used for rowing, then a removable posterior wall can be fabricated by using a clip with a supracondylar removable wedge. A proximal strap that runs circumferentially around the proximal socket can be used to help hold the removable wall in place. The entire posterior wall can be lowered if the remaining limb is particularly long. Those with an above the knee (AK) amputation may find the flex from the hip socket is impinged, whilst a rower with BK amputation may experience some impact upon the knee's ability to flex. Both AK and BK sockets can be fabricated with a flexible brim, made from thermoplastics or flexible resins, in order to increase the comfort and range of motion while rowing.

GLOSSARY

Posterior: rear or bottom

Thermoplastics: is a polymer that turns to a liquid when heated and freezes to a very glassy state when cooled sufficiently.

Prosthesis: An artificial substitute or replacement of a part of the body such as a leg.

Hamstrings: refers to any one of the three posterior thigh muscles, or to the tendons that make up the borders of the space behind the knee.

Rowing Prosthesis (leg)

The rowing prosthesis should have an ankle or foot combination that allows for a range of unrestricted motion in both dorsiflexion and plantarflexion. Over the years, various prototype ankles have been fabricated to accommodate the need for full range of motion in the ankle. The ActivAnkle is perhaps the best example. It can be unlocked for complete dorsiflexion and plantarflexion during rowing, then locked into a vertical position after rowing for standing and walking. The ActivAnkle can be used on endoskeletal BK and AK systems and may also be modified for exoskeletal systems.

Figure 84: ActivAnkle™

Figure 85: Flexi-Foot system with quick release mounting for prosthesis

A lower limb prosthesis, that engages directly with the footplate, should implement a quick-release system (Figure 84 and Figure 85) Both of these devices can be used on an indoor rowing machine and in a boat, permitting a full range of movement during the stroke.

Upper Extremity Amputees

Figure 86: Upper extremity amputee - use of articulated carbon sleeve for indoor rowing machine use

Figure 87: Modified gripping aid for sweep oar rowing

GLOSSARY

Dorsiflexion: is where the angle between the surface of the foot and the leg decreases, so that the toes are brought closer to the shin.

Plantarflexion: : is the movement which increases the approximate 90 degree angle between the front part of the foot and the shin, as when pushing down on a car pedal. The word "plantar" is commonly refers to the bottom of the foot.

Endoskeletal: is an internal support structure. The vertebrate is basically an endoskeleton made up of two types of tissues (bone and cartilage).

Exoskeletal: is an external support structure that protects something, in contrast to the internal skeleton (endoskeleton) of a human.

Amputee Coaching considerations

Rowers with an amputation experience increased levels of work compared to able-bodied rowers when rowing. The result is that these rowers may tire quicker and develop thermoregulatory issues

- Rowers with an amputation tend to perspire more as they have less surface area through which to release heat. Wearing a prosthesis can prevent perspiration evaporating, and so limit the cooling benefits associated with evaporation. (This may be more prevalent among LTArowers who have more active muscle mass).
- Muscular imbalances may be a consequence of surgical intervention and can lead the body to take compensatory measures to overcome the original deficiencies. However compensatory measures can in turn influence the further development of yet more muscular imbalances if they are not monitored.
- Pain and 'phantom pain' also requires consideration when coaching rowers with amputations. Pain influences the rower's ability to bear weight fully and impairs the ability to row.

Injury Prevention

Introducing preventative measures into the rower's training program is the preferred method of injury management.

Listed below are some issues that coaches should be aware of:

- Direct pressure combined with the frictional and shear forces, that occur whilst rowing, do require careful consideration to ensure that the rower has a suitable liner between the socket and the residual limb.
- Increased perspiration, inadequate stump care, poor hygiene and poor maintenance of the prosthesis all contribute to injury (e.g., skin irritations). To overcome skin irritations the rower should remove the prosthesis after the training session to wipe perspiration from their residual limb and liner.
- An inadequately fitting socket can produce pressure points on a residual limb. As these points are repeatedly loaded throughout the drive phase, the skin can begin to breakdown. Massage is commonly used as a preventative measure as well as an effective way to manage this type of injury.

It is important to note that these injuries can be avoided. This can be achieved through constant stump monitoring, stump management, as well as the careful maintenance of a prosthetic.

GLOSSARY

Phantom pain: Phantom pain sensations are described as perceptions that an individual experiences relating to a limb or an organ that is not physically part of the body.

Cerebral Palsy (CP)

The most recently accepted definition of cerebral palsy (CP) is: "Cerebral palsy describes a group of permanent disorders of the development of movement and posture, causing activity limitation, that are attributed to non-progressive disturbances that occurred in the developing foetal or infant brain. The motor disorders of cerebral palsy are often accompanied by disturbances of sensation, perception, cognition, communication and behaviour, by epilepsy, and by secondary musculoskeletal problems." (Rosenbaum P, Paneth N, Leviton A, et al, 2007, 109:8)

It is important to note that symptoms of CP are diverse. These may range from individuals who have motor and sensory impairment impacting movement and posture, to individuals with very significant symptoms, contributing to motor, sensory and cognitive impairments.

Cerebral Palsy International Sports & Recreation Association

Common Terminology of Description

Individuals with CP are diagnosed with a particular 'type' of the disorder based on their movement impairment and the limbs affected. Common terminology used for hypertonic presentations are:

- Hemiplegia: The arm, trunk and leg of the same side are affected
- Diplegia: Both legs are affected (it is likely the lower trunk/pelvic region is also affected)
- Triplegia: Three limbs and partial trunk are affected, usually two legs and an arm
- Quadriplegia/tetraplegia: All limbs and trunk affected

However these terms do have limitations. For example, it is common for an individual with spastic diplegia to have upper extremity fine motor skill impairment. But it is unclear how much upper extremity impairment is needed to classify someone quadriplegic rather than diplegic. Similarly the term hemiplegia is inadequate as people diagnosed with this type of CP often have some impaired movement on the 'unaffected' side. Due to the fact that this terminology can be inadequate, some individuals may undergo a simple diagnosis of bilateral or unilateral involvement which predominately involves the upper and/or lower body.

Description of Movement Impairments

Movement impairments which may be noted in the various forms of CP.
These impairments may be grouped as:

- Positive motor signs: motor signs of increased activity.
- Negative motor signs: motor signs of decreased or insufficient activity.

It is rare for a person to have only one positive or negative sign of impaired movement. Most often both signs will exist side by side, resulting in people having a wide range of movement abilities.

Positive motor signs

Hypertonia

Hypertonia is defined as 'an abnormal increase in muscle resistance in response to an attempt to change its length through an external movement of the associated joint'. Hypertonicity may appear in the form of spasticity and/or dystonia. Spasticity is often the most prevalent movement impairment in people with CP, but it is very common for individuals to have spasticity and dystonia. Therefore if a rower describes their type of CP as 'spastic diplegia', they may have secondary signs of dystonia.

Hypertonicity may be managed conservatively with daily stretching and motion exercises. Spasticity is commonly addressed with treatments including corrective surgery to balance muscle forces around a joint (e.g. muscle releases, alteration of line of action of a muscle) and oral medications or injections (e.g. baclofen, botulinum toxin).

- Spasticity: Spasticity is an abnormal, increased muscle resistance to an externally imposed movement, and increases if the movement becomes faster The appearance of spasticity largely depends on the direction and speed of the movement, triggered by a specific joint, angle or speed of movement.
- Dystonia: Dystonia appears as abnormal postures or movements as a result of involuntary muscle contractions. These postures continue while at rest and do not relax with passive movement. Dystonia may be associated with simultaneous agonist and antagonist contraction, displaying resistance to movement when in opposing directions (e.g. resistance to movement in both joint bending and straightening activity). The affected limb tends to remain in a somewhat fixed involuntary posture which is further worsened when the person voluntarily moves other joints of the same limb.

Hyperkinetic Movements

Hyperkinetic movements are excessive or unplanned movements performed either voluntarily or involuntarily.

- Hyperkinetic dystonia: is defined as abnormal postures that occur alongside or instead of a voluntary movement. They are movements rather than postures and are commonly triggered by voluntary movement e.g. inversion of the foot when pushing with the leg, or turning the wrist outwardly while reaching.
- Athetosis: these involuntary, writhing movements are slow, continuous and purposeless and may prevent the person from being still. They are usually displayed in the hands, feet or mouth, although athetosis is not common in people with CP.
- Chorea: these movements are random, involuntary patterns or brief extraneous movements. Commonly faster than athetosis, chorea is jerky, random and occurs with voluntary movement in the large muscles of the trunk and limbs.

Negative motor signs

Negative motor signs occur as a result of decreased or insufficient motor activity. Weakness is the most common negative motor sign to occur in people with CP.

- Weakness: This is related to neurologically derived insufficient muscle activation to voluntarily generate force in a muscle.
- Reduced Selective Motor Control: This describes an impaired ability to isolate the activation of muscles to form a coordinated movement to achieve a desired goal.
- Ataxia: This is an inability to activate correct movement patterns to generate a normal or expected trajectory. Ataxic movements cannot be attributed to weakness or involuntary muscle activity around affected joints. It results in a difficulty to perform rapid and fine movement with accuracy. Ataxia is often associated with poor balance in ambulatory individuals.

GLOSSARY

Baclofen: is a prescribed drug, primarily used to treat spasticity.

Botulinum toxin: is a prescribed drug, primarily used to treat spasticity.

Dystonia: is a neurological movement disorder, in which sustained muscle contractions cause twisting and repetitive movements or abnormal postures.

Agonist: describes a muscle that causes specific movement or possibly several movements to occur through the process of its own contraction.

Antagonist: Most muscles work in pairs, and when a muscle works it needs to have an agonist and an antagonist, unless the muscle's natural state is opposite to that which is produced by the muscle.

Extraneous: not belonging to, or dependent upon, a thing; without or beyond a thing

Atheosis: Involuntary writhing movements particularly of the arms and hands.

- Apraxia/developmental dyspraxia: This is an inability to perform complex motor tasks, due to a loss of ability or lack of skill, despite appropriate practice. It is important to distinguish apraxia from an inability to perform due to weakness, poor motor control or hypertonicity.

Cerebral Palsy Coaching Considerations

Current research indicates that individuals with CP will respond to strength and endurance training like able-bodied rowers. It has demonstrated that people with CP will not lose the range of motion in a joint if strengthening is accompanied by specific programmes of flexibility. Strengthening programmes can address weak muscles, although these gains may be modest if there is an underlying neurological impairment. It is also important to remember that strength training for people with CP should follow the same overload principles that apply to people without CP.

Fatigue should be monitored, particularly during sessions when increased loads are added to strengthening exercises, as fatigue may result in deterioration in controlled movement patterns. For rowers with impaired coordination, strengthening exercises should focus on achieving coordinated movement patterns before the weight (load) is increased.

Hypertonicity affects the hamstrings, adductors, gastrocnemius and soleus in the lower body. Monitor the length and range of motion of these muscles in this area. Most people with CP will benefit from a flexibility programme which helps address areas of hypertonicity. Stretching is most effective when prolonged stretches are used to encourage the muscles to relax and achieve their optimal length without stimulating their reflexes. These programmes can be individualised to target areas of high tone and joints associated with overuse and/or postures enforced by rowing (e.g. hip flexors shortening). For example, an extended low-load warm-up with large rhythmical movements, followed by stretching will help prepare rowers for training and racing.

Hypertonicity can influence an individual's ability to achieve an effective, high stroke rate. It can lead to difficulty with quick transitions between the extension and flexion of limbs which are necessary to achieve higher rates. Difficulty may also be noted with the co-ordination of quick upper extremity activity required for effective blade work. This results in a decrease in force production, causing rowing technique to deteriorate at these rates. For example, increases in the speed of movement can trigger an increase in hypertonicity and therefore result in a decreased range of motion and shorter stroke. This may be particularly evident in an effective race start. Yet despite these difficulties, a rower with CP will respond to training including speed work. Their performance will be enhanced by finding the optimal stroke rate for racing.

Endurance training follows the same principles as those used with people without CP. People with CP tend to have higher heart rates, blood pressure and lactate concentrations when performing at sub maximal work rates than those without CP. It has been suggested that people with CP use more energy during the same activity due to the complications of hypertonicity, impaired co-ordination and hyperkinetic movements, which lead to inefficient movement patterns and increased energy expenditure. For this reason training targets and monitoring will need to be individualised.

GLOSSARY

Hamstrings: refers to any one of the three posterior thigh muscles, or to the tendons that make up the borders of the space behind the knee.

Gastrocnemius: refers to the bulging shape of the calf) is a very powerful superficial muscle that is in the back part of the lower leg. It runs from its two heads just above the knee to the heel.

Soleus: is a powerful muscle in the back part of the lower leg

Trajectory: is the path that an object moves along.

Multiple Sclerosis (MS)

Multiple Sclerosis (MS) is the most common disabling neurological disease in young adults in the Western world, although the exact causes of the disease remain largely unknown. MS is an inflammation and chronic degeneration of the central nervous system (brain and spinal cord). The disease attacks the protective layer (myelin) of the nerve connections (axons) in the central nervous system, impairing the nerve conduction. The symptoms of MS are excessive fatigue, weakness and motor dysfunction including spasticity. Functionality after diagnosis has been improved with advances in treatment resulting in longer times reported until the development of irreversible disability.

Types of MS

The different types of MS are largely defined by their symptom progression. The most common diagnosis at the initial onset of the disease is relapsing remitting MS (approximately 85-90%).

Relapsing Remitting MS

This is the most common type of MS with most people developing symptoms which eventually lead to a diagnosis of MS beginning in this way. Relapsing remitting describes the period when symptoms or progression of symptoms present themselves (a relapse) and the period when they subside (remission).

Secondary Progressive MS

Secondary progressive MS describes a progressive increase in symptoms. This is a steady progression without the remission of symptoms, however the progression may be very slow and is not easily detected. Commonly people with Relapsing Remitting MS will eventually develop Secondary Progressive MS, and it is estimated that approximately 65% of these will develop Secondary Progressive MS after 15 years.

Primary Progressive MS

Primary Progressive MS describes the presentation of MS in which the initial or primary symptoms of MS are followed by continued progression of symptoms. Symptoms will progress without a period of remission. This type of MS is estimated to affect approximately 10-15% of people diagnosed with MS.

Benign MS

Benign MS describes a form of MS which results in very little to no disability 10 to 15 years after the first presentation of symptoms.

Movement impairments

Fatigue: The excessive fatigue experienced by people with MS is often reported as the most debilitating symptom. It is commonly described as a systemic feeling of fatigue which is not proportional to the activity undertaken. The exact reasoning behind this fatigue is not clear and is likely multifactorial. It is now widely accepted that an individualised exercise program is of significant importance to maintain fitness and to slow the progression of fatigue.

Spasticity: Spasticity is the speed-dependent increased resistance to lengthening of a muscle (hypertonicity) and increased responsiveness of reflexes of a muscle (hyperreflexia).

Weakness: The central nervous system's pathway of communication is made up of networks of axons which communicate with muscle fibres. The speed at which muscle fibres are activated and the accumulated activation of muscle fibres, are impaired by MS leading to varying degrees of weakness.

Balance and co-ordination: MS affects the sensory and motor tracts of the central nervous system. This may result in impaired balance and co-ordination along with the ability to perceive movement and to alter movement according to a goal.

Multiple Sclerosis coaching considerations

Research has consistently reported the positive outcomes of exercise in people with MS. It helps reduce the development of secondary diseases (e.g. cardiovascular disease, obesity) and maintains a greater level of independence. This research has focused on the benefits of endurance training, but strength training can have a positive influence when both programmes are well suited to the person's abilities. The principles of gradual overload are applicable here, so monitor each individual to direct their progression. Spasticity can be managed with the prolonged gentle stretching of muscles (20 seconds to 1 minute) as long as it is not painful.

Exercising in heat accelerates the onset of fatigue. People with MS experience this at an accelerated pace and in less heat. It is not clear as to why this happens but it has been suggested that factors related to a decreased efficiency of sweating and heat dissipation may hasten the response. The use of pre-cooling can significantly improve performance and delay the onset of fatigue as well as decreasing spasticity in some individuals.

Individuals with MS beginning rowing for general fitness will need to monitor their levels of fatigue in relation to the amount of time they are training and at what intensity. This self-monitoring harnesses a knowledge of anticipated responses which encourages a successful integration of training into their lifestyle. Monitoring for competitive rowers will be of increased importance ahead of racing, such as planning a warm-up and recovery between races.

Poliomyelitis

Poliomyelitis is a viral infectious disease affecting children and young adults. The polio virus attacks the components of the central nervous system which control muscle activation, at the level of the motor neurons of the spinal cord. Poliomyelitis paralyses muscles with varying degrees of severity. The acute infection phase is followed by a progressive recovery phase but will leave varied levels of residual muscle wasting and weakness.

The last polio epidemics in Europe and the UK were in the 1950s. Vaccination has essentially resulted in eradication of poliomyelitis in the western world, but without world-wide vaccination the virus remains active in some developing countries.

Movement impairments

Poliomyelitis develops with varying degrees of muscle wasting and weakness, causing changes in postures and movement strategies. The muscles which are affected relates directly to the level of the spinal cord at which the virus was active. For example, people may be affected in one limb, both legs or one side of the body. As an individual ages, the effects of polio may alter. Most of the later effects are related to biomechanical stresses secondary to muscle imbalance or postural deformity and may require bracing to protect joints.

Poliomyelitis Coaching Considerations

Coaching a rower with poliomyelitis can be optimised by having a discussion with the rower regarding specific weak muscles or joint movements. This may be very obvious in some individuals however others with a variable extent of paralysis may be harder to read on first observation. Imbalances in weak muscles and unimpaired muscles around a joint can cause tense, opposing movements which are associated with joint deformity and instability. Note any changes in joint function to allow you to make modifications to the rowing stroke and reduce the likelihood of overuse injuries in these joints.

Post-Polio Syndrome

People with poliomyelitis will have symptoms that do not progress or alter for many years. Yet some people will experience new symptoms 15 years or so after the initial attack. Post-polio syndrome symptoms are characterised by:

- new muscular weakness occurring with sudden onset and quick-progressing deterioration associated with any of the following:
  - muscle atrophy
  - muscle or joint pain
  - excessive fatigue
  - cold intolerance

As some of these symptoms are common with other conditions, post-polio syndrome is a diagnosis of exclusion. This means that all other possible medical explanations for these symptoms are investigated and excluded. It remains unclear what leads to post-polio syndrome. It has been proposed that an overuse of remaining neurological structures of impaired muscles may lead to deterioration, or an auto-immune inflammatory process occurs, or the residual poliovirus is reactivated.

Post-Polio Syndrome Coaching Considerations

Strength training for people with post-polio syndrome can help regain some muscle strength. If changes associated with post-polio syndrome do not stabilise, it is important to maintain a moderate exercise intensity and monitor closely for signs of increased pain or worsening muscle fatigue. Endurance training improves cardiovascular respiratory parameters in people with post-polio syndrome, without any adverse effects. Research in this area has focused on moderate exercise of approximately 70 % of maximal heart rate.

Training for rowing will commonly approach levels beyond this threshold; therefore monitor the individuals for adverse effects like prolonged fatigue following training at higher intensities. The negative fatigue is the type of fatigue from which it can be a struggle to recover. This can present itself in the form of muscle or joint pain, in keeping with overuse injury or an overall sense of fatigue, which may limit simple daily activities which could previously be completed effortlessly.

Spinal Cord Injury (SCI)

The effects of SCI depend on the type and the level of the injury. SCI can be divided into two types - complete and incomplete. A complete injury means that there is no function below the site of the injury; no sensation and no voluntary movement. Both sides of the body are equally affected. An incomplete injury means that there is some function below the primary level of the injury.

A person with an incomplete injury may be able to move one limb more than another, may be able to feel parts of the body that cannot be moved, or may have more function on one side of the body than the other. With the advances in acute treatment of SCI, incomplete injuries are becoming more common.

The site of injury helps predict which parts of the body might be affected by paralysis and a loss of function. Remember that in incomplete injuries there will be some variation in these prognoses:

The spinal cord is rarely severed unless penetrated by a very high velocity impact. More often the cord remains anatomically intact but suffers contusion, infarction or mechanical deformation that interrupts it's local or relay circuitry. As more than 50 % of people with an SCI experience varying degrees of motor, sensory or autonomic sparing at different levels of the spinal cord, they can be classified using the benchmark system of American Spinal Injury Association (ASIA). The accurate description of an injury to a given spinal column segment involves a designation of the spinal region (e.g. cervical, thoracic, lumbar or sacral), a spinal nerve, and the degree to which the injury is neurologically complete or incomplete. The ASIA definitions of complete and incomplete are:

1) 'Complete injury' describes the absence of sensory and motor function in the lowest sacral segment
2) 'Incomplete injury' describes partial preservation of sensory and/or motor functions below the neurological level and including the lowest sacral segment.

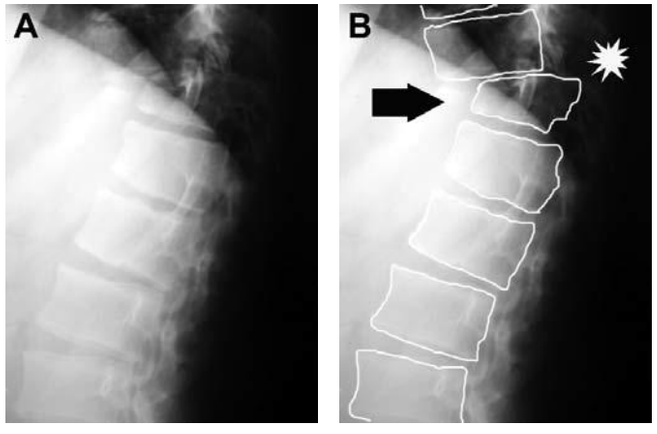


Figure 88: A lateral radiograph of thoracic spine of an AS class rower, showing a fracture and posterior dislocation of T9 vertebral body resulting in a complete SCI behind the vertebra. The injury was caused by a fall from a height. A) Plain radiograph; B) Vertebral bodies are highlighted with white line. Black arrow is pointing to fractured and dislocated vertebral body. White star presents place of spinal cord injury.

GLOSSARY

Contusion: An injury in which the skin is not broken; a bruise

Infarction: Localised necrosis (death) resulting from obstruction of the blood supply.

This table outlines the functional goals for specific levels of complete injury.

Level	Muscles Tested	Abilities	Functional Goals
CERVICAL			
C1-C3		C3-limited movement of head and neck	Breathing: Depends on a ventilator for breathing. Communication: Talking is sometimes difficult, very limited or impossible. If speech is limited, communication can be accomplished with a mouth stick and assistive technologies like a computer for speech or typing. Daily tasks: Assistive technology allows for independence in tasks such as turning pages, using a telephone and operating lights and appliances. Mobility: Can operate an electric wheelchair by using a head control, mouth stick, chin control or a power tilt wheelchair for independent pressure relief.
C3-C4		Usually has head and neck control. Individuals at C4 level may shrug their shoulders.	Breathing: May initially require a ventilator for breathing; usually adjust to breathing full-time without assistance. Communication: Normal. Daily tasks: With specialized equipment, have limited independence in feeding and operating an adjustable bed with an adapted controller.
C5	Elbow flexors (biceps brachii)	Typically has head and neck control, can shrug shoulders and has shoulder control. Can bend his/her elbows and turn palms face up.	Daily tasks: Independent eating, drinking, face shaving/washing, brushing teeth, & hair care after aid in setting up specialized equipment. Health care: Can manage their own health care by doing self-assist coughs and pressure reliefs by leaning forward Mobility: May have strength to push a manual wheelchair for short distances over smooth surfaces. A power wheelchair with hand controls is used for daily activities. Driving may be possible after evaluation by a qualified professional to determine special equipment needs.
C6	Wrist extensors (extensor carpi ulnaris, extensor carpi radialis longus and radialis brevis)	Has movement in head, neck shoulders, arms and wrists. Can shrug shoulders, bend elbows, turn palms up and down and extend wrists.	Daily tasks: With some specialized equipment can feed, bathe, groom, dress and maintain personal hygiene with greater ease. May independently perform light housekeeping. Health care: Can independently do pressure relief, skin checks and turn in bed. Mobility: Can independently complete transfers, often with a sliding board. Can use a manual wheelchair for daily activities but may use a powered wheelchair for greater independence.

Spinal Cord Injury Information Network

Level	Muscles Tested	Abilities	Functional Goals
C7		Similar movement as an individual with C6, may straighten elbows.	Daily tasks: Household duties. Needs fewer adaptive aids for independent living. Health care: Able to do wheelchair pushups for pressure reliefs. Mobility: Daily use of manual wheelchair. Can transfer with greater ease.
C8		Added strength & precision of fingers resulting in limited hand function.	Daily tasks: Can live independently without assistive devices for feeding, bathing, grooming, oral and facial hygiene, dressing, bladder and bowel management.
T1 T2-T6	Finger abductors (Abductor digiti minimi)	Has normal motor function in head, neck, shoulders, arms, hands/fingers, greater use of rib/chest muscle	Mobility: Has increased ability to do unsupported seated activities. Some individuals will be capable of limited walking with orthotic aids. This requires high levels of energy and puts stress on the upper body, offering no functional advantage. Can lead to damage of upper joints.
T7-L1			Daily tasks: Able to perform unsupported seated activities. Health care: Has improved cough effectiveness.
L2-L5	Finger abductors (Abductor digiti minimi)	Has additional return of motor movement in the hips and knees.	Mobility: Walking is a viable function, with the help of specialized leg and ankle braces. Lower levels walk with greater ease with the help of assistive devices.
S1-S5	Ankle plantar flexors (Gastrocnemius)	Various degrees of return of voluntary bladder, bowel and sexual functions.	Mobility: Increased ability to walk with fewer or no supportive devices.

It is important for those working with rowers with an SCI, to differentiate between upper and lower motor neuron injuries. Lesions of upper motor neurons result in a 'decentralization' of the nervous system, spastic paralysis and exaggerated sensorimotor reflexes below the injury. This means that motor, sensory and autonomic reflexes are preserved, but are no longer under the command of the brain. The contrasting injury is a lower motor neuron lesion, which often accompanies SCI at the T10 level or lower, and almost always occur at, or caudal to, T12. Rowers with these lesions lose central nervous system control of sensorimotor functions, as well as sensorimotor reflex activity, which causes flaccid paralysis and areflexia ("denervation"). This explains the greater loss of lower extremity muscle mass in individuals with flaccid rather than spastic paralysis.

GLOSSARY

Gastrocnemius: Is the calf muscle that is visible from the outside of the body. It attaches to the heel with the Achilles Tendon and originates behind the knee on the femur, crossing two joints.

Spinal Cord Injury coaching considerations

- Spasticity: This typically occurs in the muscles below the site of injury and is exacerbated by exposure to cold air, urinary tract infections and physical exercise. It is characterised by high muscle tone or hyperactive stretch reflexes and can be managed with stretching and by avoiding exercises that cause excessive spasticity.
- Autonomic Dysreflexia: This is a sudden rise in blood pressure caused by an exaggerated nervous system response to noxious stimuli below the level of injury, usually due to bladder/bowel over-distension or blocked catheter. Symptoms include profuse sweating, sudden elevation in blood pressure, flushing, shivering, headache, and nausea. Seek medical attention immediately when it occurs.
- Orthostatic hypotension: A drop in blood pressure (greater than 20 mmHg for systolic blood pressure and greater than 10 mmHg for diastolic blood pressure). It occurs in upright postures, especially moving from supine to upright sitting/standing/head-up tilt. Symptoms include nausea, dizziness and lightheadedness. Monitor blood pressure throughout exercise, avoid quick movements, perform orthostatic training, maintain hydration, use compression stockings and an abdominal binder. If orthostatic hypotension occurs, lie in a supine position with the individual's feet elevated.
- Thermoregulation: Irregular body temperatures are often experienced by individuals with SCI. Ensure they wear appropriate clothing, drink plenty of fluids and take precautions. In warm environments, a fan and water spray will aid cooling, and in cold environments wear extra layers.
- Pressure sores (decubitis ulcers): Damage to the skin or underlying tissue can be caused by prolonged sitting, use of old wheelchair cushions, shear forces or as a result of a fall. Check skin regularly and perform wheelchair push-ups.
- Transfers: Be sure to follow appropriate guidelines. Please refer to the Transfer section of this guide on page 59.
- Balance: Use physical assistance devices to hold the body in position during upright exercise.

Importance of Exercise

1. It prevents secondary conditions such as cardiovascular disease, diabetes, pressure sores, carpal tunnel syndrome, chronic obstructive pulmonary disease, hypertension, urinary tract infections and respiratory disease.
2. It prevents deconditioning and obesity.
3. It provides psychological and/or recreational benefits.

Exercise limitations - Key considerations

- Overuse of upper extremities
- Limited amount of active muscle mass: reduced energy consumption
- Blood pooling in legs: reduced pre-load of heart: reduced stroke volume
- Autonomic nervous system: cardiac control, temperature regulation (vasoconstriction/dilation)

Pressure sores

Rowing is one of the most dynamic of all seated sports and an SCI is particularly susceptible to pressure sores. Many people with a SCI will have their preferred method of skin protection system that the coach should utilise in and out of the boat.

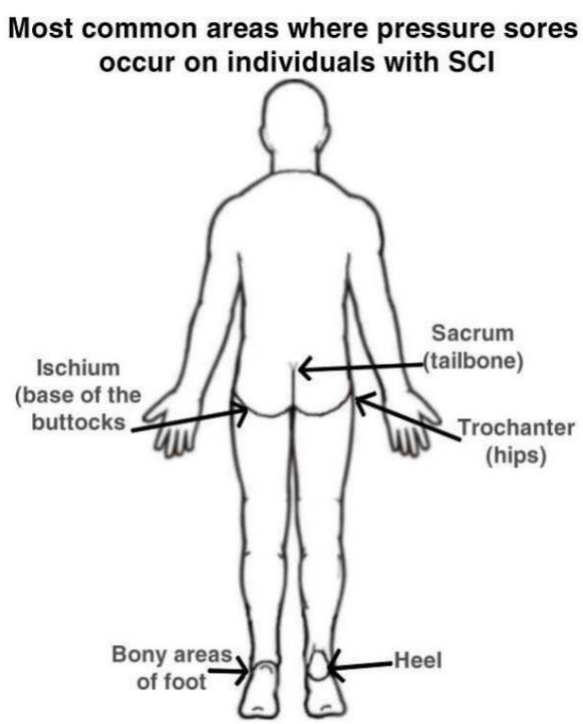


Figure 89: Common areas where pressure sores occur on individuals with SCI

A number of skin protection systems are available specifically for rowing. (See Equipment and Regulations section)

Pressure sores are caused by too much pressure on a person's skin for a long period of time. Pressure sores can occur when a person sits in one position for too long (boat or ergometer).

Shearing is another kind of pressure injury; it happens when the skin moves one way and the bone beneath it another.

An individual with a low level incomplete lesion SCI is particularly predisposed to this type of injury in sliding seat rowing. Normally the nerves send messages of pain or feelings of discomfort to the brain which triggers the person to change position, but damage to the spinal cord keeps those messages from being transmitted.

Individuals with SCI constantly learn new ways to change their position to prevent too much pressure.

Respiratory Dysfunction

Respiratory complications and infection are the main post-SCI complications. When the injury involves the upper thorax, the normal breathing pattern is permanently altered. The diaphragm does most of the work in quiet breathing. The chest wall muscles (inter-costal) are used primarily for deep breathing or coughing. The abdominal muscles also participate in coughing. When the inter-costal and abdominal muscles are paralysed, the entire load is taken by the diaphragm. This results in poor coughing and a high risk of pneumonia. Pneumonia is one of the most common complications of acute spinal cord injury. Preventive measures are very important to reduce the risk of pneumonia.

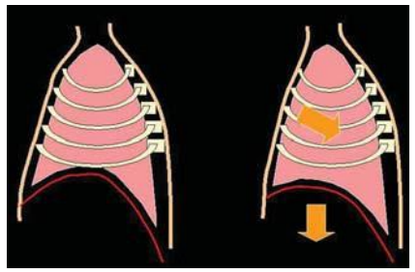


Figure 90: Diagram depicts decreased tidal volumes. Arrows indicate paralysis to the inter-costal muscles with load taken by the diaphragm.

Hydration - Thermo-regulation

After a spinal cord injury, the temperature of the body has an increased tendency to fluctuate in relation to its environment. When in a hot environment a SCI rower's temperature may increase (hyperthermia) or decrease (hypothermia) in a cold environment. This is caused by the altered function of the autonomic nervous system. The higher the site of the spinal cord injury, the greater the tendency for fluctuations in body temperature.

GLOSSARY

Ergometer: a machine used to simulate the action of rowing for the purpose of exercise or training, and measures the amount of work performed.

Thermoregulation in SCI rowers

Rowers with a SCI may be less able to regulate their body temperature or less able to respond to changes in their environment. With high level SCI, the person may be especially insensitive to changes in heat or cold. For example the early symptoms of shivering may not be apparent in these rowers.

Hyperthermia refers to an elevation in body temperature. For example, it may occur on a hot day if a SCI rower is waiting to go afloat.

One or more of the following symptoms may indicate hyperthermia:

- Skin feels hot, dry and appears flushed
- Feeling of weakness
- Dizziness
- Visual disturbances
- Headache
- Nausea
- Elevated temperature
- Pulse is generally rapid and may be irregular or weak.

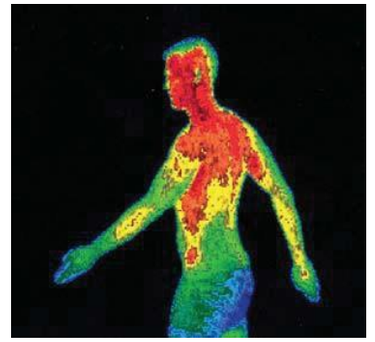
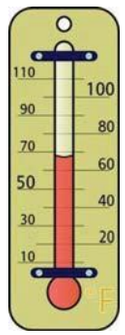


Figure 91: Thermo-imaging showing majority of heat loss during exercise in red



It is important to prevent hyperthermia when exposing a SCI rower to an overheated environment. Know how long your rower can be in an overheated environment without developing symptoms. Ensure that they drink plenty of fluids, wear protective, light-weight clothing (cotton and light colours) and wear a hat.

Paralysis limits the ability to perspire below the site of the injury, so it is important that SCI rowers are kept hydrated. The higher the level of the injury (tetraplegia) the more susceptible the person is to temperature regulation problems (particularly important when on the water).

SCI rowers should be encouraged to seek shade during rest periods and wear light clothing and use spray bottles to cool off.

SCI rowers are also at risk of developing hypothermia. The signs and symptoms of hypothermia follow a typical course, though the body temperatures at which they occur vary from person to person. The impact of hypothermia on the nervous system often becomes apparent quite early. Co-ordination may begin to suffer as soon as body temperature reaches 95°F (35°C).The use of an 'ice-jacket' (Figure 92) may be useful in extremes of temperature.

Figure 92: An SCI rower using an ice jacket.

Autonomic Dysreflexia (AD)

Autonomic Dysreflexia (AD), also known as Hyperreflexia, is a condition caused by a sharp rise in blood pressure which can lead to stroke and possibly death. Individuals with a SCI at the T-6 level or above are at the greatest risk. AD is usually caused by an irritating stimulus below the level of the injury. Symptoms include headache, facial flushing, perspiration, and a stuffy nose.

AD occurs primarily because of an imbalance in the system which controls blood pressure. One of the major ways the body controls blood pressure is by tightening or relaxing little muscles around the blood vessels. When the muscles contract, the blood vessels get smaller and blood pressure increases.

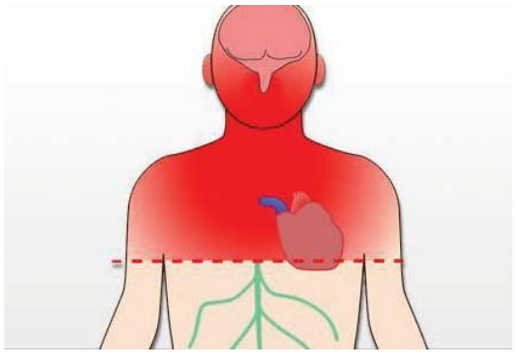


Figure 93: Diagram showing Autonomic Dysreflexia at T6 (dotted line) and above.

When an irritating stimulus occurs, a reflex is initiated that causes the blood vessels to constrict, raising the blood pressure. In an intact spinal cord, this same stimulus also sets in motion another set of reflexes that moderates the constriction of blood vessels. However, in someone who has SCI at the T-6 level or above, this signal cannot travel along the spinal cord due to the injury. Some of the nerves at the T-6 level also control the blood flow to and from the gut, which is a large reservoir of blood. Uncontrolled activity of these nerves may cause the blood from the gut to flow into the rest of the blood system. The result is that blood pressure can increase to dangerous levels and the increase in blood pressure must be controlled by outside means. The symptoms of AD are fairly easy to recognise and surprisingly consistent. They include:

1. Sudden, pounding headaches
2. Flushed or blotchy skin
3. Facial flush, perspiration (above the level of injury)
4. Goosebumps
5. Spasticity
6. Stuffy nose
7. Slow heart-rate (reflex bradycardia)
8. Dizziness and nausea

If a SCI rower complains pre/post or during exercise of any of the above symptoms, pay attention! Start looking for the cause of AD and stop whatever is causing it!

Common sources of Autonomic Dysreflexia are things that irritate or stimulate the body:

1. A full or distended bladder (this is the most common source of AD)
2. Bladder related causes such as bladder infection, spasms, or stones
3. A full or impacted rectum (including constipation)
4. Pressure sores
5. Tight clothing, irritating wrinkles or folds, or creeping underwear or pants.
6. An injury below the spinal cord injury such as a broken ankle, cut or scrape
7. Anything that produces discomfort below the level of injury.

What a coach should do:

During the pre-activity screening process, the coach should establish if the rower has ever had autonomic dysreflexia, and if so, ask what caused it. This will form part of the overall 'risk assessment', which is particularly important for on-water activity.

The first thing to do when it is identified that a rower is having an AD episode is to raise the person's head above their knees (preferably in a sitting position). This position naturally reduces the blood pressure. Look for the common causes listed above and seek medical assistance.

Spina Bifida

Spina Bifida is a congenital disorder caused when the embryonic spinal cord and its surrounding protective column are interrupted and do not close fully. It is one form of SCI. Spina Bifida falls into different types:

Spina Bifida Occulta

This is the least serious form of spina bifida. Many individuals are unaware that they have spina bifida occulta as there are commonly no symptoms associated with the very small opening in the spine and small gaps in the spinal column. Treatment is rarely required.

Spina Bifida Meningocele

Spina Bifida Meningocele is rare. It is characterised by the protective membrane of the spine being pushed out between the vertebrae of the spinal column. This is commonly corrected by surgically removing these membranes, without compromising the spinal cord.

Spina Bifida Myelomeningocele

The term 'spina bifida' commonly refers to spina bifida myelomeningocele, as the other types cause very little or no physical disability. This is the most serious type of spina bifida and usually results in physical disability. The condition is characterised by several incomplete and open vertebrae in the spinal column, through which the protective membranes of the cord poke out, requiring surgical intervention to close.

This can result in complete or partial paralysis of the leg muscles or lower trunk depending on where the spinal lesion lies. Some individuals will develop the ability to walk, while others will need to use a wheelchair. In addition, many individuals with spina bifida myelomeningocele will also develop hydrocephalus. Hydrocephalus is a condition where an excess of the fluid surrounding the brain and spinal cord (cerebrospinal fluid) accumulates around the brain. The treatment for hydrocephalus is to insert a shunt into the brain to help the body regulate this fluid.

Spina Bifida Coaching Considerations

The coaching considerations for spina bifida are essentially the same as those for spinal cord injuries. Nonetheless, as spina bifida may additionally have some impact on the central nervous system and brain, there are some extra concerns. Some individuals may demonstrate signs of hypertonicity and impaired coordination of their arms or hands, commonly visible in the fine motor skills of the hands. Rowers with spina bifida at a high level of the spine are more likely to exhibit impaired upper limb co-ordination. Additionally, these people may experience learning difficulties, especially those with hydrocephalus, which can cause further damage to the brain due to the increased pressure from excess fluid.

Approximately 80% of people with spina bifida have intelligence within the normal range but may have learning difficulties. These learning difficulties can be mild and will not impact upon the learning of a sport. However some may have difficulty maintaining attention span, solving detailed problems or understanding new and abstract concepts i.e. technique or race plans. These can be managed effectively by repeating new material, coaching one on one time and using written explanations and clear diagrams to reinforce concepts.

Since spina bifida is a congenital form of spinal cord injury, notable changes can appear in the growth of affected limbs. This is particularly true of individuals with significant paralysis.

It is common for the pelvis and bones in the lower extremities to be limited in growth and there can be an increased likelihood of scoliosis (abnormal curvature of the spine) and risk of joint instability (particularly the hips). Permanent pelvic or lumbar spine postural fixations may render certain muscles in the hips and low back ineffective and significantly impact seating options. The proximity of the rib cage to the pelvis can limit trunk function and in some cases of postural dysfunction, the ribcage may not be free of the pelvis and actually be positioned within the pelvis.

When working with a rower with spina bifida and hydrocephalus, the coach would benefit from having a conversation with the rower (or their parent, depending on their age) to discuss the signs and symptoms of problems with a shunt . Although it is unlikely a problem will arise during training, it is beneficial for the coach to be able to recognise an issue if it arises. The most common problem would be a block in the shunt, resulting in increased fluid around the brain. This will require an immediate assessment by a doctor as the shunt will need to be surgically repaired.

Common signs include:

- Headaches
- Irritability
- Lethargy or drowsiness
- Disorientation
- Personality changes
- Nausea and vomiting
- Lack of appetite
- Seizure
- Visual problems (blurred or double vision)
- Instances of incontinence in a person without history of this

A Final Coaching Consideration – Training Diaries

The overarching principle for training people with physical disabilities is to approach the development and monitoring of training on an individual basis. Each person has unique needs despite the fact they may have the same diagnosis or similar impairments.

The use of training diaries provides valuable information for everyone involved. They are especially useful during the initiation of training, to track changes in training and review training methods or intensities. Training diaries should include information regarding goals, the length of sessions, intensity of training (heart-rate, perceived exertion), nutrition, weight, sleep cycles, subjective reports of feeling of fatigue vs. rested periods. For individuals with a physical disability training diaries may benefit from including information regarding any impact on activities of daily living (ADLs), e.g. transfers, wheeling endurance, skin health, monitoring of specific joints of known concern. This will facilitate the rower and the coach to direct training from an informed position.

Every rower will need an individualised training plan to optimise their performance for competition. Rowers with a physical disability may require greater individualisation as there is less research and information available to assist in understanding training response and monitoring due to the variability of physical presentation.

Adaptive Rowing Ergometer Technique Technical Model PR1

1 Head and chin are upright with handle drawn towards the body and forearms parallel to the floor. The rower leans back slightly with relaxed shoulders. Legs are positioned with flexion in the knees to prevent potential injury and/or predisposition to spasm.

3. Trunk and shoulders forward and flexed. The rower leans on trunk strap, hands over feet. Head upright.

5. The arms/shoulder draw is initiated to accelerate the handle towards the body.

2. Arms are relaxed and fully extended.

4. Forearms horizontal, lean back slightly, handle drawing towards the body.

6. The finish.

GLOSSARY

Ergometer: a machine used to simulate the action of rowing for the purpose of exercise or training, and measures the amount of work performed.

Adaptive Rowing Technique Technical Model – PR1

The aim in fixed seat rowing technique is to keep things simple and aim to do the basics well so the rower's sculling is effective and enables them to use their physical potential to move the boat. Technique must be reproducible at high rates. The ability to apply power effectively through the water by exhibiting the basics is paramount. All movements have to follow each other in a fluid, continuous cycle.

The Catch

2. The shoulders are forward flexed, and the trunk is leaned against the chest strap.
3. The hands rise to “lock” the blades into the water.
4. The catch is initiated using powerful shoulder muscles.

Note: The rower is strapped at the trunk and knees.

Mid-drive

5. The catch is taken with one smooth continuous accelerated movement (no pause), employing the powerful shoulder muscles and then the arms.

The Finish

6. The trunk is set against the backrest of the seat.
7. The shoulders and neck are relaxed.
8. The hands make a small tap downwards with flat wrists, to lift the blades clear of the water.

The Recovery

9. The hands move away level with the arms and shoulders fully relaxed.
10. The sculls are pushed smoothly out towards the front end with the blades squared early enough to enter the water again without having to pause to complete the squaring action.

Hearing Impairment Coaching Considerations

Definitions of deafness

Someone's level of deafness is defined according to the quietest sound they can hear, measured in decibels.

International symbol for Hearing Impaired.

- **Mild deafness**
  Mild deafness can cause some difficulty following speech, mainly in noisy situations. The quietest sounds they can hear are 25 to 39 decibels.
- **Moderate deafness**
  People with moderate deafness may have difficulty following speech without a hearing aid, and find the quietest sounds they can hear are 40 to 69 decibels.
- **Severe deafness**
  People with severe deafness rely on lip-reading, even with a hearing aid, as the quietest sounds they can hear are 70 to 94 decibels. British Sign Language may be their first or preferred language.
- **Profound deafness**
  Profoundly deaf people can hear an average 95 decibels or more. BSL may be their first or preferred language, but some prefer to lip-read.

There are an estimated 8,945,000 deaf and hard of hearing people in the UK, making this a significant impairment group.

Terminology

The following terminology is used by the Royal National Institute for the Deaf (RNID)

- **People who are deaf**
  This is a general term used when talking about people with all degrees of deafness.
- **People who are hard of hearing**
  This describes people with a mild to severe hearing loss. It is often used to refer to individuals who have lost their hearing gradually.
- **People who are deafened**
  People who are deafened were born being able to hear and became severely or profoundly deaf after learning to speak. This can happen suddenly or gradually.
- **People who are deafblind**
  Many people who are deafblind have some hearing and vision. Others will be totally deaf and totally blind. There are about 23,000 people who are deafblind in the UK.
- **The deaf community**
  Many deaf people whose first or preferred language is British Sign Language (BSL) consider themselves part of the Deaf community. They may describe themselves as Deaf with an upper case "D" to emphasise their Deaf identity.

Ways to communicate

British Sign Language (BSL) - A Recognised Language

BSL was recognised by the UK government as an official minority language in 2003. This has led to increased funding for the needs of the communication of people who are Deaf, and an increased awareness of the language which now has a similar status to that of other minority languages such as Gaelic and Welsh.

Sign Supported English

Another form of sign language used in Britain is known as Sign Supported English (SSE). SSE is not a language in itself. SSE uses the same signs as BSL but they are used in the same order as spoken English. SSE is used to support spoken English, especially within schools where children with hearing impairments are learning grammar alongside their signing, or by people who mix mainly with hearing people.

Is Sign Language Universal?

Many hearing people have the false impression that Sign Language is a worldwide universal language. Due to the isolated nature of Sign Language there is significant variation from city to city within the UK, known as regional variation, and can be thought of as being similar to regional accents and colloquialisms found in spoken languages. Other countries have their own sign language, many of which are completely unrelated to BSL.

Effective Communication

It is likely that the coach will have limited or no knowledge of sign language. Below are some guidelines to establish effective communication between the coach and the rower with a hearing impairment:

1 Be patient and friendly and take time to communicate.

2 If you are not understood you can:

- repeat what you have said
- rephrase what you have said
- give clues to what you mean
- write things down if necessary

Coaches should:

1. Face the person and speak normally but clearly.
2. Learn how to communicate effectively with the person who is lip-reading or using a sign language interpreter.
3. Facilitate communication between the rower and the rest of the crew.
4. Keep background noise to a minimum.
5. Remember that it is not possible for a deaf rower to lip-read at the same time as looking at technical aspects of the rowing stroke such as blade work. Keep this in mind when including them in video analysis sessions with the rest of the crew.
6. Structure your coaching sessions well and write down the session objectives to supplement verbal instruction.
7. Allow additional time for a hearing impaired rower to understand and assimilate what you have said and to make contributions to discussions.
8. Allow time for relaxation or 'eye breaks' as hearing impaired rowers will need to maintain high levels of concentration in order to follow communication.
9. Consider using a ‘skilled performer’ to demonstrate rowing technique whilst talking to the rower directly making direct eye contact. Deaf/hearing impaired individuals are ‘visual learners’.

Supplement oral instruction with hand and arm gestures which substitute the spoken word. For example use the hand to explain feather, roll-up and square sequence.

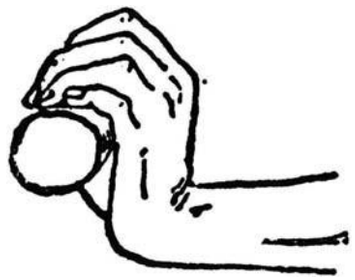
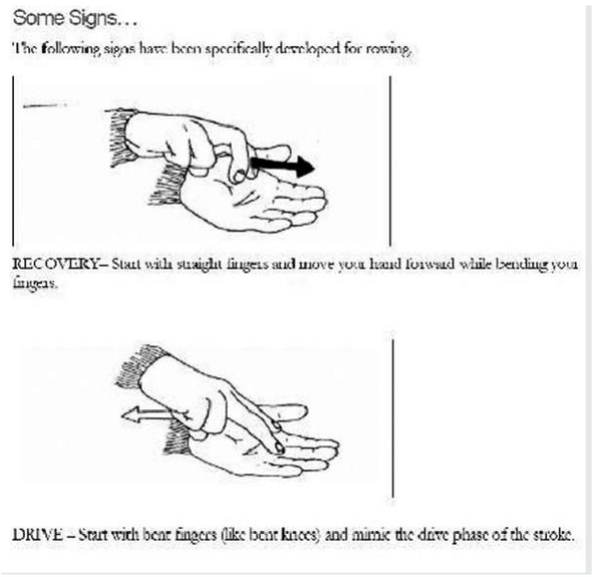


Figure 94: Using hand gestures to explain feathering, roll-up and square sequence.

Braille (Deaf-Blind Communication)

Braille is a tactile symbol system used by individuals with visual impairments to read and write. Combinations of six embossed dots arranged in a cell of two columns make up the Braille characters, representing letters, words, and parts of words. Braille is used internationally, but different countries change the code of the characters to match their language.

Below are some signs that have been specifically designed for Rowing by Jill Yates, Head Coach for the Deaf Rowing Program, Deep Cove Rowing Centre, Vancouver, Canada.



© Jill Yates

For further information please refer to:

British Deaf Association official website and the home of the largest UK Deaf organisation run by Deaf people for Deaf people www.bda.org.uk/

Royal National Institute for Deaf People www.rnid.org.uk

UK Deaf Sport is a registered charity which aims to encourage Deaf people to participate, to enjoy and to excel at sport. www.ukdeafsport.org.uk

Competition

Adaptive rowing has designed principles for national and international competition:

'Equality and Opportunity' in the sport of Rowing

Cater for varied disability types

Gender equity in crew boats

Inclusion

Able-bodied rowers + Rowers with a disability =

BRITISH ROWING

International Boat Classes

The boat classes and events used in international events are designed to reflect FISA competition principles. There are 5 Boat Classes:

Legs, trunk and arms mixed coxed four (PR3 Mix4+)
Mixed gender crew. Male or female coxswain with or without adaptive rowing classification. Sliding seat.

Legs, trunk and arms mixed ID coxed four (PR3 IDMix4+)
Mixed gender crew. Male or female coxswain with or without adaptive rowing classification. Sliding seat.

Trunk and arms mixed double (PR2 Mix2x)
Mixed gender crew. Fixed seat.

Arms and shoulders women's single (PR1 W1x)
Women only. Fixed seat with stabilising pontoons.

Arms and shoulders men's single (PR1 M1x)
Men only. Fixed seat with stabilising pontoons.

National Boat Classes

The international (FISA) boat classes rely on mixed gender with different disabilities in crew boats. At national level, British Rowing adaptive competition can include events, which can be mixed, single gender or open category to help develop the sport.

For further details contact:

British Rowing National Adaptive Development Officer,
6 Lower Mall,
Hammersmith,
London,
W6 9DJ

Special Olympics

Eligibility

Special Olympics rowing training and competition is open to every person with intellectual disabilities who is at least 18 years old and who registers to participate.

Age Requirements

There is no maximum age limitation for participation in the Special Olympics. The minimum age requirement for participation in Special Olympics may permit children who are at least 6 years old to participate in age-appropriate Special Olympics training programs.

Identifying Persons with Intellectual Disabilities

A person is considered to have intellectual disabilities for purposes of determining his or her eligibility to participate in Special Olympics if they satisfy any one of the following requirements:

- They have been identified by an agency or professional as having intellectual disabilities as determined by their localities; or
- They have a cognitive delay, as determined by standardised measure such as intelligent quotient (IQ) testing or other measures. These must be generally accepted within the professional community in the Accredited Program's nation as being a reliable measurement of the existence of a cognitive delay.
- They have a closely related developmental disability, meaning they have functional limitations in both general learning (such as IQ) and in adaptive skills (such as in recreation, work, independent living, self-direction, or self-care).

Persons whose functional limitations are based solely on a physical, behavioural or emotional disability, or a specific learning or sensory disability, are not eligible to participate in the Special Olympics, but may be eligible to volunteer for Special Olympics as partners in Unified Sports®, if they meet the separate eligibility requirements for participation set forth in the Sports Rules.

Degree of Disability

Participation in the Special Olympics training and competition is open to all persons with intellectual disabilities who meet the age requirements, regardless of the level or degree of their disability, and whether or not they have other mental or physical disabilities, so long as that person registers to participate in Special Olympics as required.

Multiple Handicaps

Persons who have multiple handicaps may participate in Special Olympics provided they are eligible as noted above.

Profound Disabilities

Individuals with profound disabilities can participate through Special Olympics Motor Activities Training Program (MATP), developed by physical educators, physical therapists and recreation therapists. MATP emphasises training and participation rather than competition.

Athlete Registration

Registering for the Special Olympics is a simple process. All individuals who meet the eligibility requirements and wish to participate must register with an accredited Programme including:

- Submission of an Athlete Registration Form, which contains registration information, medical information and a medical certification; and
- Submission of an Athlete Release Form, which contains a release to be signed by an adult athlete or by the parent/guardian of a minor athlete concerning medical matters and publicity permissions.

Unified Sports Registration

Special Olympics Unified Sports® is a programme that combines approximately equal numbers of Special Olympics athletes and athletes without intellectual disabilities (called Partners) on sports teams for training and competition. Age and ability matching of athletes and partners is defined on a sport-by-sport basis.

Special Olympics Rowing Sport Rules

The Special Olympics Sports Rules govern all Special Olympics competitions which are based upon rules from British Rowing. International sports federations and national governing bodies' rules are employed except when they are in conflict with the Special Olympics rules.

The fundamental difference between the Special Olympics competitions and those of other sports organisations is Divisioning. Competitions are structured so that athletes compete with other athletes of similar ability in equitable divisions.

Procedures for Divisioning

An athlete's ability is the primary factor in Divisioning. The ability of a rower or team is determined by an entry score from a prior competition or seeding. Age and gender are other significant factors in establishing competitive divisions.

Ideally, competition is enhanced when each division accommodates at least three and no more than eight competitors or teams. The following procedure describes the sequential process for creating equitable divisions and provides guidance for managing athlete participation.

The primary focus throughout the divisioning process should be on the competitiveness of the athlete.

Step One: Divide Athletes by Gender

Female athletes compete against other female athletes, and male athletes compete against other male athletes. A relay team that consists of both male and female athletes shall compete in the male division of the competition if there are not enough other relay teams with male and female athletes at the appropriate level of competition.

Step Two: Divide Athletes by Age

An athlete's age group shall be determined by their age on the opening date of the competition.
Athletes are divided into the following groups: ages 8-11; 12-15; 16-21 years.
Athletes compete against other athletes within the same age group, unless there are less than three competitors in an age group, these athletes will compete in the next age group up. This group will be renamed to accurately reflect the entire range of competitors within the group

Step Three: Divide Athletes by Ability

To complete the divisioning process, the following guidelines shall be applied according to the event being divisioned.

Rowing Team Events

Step One: Divide Teams by Gender

Teams are divided into two groups based upon gender. Mixed gender teams are permissible and shall compete against other mixed gender teams or, if there is not enough mixed gender teams, against male teams. If there is only one male or one female team within the competition, they will be divisioned with teams of the opposite gender but of a similar age and ability.

Step Two: Divide Teams by Age

The age group of a team is determined by the age of the oldest athlete on that team on the opening date of the competition.
The teams are divided into the following age groups: 8-11; 12-15; 16-21 years.
Teams should compete against other teams within the same age group.

Step Three: Divide Teams by Ability

All Special Olympics rowing sport competitions shall utilise the sports specific skill assessment tests and a preliminary seeding round to assess the level of ability of the participating teams.
Within each ability group, age groups may be combined to create divisions.
If there are only two male or two female teams within the competition, these teams shall compete against each other.

If there is only one team within an age or ability group, that team must be divisioned with other teams, regardless of age or ability.

Suggested model for Indoor Rowing Events

1. Individual Male 3 minutes
2. Individual Female 3 minutes
3. Individual Male 6 minutes
4. Individual Female 6 minutes
5. Pair Mixed 6 minutes
6. Relay Mixed 4x500m
7. Unified Relay Mixed 4x500m

Figure 95: Indoor Rowing team events.

- All races will be performed on standardised rowing ergometers
- All competitors must present their credentials at time of registration.
- No more than 50% of any crew may be substituted. Only substitutes of the same gender will be accepted.
- Relay teams which have already competed in the 4 x 500m Mixed relay will not be permitted to substitute rowers for their race in the 4 x 500m Unified Relay.

"One of the Greatest Challenges Persons with Intellectual Disability Face is Overcoming the Barriers to Inclusion" Tim Shriver, Special Olympics.
Further information - www.sogb.org.uk

GLOSSARY

Ergometer: a machine used to simulate the action of rowing for the purpose of exercise or training, and measures the amount of work performed.

Therapeutic Rowing

Functional Electrical Stimulation Assisted Rowing (FES)

Functional Electrical Stimulation (FES) rowing is a revolutionary new form of adaptive rowing for those with spinal cord injury (SCI). The paralysed leg musculature is activated by multiple channels of electrical pulses applied by self-adhesive electrodes attached to the skin.

The following authors have contributed information to this section of the Adaptive Rowing guide.

Brian Andrews (Biomedical Engineering Oxford Brookes University and Nuffield Department of Surgery Oxford, UK), Dries Hettinga (School of Health Sciences and Social Care, Brunel University, London, UK), Simon Goodey (London Regatta Centre, London, UK) and Robin Gibbons (Brunel University, London, UK)

The stimulated muscle contractions are synchronised with voluntary rowing movements of the upper limbs. FES Rowing has been demonstrated on land and water using adapted rowing technology that includes a rowing ergometer, the London Regatta Centre's rowing tank, a custom sculling simulator and single scull.

This has involved volunteers with paraplegia and quadriplegia following spinal cord injury ranging from ASIA (A/B) C4/5 to T12 using at least four channels of surface electrical stimulation.

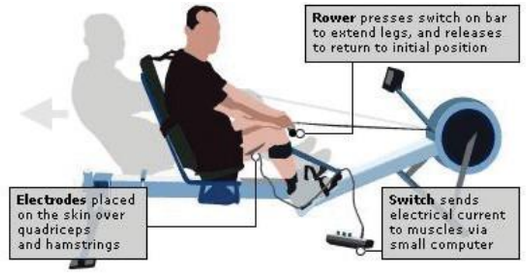


Figure 96: Diagram illustrating how FES works.

FES rowers have competed alongside able-bodied rowers over the Olympic distance of 2,000m at The British Indoor Rowing Championships (BIRC) in 2004 to 2006 and at the World Indoor Rowing Championships (CRASH-Bs – 2006 in Boston, USA). The best performance to date has been achieved by a 23 year-old male (T12 ASIA (A)) in 10 min 28 sec. A range of exercise intensities can be achieved from recreational use to higher levels with VO2 in excess of 35ml/kg/min. It is expected that such high levels may help some to achieve significant reductions in the risks to their health, particularly in the case of preventing cardiovascular disease and Type 2 diabetes which an individual with SCI is at a higher risk of developing.

Figure 97: FES rowers at the British Indoor Rowing Championships.

GLOSSARY

Paraplegia: An impairment in motor or sensory function of the lower extremities. The word comes from the Greek for "half-striking". It is usually the result of a spinal cord injury or a congenital condition such as spina bifida which affects the neural elements of the spinal canal

Quadriplegia / Tetraplegia: is paralysis caused by illness or injury that results in the partial or total loss of use of all their limbs and torso.

Although rowers with a SCI regard exercise as important and clearly beneficial to them, there are several hurdles to overcome. In the general population, physical exercise should be performed with an intensity high enough to offset the risk of developing coronary heart disease

However, many individuals with SCI can have difficulty in achieving these levels using only their preserved upper limb muscles (Manns et al, 1999). Even though some can achieve moderately high oxygen consumption, maintaining sufficient aerobic power with limited muscle mass is difficult and can be constrained by fatigue. Furthermore, over 50% of wheelchair users have painful and often debilitating overuse syndromes of the upper limbs that can contribute to the early loss of independence. The solution may be FES of the paralysed lower limbs to increase the amount of metabolically active muscle mass.

However, FES exercise alone is not of sufficient intensity for many of the beneficial adaptations associated with aerobic exercise. Hybrid FES exercise that involves both innervated upper body and electrically stimulated lower body has been explored and has been shown to produce significantly greater aerobic power and peak oxygen consumption than FES exercise alone.

FES Sculling

Recently, FES rowing in the tank and on-water has been further developed, in preparation for on-water sculling, practice sessions were undertaken at the London Regatta Centre tank.

Figure 98: FES sculling in the rowing tank and on the water.

The Alden 16 (single) and Alden 18 (double) recreational rowing boats were chosen for their stability and for the removable stateroom module. A bungee cord was attached to the custom sliding seat to assist recovery. To facilitate laboratory training and development, a sculling simulator was developed based on the Alden stateroom module.

Figure 99: The Alden 16 (single) recreational boat adapted for FES

Figure 100: A sculling simulator.

In the simplest arrangement, a 4-channel surface stimulation is used (as with the indoor rowing machine) with the control switch mounted on the oar handle. Training in the simulator followed a similar protocol to that used following on the adapted Concept 2 ergometer.

Following at least two one-hour sessions on the rowing simulator and prior to rowing on-water, FES rowing is undertaken in a powered rowing tank with the water flow rate set to simulate a boat speed of 2.3m/s. In addition to two or three one hour FES indoor rowing sessions per week, a further one-hour per week of FES rowing is undertaken in an adapted station in the turbine-powered rowing tank at the London Regatta Centre (McLean 2002).

Research data

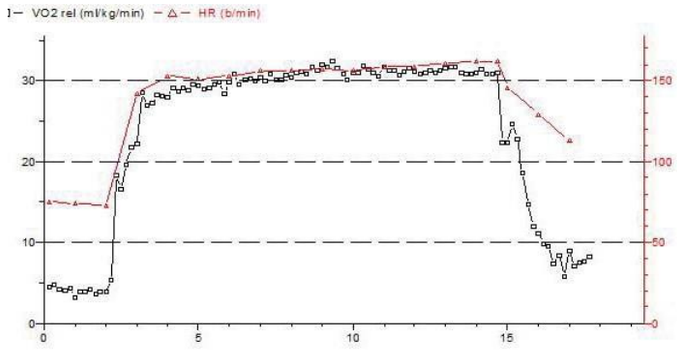


Figure 101: 2000m FES Ergometer session (sub-maximal)

Note: High oxygen consumption values sustained for prolonged period of time.

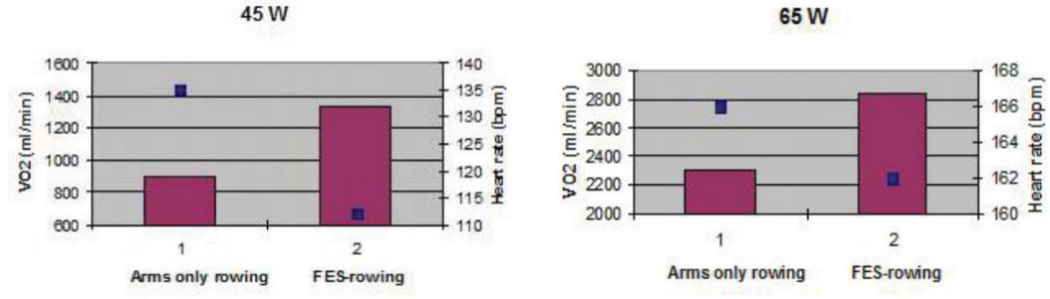


Figure 102: Graphs show oxygen consumption and heart rate during FES Rowing session and Arms Only session at same power output

During a FES session, the VO2 will be higher and the heart rate lower. This indicates that during FES rowing the body is able to use more oxygen even when the heat rate is lower. Each heart beat is able to deliver blood to the muscles more efficiently.

During an Arms only session, blood pooling in the legs occurred resulting in reduced venous return to the heart, which reduced the stroke volume. To ensure sufficient blood and oxygen supply to the muscles, the heart rate needs to be higher.

Figure 102 demonstrates that FES rowing is a more efficient type of cardiovascular training over fixed seat / arms only rowing

Results from pilot studies

- Effective shoulder retraction exercise (employing retractor muscles in shoulders)
- Effective cardiovascular training aid (offset coronary heart disease)
- Prevention of Type 2 diabetes
- 'Able-bodied' appearance of legs
- Improved bone mineral density
- Decubitus / Pressure Sore prevention
- Psychological effects

FES rowing is now offered at the London Regatta Centre, Brunel University, The Department of Physical Medicine and Rehabilitation, Harvard Medical School at the Spaulding Hospital in Boston USA. It offers those with a SCI a range of options in terms of exercise intensities and volumes.

Future Developments in FES Rowing

Increasing intensity of exercise:

Muscle fatigue can occur during FES- applied exercise. It is suspected that this is in part due to sub-optimal conditioning and poor blood perfusion during rowing. The aim is to increase the level of endurance while still maintaining a high power output level. It has recently been discovered that different components of the key quadriceps muscle (rectus femoris, vastus lateralis, vastus medialis) can be alternated during the power generating drive phase of the rowing cycle to significantly reduce fatigue by improving stimulation parameters.

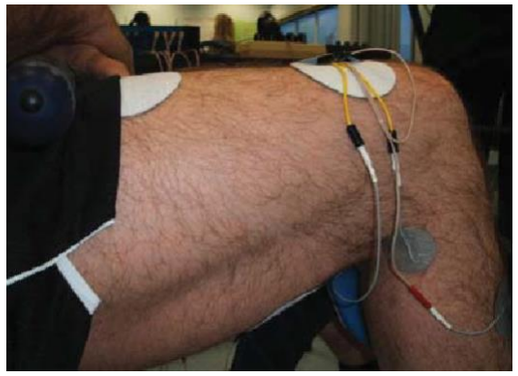


Figure 103: Non-invasive surface electrodes placed on Quadriceps and Hamstring muscle groups

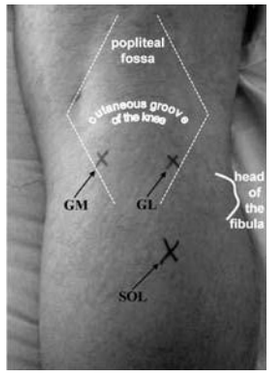


Figure 104: Additional stimulation parameters to include Gastrocnemius and Soleus muscle groups

Preventing early muscular fatigue:

Directly monitoring muscle lactate during rowing, is now possible using an exciting new technique called microdialysis. This will be the first time that the technique will be used in rowing. This application of microdialysis may also have significant implications for the wider rowing community since the dynamics of lactate build-up and clearance from the muscles is central to the optimal training of rowers.

GLOSSARY

Gatrocnemius: Is the calf muscle that is visible from the outside of the body. It attaches to the heel with the Achilles Tendon and originates behind the knee on the femur, crossing two joints.

Soleus: Is a powerful muscle in the back part of the lower leg (the calf). It runs from just below the knee to the heel, and is involved in standing and walking.

Mental Health

There is now clear medical evidence to support the claim that exercise enhances positive mental health as indicated by relief in the symptoms of depression and anxiety. It is estimated that one in four people will experience a mental health problem within the course of a year. In the UK a significant percentage of GP consultations are for mental health related issues and the prevalence rates of mixed anxiety and depressive disorders are on the rise. Depression is one of the most common conditions in the UK and it has been estimated that by 2020 it will be the second biggest global health problem after chronic heart disease. Depression is becoming more common in young people and suicide accounts for 30% of the deaths in the 15-24 year age group (Carr, 2002)

Risk Factors

People with mental health problems are at a significant risk of social exclusion, stigma and discrimination. They can face barriers to engaging in the community and struggle to access leisure and recreational facilities. These factors can contribute to and exacerbate mental health problems, but can be addressed by referral to an exercise programme, such as rowing.

GP Prescribing

Medical experts are urging GPs across the country to prescribe physical activity and a healthy lifestyle rather than drugs.

For some individuals, rowing both indoors and on water may prove to be an effective treatment for a range of mental health conditions, such as anxiety and depression.

The benefits of exercise for treating depression

There is substantial evidence to show a causal link between physical activity and a reduction in clinical depression, with exercise proving as effective treatment as medication or psychotherapy. Exercise can reduce anxiety, decrease depression, enhance mood, improve self-worth and body image, as well as improve cognitive functioning. According to the National Institute for Clinical Excellence, people with depression, particularly mild or moderate depressive disorders, structured and supervised exercise can be an effective intervention that has a clinically significant impact. In view of this, there are several reasons for using exercise as a first-line treatment:

- Exercise has far fewer negative side effects than antidepressants – it has co-incidental benefits, including reduced risk of heart disease, stroke, high blood pressure, some cancers, Type 2 diabetes, osteoporosis and obesity.
- Exercise can be used to treat patients who have a mix of physical and mental health problems – it is a holistic care option.
- Exercise is a sustainable behaviour change. Once the exercise habit is learned, it can be integrated to form part of a healthy lifestyle.
- Exercise does not carry the stigma sometimes associated with medication or counselling.
- Exercise is a popular treatment – in one survey, 85% of people with mental health problems who used exercise as a treatment said they found it helpful.
- Exercise can give patients a sense of control over their recovery, which in itself counteracts the feelings of hopelessness often experienced in depression.

For further information, contact:

Mental Health Trust

Sea Containers House, 20 Upper Ground, London SE1 9QB

Tel: 020 7803 1100 Fax: 020 7803 1101

www.mentalhealth.org.uk

Ann Craft Trust

Centre for Social Work, University of Nottingham, NG7 2RD

www.anncrafttrust.org

Brain Injury

Brain injuries are commonly caused by road traffic accidents, assaults, strokes and haemorrhages and those most at risk are the 15-29 age group, particularly men.

Regardless of the cause, brain injury affects each person differently. They can experience physical problems such as muscle weakness, poor co-ordination and fatigue; cognitive issues like disorientation, memory difficulties and poor concentration and emotional difficulties, including personality changes, mood swings and anxiety/depression. Every brain injury is different and any combination of problems may be experienced by an individual.

Brain injury is often called 'the hidden disability' because the problems are not obvious to others and this can result in a lack of appropriate adjustments being made. The consequences of brain injury are often life-changing for the individual and their families, affecting their ability to work, their relationships, integration in society and ability to participate in leisure activities. Despite the limitations, many are still very keen to find challenges and exciting activities to become involved in.

Traumatic or acquired brain injury (TBI or ABI) can result in various changes in the physical, cognitive and psychosocial well-being of a person. In the physical area it often results in changes (rather than limitations) to the physical performance and exercise tolerance of the patient. Mobility and coordination can be two very challenging areas for a person with TBI. Almost unavoidably this could lead to a sedentary life style.

The risks of a sedentary lifestyle

A sedentary lifestyle results in an increased risk of Type 2 diabetes mellitus (non-insulin dependent diabetes), cardiovascular diseases, obesity and various types of cancer. Nevertheless a large part of the population does not achieve the recommended physical activity standards recommended by medical doctors.

Besides the physiological benefits of physical activity, do not forget the psychosocial benefits of being physically active. Studies have shown that physical activity can improve self-esteem, well-being and self image.

Physical activity and disability

Unfortunately a physical disability very often limits an individual's options for physical activity. This can be due to the disability itself but often it is a result of non-inclusive exercise environments. Legislation and regulations have been put in place to maximise available exercise opportunities by stimulating inclusive exercise initiatives within society. Thanks to a growing understanding of various disabilities and the positive impact physical activity has on an individual with a disability, it is now possible to get able-bodied and disabled persons physically active. Often this is even more important in persons with disabilities since they are predisposed to various risk factors that decrease quality and longevity of life.

Moreover, a person with a disability faces more often psychological and social problems directly linked to dealing with their disability.

TBI and physical activity

The degree to which brain injuries impact the quality and longevity of life is very dependent on its specific consequences and the person. No case is ever the same, but everybody can benefit from physical activity. As mentioned in the Physical disability coaching considerations section mobility and co-ordination of movement can be challenging for someone with a TBI. This has to be taken into consideration when setting up a physical exercise programme.

Got a TBI? Why row?

Rowing has aspects that can be of specific benefit for a person with a TBI. Rowing is not exclusively based around a fine sculling boat. There are other stable types of rowing boat which might be better suited for a person with a TBI, and if needed additional equipment can be fitted to the boat.
www.britishrowing.org/explore-rowing

See Equipment and Regulations section for further details.

Other training devices can be a (powered) indoor rowing tank or an indoor rowing machine. The risk of being out on the water is absent in these training environments, which can be very helpful for many people (able-bodied and disabled) during their initial rowing lessons. A standard indoor rowing machine is a very safe and stable learning platform. Problems with balance and posture are reduced to a minimum and can be further reduced by using a special seating system, which gives also support in the back. Straps around the waist and/or shoulders can further limit any unfavourable movement.

Since rowing on an indoor rowing machine and sculling (an oar in each hand) are symmetrical movements, weakness or impaired co-ordination on one side of the body can be overcome by the other (stronger, better co-ordinated) side. This can be very helpful for a person with a TBI, since hemiplegia (paralysed or partly-paralysed one side of the body) is often seen in this group.

Rowing is an exercise that involves the upper and lower body. This means that a maximal amount of muscle mass is engaged during the exercise. The more active muscle mass is engaged, the higher the intensity of the exercise can be. Several studies have shown that the average person with a TBI has a lower exercise tolerance and is less physically fit than an average able-bodied person. Rowing (especially on an indoor rowing machine) is a type of activity that allows training to be built up slowly whilst progression can be easily tracked.

TBI rowing programmes are active in Australia thanks to direct funding from the NSW Sports Council for the Disabled. These include Nepean Rowing Club (Coach Coordinator, Ben Felton) and Penrith Lakes Adaptive Rowing (PLARC) in Sydney (Coach Co-ordinator, Chad King). Participants in the programme have been able to demonstrate attainable skills with improvement in their balance, co-ordination, social interaction and self-esteem.

A programme is now active at London Regatta Centre in collaboration with Headway, the brain injury association, under the direction of Simon Goodey (Director of Rowing).

For further information contact:

Bradbury House, 190 Bagnall Road, Old Basford
Nottingham, Nottinghamshire, NG6 8SF

www.headway.org.uk

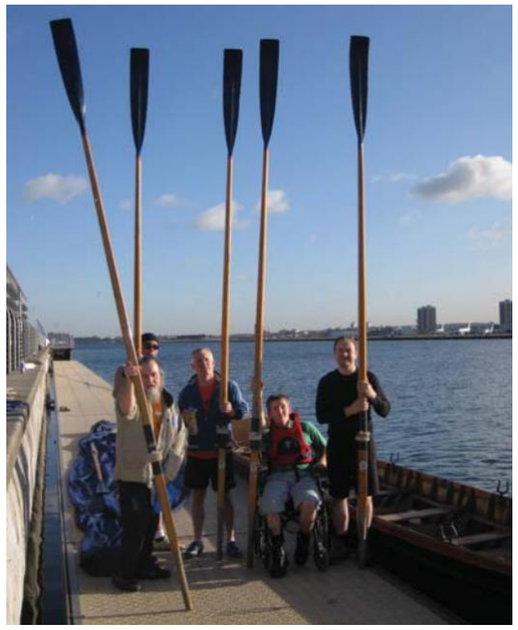


Figure 105: Headway Rowing Team

Injury Treatment, Management, and Prevention in Adaptive Rowing

Introduction

Adaptive rowing only debuted at the Paralympic Games in Beijing 2008, and there is no epidemiological data available on traumatic and overuse injury in this group.

As the basics of the sport are the same for rowers with and without physical disability, most of the medical experiences gained through care of the elite level rowers without disability will be applicable in the treatment and prevention of injuries among adaptive rowers. However a variety of physical disabilities among rowers from the Arms and Shoulders (AS) and Trunk and Arms (TA) categories, create specific conditions and alter the biomechanics of their rowing. This causes some specific health conditions which have not been seen in rowing previously and demand specific therapeutic and prevention measures.

Table 1

The studies of injuries amongst rowers arranged by the year of publishing

Author & Year	Number of rowers	Age of rowers	Gender of rowers	Performance level of rowers	Number of injuries	Period of follow up
Weightman D & Browne RC 1975	NA [A,B]	NA	NA	Rowing club	19 C	1 year
Howell DW, et al. 1984	17	NA	Female	United States national and international lightweight rowers	13	Present musculoskeletal symptoms
Budgett RG & Fuller GN 1989	69 [D]	18-33 [E]	Male	British international selection	58	1 year
Hosea TM, et al. 1989	NA	18-22	Both	Intercollegiate rowers from Harvard and Rutgers	180	3 consecutive years
Reid RA, et al. 1989	40	17-33 [F]	Female	Rowers who held scholarship of Australian Institute of Sport	61	4 consecutive years
Coburn P & Wajswelner H 1993	NA	NA	NA	NA	54	1 year
Pelham AW, et al. 1994	50	18-34	Both	Canadian rowing team	49	Through the entire rowing career
Wajswelner H, et al. 1995	NA	NA	NA	National and international Australian rowers	222	1 year for national and 2 years for international
Hickey GJ, et a. 1997	172	14-36 [G]	Both	Rowers who held scholarship of Australian Institute of Sport	320	10 consecutive years
Parkkari J, et al. 2004	77	15-74 [H]	NA	General Finnish population	4	1 year
Smoljanovic T, et al 2009	398	16-18	Both	Participants at the Junior World Rowing Championships in Beijing, People's Republic of China, 2007	393	1 year
Wilson F, et al. 2010	20	26.25 [I]	Both	International rowers competing as part of the Irish Amateur rowing Union squad system	44	1 year

A = NA, not available;
B = all 19 injured rowers were male;
C = 30 of 32 rowing clubs responded;
D = replies were received from 69 of a possible 81 oarsman;
E = mean age was 24.6;
F = average age at medical consultation was 20.2;
G = average age at the start of scholarships was 20.1 years for the females and 21.3 years for the males;
H = the exact age, gender and performance level of rowers was not presented in the article;
I = the mean age was 26.25 (4.18) years

Injuries amongst Rowers without Physical Disability

Several reports have provided epidemiological data and overviews of the specific injuries that may be caused by rowing. The low individual injury risk per exposure time (1.5 per 1000 hours of participation) places rowing within the general population in a group with sports such as golf, dancing, swimming, and walking.

This level of injury risk in rowers seems to exist even at the highest level of competition. The risk of incurring an injury during the Summer Olympic Games 2008 was lowest for sailing, canoeing/kayaking, rowing, synchronised swimming, diving, fencing, and swimming. It is important to emphasise that none of the rowers who had lost more than 30 days' training were selected for the senior national team at the time.

Rowing is a repetitive motion, low impact sport meaning rowers are unlikely to suffer sudden and unexpected injuries.

A traumatic injury is defined as any sudden tissue damage (contusion, laceration, fracture, cerebral concussion, sprain, strain, and dislocation) resulting from trauma.

Figure 106: A traumatic injury can be sustained during competition. Catching a boat-stopping crab shortly before the finish line in LTAclass was additionally complicated as the rower in the stroke seat had a visual impairment and was unable to help his crewmate release the oar.

An overuse injury is defined as a chronic, long-lasting pain usually connected to a sport but for which the rower cannot report a specific inciting event. Overuse injuries occur when tissue (muscle, tendon, bone, cartilage, etc.) cannot adapt adequately to the stresses placed on it, i.e. when the rate of injury exceeds the rate of adaptation and healing. The amount of stress placed on the musculoskeletal system of an elite rower can be roughly estimated on the basis that they will perform more than half a million rowing strokes annually. The peak force on the oar during the rowing stroke differs depending on technique but may approach 800 to 900N. 72.1% of injuries in female rowers and 69.6% of injuries in male rowers are overuse injuries. Like other repetitive motion sports, the cause of rowing overuse injuries can usually be traced to a training error in either volume or technique, or inappropriately sized or configured equipment.

Furthermore, most rowers train all year round, with an emphasis on weights and distance training in the autumn and winter, and increasing intensity and anaerobic work in the spring and summer seasons. During the cold periods of the year, rowers perform specific rowing training and assessments on indoor rowing machines. The load associated with the use of these machines presents a significant injury risk. The combination of long distances and indoor rowing machine use could explain an increase in the frequency of rower injuries during the late autumn and winter period.

Numerous studies agree that the spine, especially the lower part, is the most frequently injured region among rowers. Other common sites of injury in rowers are forearm, wrist and chest or thoracic spine. Chronic chest injuries were much more common in the female rowers, with rib stress fractures making up 10.2% of chronic injuries in women. As rib stress fractures infrequently occur among young rowers under the age of 19 years, chests are not so frequently injured among elite level junior rowers.

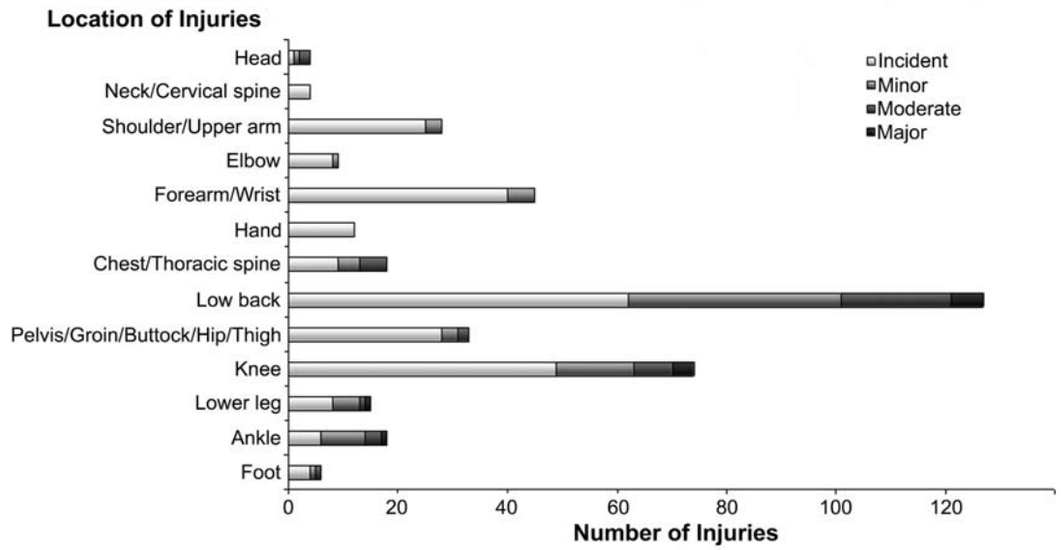


Figure 107: Graph showing the severity of injuries among elite level junior rowers by location. Injuries were classified according to Morgan et al. Incident injury – an injury which has not resulted in any absence from competition or training, Minor injury - an injury that interrupts participation for a period of less than one week, moderate injury – an injury that requires an absence for more than one week but less than one month, and major injury - causes an absence for more than onemonth.

Specific Musculoskeletal Rowing Injuries

Lower Back Pain

A number of authors have reported a significant incidence of lower back pain among the rowing population (Figure 107). Lower back pain appears to be somewhat more common in endurance sports that specifically load the lower back during training and competition. Reid and McNair have identified several factors that may influence the onset of lower back pain in rowers. These include:

- High compressive loads being placed on the lower spine during the stroke
- The flexed posture of the back during the drive phase
- The rotation of the trunk in sweep rowing
- Repetitive loading
- The time of day of training
- Muscle fatigue
- Impaired proprioception
- Hypermobility of the lower spine
- Stiffness of the hamstring muscles.

Furthermore, Teitz et al. associated the development of back pain with factors including age, rowing history before age 16, use of a cleaver blade, free weight training, weight machines, and use of an indoor rowing machine; midline indoor rowing machine cable position and indoor rowing training sessions lasting longer than 30 minutes.

Bernstein et al. have shown that with fatigue, the stroke with the fixed ergometer flywheel lengthened at the "catch" (beginning of the stroke) and shortened at the finish of the stroke. No significant changes in stroke length were seen with the sliding-head ergometer. Rowers achieve relatively high levels of lower back flexion during the rowing stroke, and these levels are increased during the course of a rowing trial. Evidence of muscle fatigue in erector spinae muscles was apparent, and this observation may in part be responsible for the increased levels of lower back flexion. Excessive lower back flexion may affect the potential for injury to spinal structures. Understanding and awareness of lower back flexion and muscle fatigue in spinal muscles is important for injury prevention in rowers.

Hickey et al. found that a significant proportion of the lower back injuries resulted from weight training rather than rowing. That was particularly apparent in acute injuries.

Although most cases of low back pain are self-limited, many rowers have persistent symptoms. Rowers who experience back pain that causes one or more weeks absence from training or competition are likely to have a recurrence. Degenerative disc disease and spondylolysis are among the most common structural abnormalities associated with low back pain. Regardless of a rower's motivatation to return to activity, a specific pain generator is not always found and often makes diagnosis or treatment challenging. Therefore it is important that rowers have an awareness of less common causes of back pain, such as sacroiliac joint dysfunction, stress reactions, or costovertebral subluxation.

A detailed explanation of the diagnostic and treatment procedures for all pathological conditions which cause back pain is beyond the scope of this book. As it is impossible to avoid all factors related to lower back pain, rowers and their coaches should incorporate an awareness of these injuries and factor this into their training and rehabilitation programs to reduce their frequency.

Rib Stress Fractures

Rib stress fractures are a well known and frequent sports specific injury in rowing. They occur in approximately 6.1% to 12% of rowers and account for the most time lost from training and competition. In most cases there is a history of an increase in training intensity or a change of rowing technique leading up to the injury.

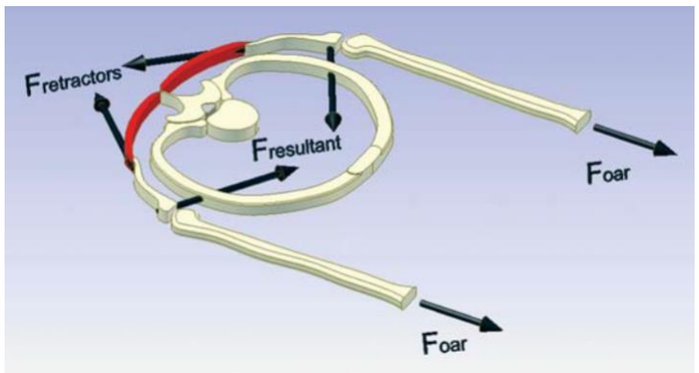


Figure 108: Schematic of rib-cage compression generated by the combined pull of the retractors and oars during early drive. Foar is the force generated by the pull of the oar on the upper limb. It results from leg extension and generates a scapula protraction moment. Fretractors is the force generated by the pull of the retractors on the scapula. Fresultant is the resultant force of Foar and Fretractors, as resolved using the parallelogram method. Fresultant generates a compression moment on both sides of the rib cage. The scheme was drawn based on work of Warden et al. by Croatian former rower Marko Rusev, Bachelor of Science in Mechanical Engineering (B.Sc.M.E.).

A symptom of rib stress fractures is anterolateral or posterolateral pain in the wall of the chest. This pain increases with activity, deep breathing and/or coughing. If the rower continues with regular training and competition, the pain will increase in intensity, preventing them from rowing or weight training and remain painful through the night. It is also common to have tenderness or swelling in the area of the fracture and a palpable callus can develop with advanced injuries.

Although the awareness of stress fractures has improved rowing team doctors' confidence in the diagnosis of rib stress reactions through clinical examination, not all rib cage pain in rowers is due to a muscle strain, rib stress reaction or fracture. It is important to thoroughly diagnose any rower experiencing rib pain, regardless of their age or level of competition. Rib stress fractures usually require complete rest from training and competition until the pain goes. When the rower no longer experiences any pain, a gradual return to training and competition is possible.

Knee

In the study of Hosea et al. the knee was the most affected region among the rowers. The other studies have also confirmed the high frequency of knee injuries in rowers. Knee injuries alongside lower back injuries were the most common cause of absence from rowing among junior rowers. As rowing is a non weight bearing activity, rowers' knees typically do not sustain traumatic damage, but rowers may experience bouts of overuse injuries in the anterior part of the knee joint.

Figure 109: Rowing involves a high degree of knee flexion with large forces being placed on the patella by the quadriceps tendon during the drive phase of the stroke. Furthermore, the outside knee (the knee on opposite side from the blade) is pushed laterally to allow the outside shoulder to sweep between the knees while keeping the shoulders parallel to the handle.

The differential diagnosis of anterior knee pain is wide. A clear understanding of the pathophysiology of anterior knee pain is inhibited by the use of imprecise, and poorly defined words. For instance, one of the most common diagnoses for anterior knee pain in rowers was chondromalacia of the patella. It should be emphasized that the term refers to damage of patellar cartilage, not a patellar pain. Anterior knee pain includes a variety of mechanical (patellar hypermobility, subluxation, pathological plica syndrome, osteochondral fracture, etc.), degenerative (tendinosis, tendinopathy) and mixed (osteochondritis dissecans, stress fracture, meniscal tear, iliotibial band syndrome, etc.) causes of the pain, and the principal goal of the initial assessment is to detect remediable causes.

One of the most common causes of anterior knee pain among rowers is patellar tendinopathy or jumper's knee. It is an overuse injury characterised by pathological changes in parts of the knee joint: the quadriceps tendon and its insertions to the proximal pole of the patella (10% of the patients), and the patellar tendon (patellar ligament) and its proximal insertion to apex of patella (80%) or distal insertion to the tibial tubercle (10%). It should be emphasized that junior rowers who ran more than once a week had more overuse knee injuries than those who ran once or less per week.

Although jumper's knee is relatively easy to diagnose, its treatment can be difficult. It is common for rowers to pay insufficient attention to the early symptoms and proceed with their activities unchanged. If ignored, the lesions can proceed to the irreversible chronic stage with permanent intratendinous lesions which demands surgery. A non-surgical treatment programme (adapted to each individual) consists of a short-term halt or modification of rowing with physical therapy followed by stretching and strengthening exercises of the upper leg muscles. Correction of the predisposing causative factors (training errors, anatomic deviations that impede the normal biomechanics of rowing, foot stretcher angle, etc.) should also be implemented. It is important for rowers to perform alternative training during treatment, as non-surgical treatment calls for persistence and commitment over several months.

Forearm/wrist

Forearm and wrist injuries are common in rowers due to the excessive wrist motion of the rowing stroke. These problems can usually be traced back to poor technique or fatigue. Proper technique includes having a relaxed grip and controlling the movement of the oar as it feathers (turning the oar so that it moves parallel to the water on recovery) and squares (perpendicular to water for proper blade entry, drive and finish). The handle should roll easily, using the palm and fingers without excessive use of the thumb or wrist.

Figure 110: The rowing stroke has components of ulnar deviation and palmar flexion at the catch followed by varying degrees of radial deviation and dorsal flexion on the release. Sweep rowing (LTA class) involves feathering the blade with the inside arm alone (the arm closest to the blade); while the outside arm stays loose.

The most common injuries include Exertional Compartment Syndrome, lateral epicondylitis, de Quervain's and intersection syndrome, and tenosynovitis of the wrist extensors. Wrongly sized grips, poor rigging, and wet or rough conditions can cause the rower to use excessive wrist motion which can develop overuse syndromes. Forearm problems have been observed more commonly in inexperienced rowers, due to an inability to relax at the finish of the stroke. Also, an overly tight grip of the oar handle is typical in colder weather.

Conservative treatment usually involves adequate rest from the exacerbating activity (indoor rowing does not include feathering), ice and NSAIDs followed by stretching, and brace or taping. When these fail, cortisone injection is often very successful. In accordance with the International Standard for Therapeutic Use Exemptions (TUE), a declaration of use must be completed by the rower. Immobilisation and surgical treatment are usually only required in the most severe cases.

Injuries amongst Adaptive Rowers

Specific Considerations for Adaptive Rowers

The specific features brought to the competitive venues by rowers with a wide variety of disabilities must be carefully reviewed and understood in order to serve their health, safety, and performance needs. The areas of the body experiencing higher force transmission are different compared to able-bodied rowing due to the alteration in technique. As mentioned previously, adaptive rowers with similar levels of physical function are classified in three different classes: PR3, PR2, PR1

GLOSSARY

Ergometer: a machine used to simulate the action of rowing for the purpose of exercise or training, and measures the amount of work performed.

Spondylolysis: Spondylolysis is a defect of a vertebra. The vast majority of cases occur in the lowest of the lumbar vertebrae (L5), but spondylolysis may also occur in the other lumbar vertebrae, as well as in the thoracic vertebrae.

Sacroiliac joint dysfunction: Is a condition in which the joint is locked, partially dislocated

Costovertebral subluxation: The costovertebral joints are the articulations that connect the heads of the ribs with the bodies of the thoracic vertebrae. Subluxation occurs when there is a partial abnormal separation of the articular surfaces of a joint.

PR3

There is no significant biomechanical difference in the rowing stroke between LTA adaptive rowers and rowers without disabilities, and the same pattern of injury can be expected.

Figure 111: Early drive phase of rowing stroke in Leg, Trunks and Arms (PR3) class. In the PR3class, the extension of the lower extremities is where the main rowing force is produced. The forces generated by the legs are further increased and transferred to the oar by extension of the trunk and flexion of the upper extremities.

Remember that some PR3 rowers use a prosthesis. Prosthetics are artificial device extensions used to replace body parts lost by illness or injury (traumatic) or missing from birth (congenital) or to supplement defective body parts. Most modern prosthetics are attached to the body of the rower, usually the stump of the amputee, by belts and cuffs or by suction. The stump either directly fits into a socket on the prosthesis, or a liner is used that then is fixed to the socket either by vacuum (suction sockets) or a pin lock.

Figure 112: Early Below knee prostheses in rowers who compete in LTA class.

There are several health issues to be aware of in PR3 rowers. Phantom limb sensation is the feeling that all or part of the amputated limb is still present and occurs in adults who have undergone amputation. It will usually decrease with time. Phantom pain is a burning, painful sensation in the part having undergone amputation. It is diminished by prosthetic use, physical therapy, compression, and transcutaneus nerve stimulation, but could require medication. Localised stump pain is often related to bony or soft tissues problems, and swelling can occur after stump maturation and is caused by poor socket fit, medical problems or trauma. A poor socket fit will reduce the area of contact between the stump and socket or liner, leading to air or pressure pockets. Increased pressure on the stump can be painful, whilst air pockets allow sweat to accumulate and soften the skin. Ultimately this is a frequent cause of itchy skin rashes and with time, can cause the skin to breakdown. In cases of skin breakdown the stump or limb must be rested until the skin heals. Therefore it is essential that the stump is monitored closely, and in the case of pain and skin irritation, the socket fit should be modified.

GLOSSARY

Prosthesis: An artificial substitute or replacement of a part of the body such as a leg.

Phantom pain: Phantom pain sensations are described as perceptions that an individual experiences relating to a limb or an organ that is not physically part of the body.

Injury Management – Amputee Rowers

The table below summarises amputee specific rowing injuries. It is important that any injury is correctly diagnosed and sufficiently rehabilitated before the rower returns to previous training levels.

Injury	Signs & Symptoms	Injury Mechanism	Prevention
Skin Irritations	• Rash on stump • Flaky or peeling skin • Dermatitis/eczema • Redness of affected areas	Perspiration/heat Reaction to liner Shear/frictional forces at stump-socket interface Dry skin	Creams and moisturisers Emphasise stump and prosthetic care and management
Skin breakdown	• Broken skin • Scab • Pain	Shear or frictional forces at stump-socket interface. Insufficient management of skin irritation within socket	Rest until healed Emphasise stump monitoring Assess and modify socket fit Assess alignment Massage to break up scar tissue
Stump pain	• General stump soreness • Stump pain on loading and after training • Discomfort on loading • Muscle soreness	Stump intolerance to pressure and loading Hypersensitivity Insufficient shock absorption Socket fit	Medication (legal) Massage (for hypersensitivity and scar adhesions)
Blisters	• Liquid filled mass	Shear and/or frictional forces at stump-socket interface	Avoid loading Rest until healed
Calluses (stump orintact foot)	• Hard, toughened skin • Pain	Constant blistering Adaptation to loading Friction	Remove (podiatrist) Don't soften as it will cause breakdown
Ulcers	• Deep wounds (especially on bony prominences)	Friction and shear forces (particularly if rower has frail or thin skin). Pressure on bony prominences Pressure on desensitised skin Skin breakdown	Assess interface/liner Socket fit Assess loading of socket Close monitoring of stump condition

Considerations for capsize

Some rowers use hand strap(s) to improve their grip on the blade. The hand strap is orthotic, and supports or corrects the function of a limb or the torso. As with all other straps used in adaptive rowing, they should be single-point release with no mechanical buckles. They also need to be quick mouth-release if applicable. All rowing participants have to demonstrate the ability to swim or wear correct buoyancy aid/lifejacket. If it is possible, it would be optimal to carry out a 'controlled capsize drill' in a swimming pool. This would be of use not only to rowers using straps but also for visually impaired rowers who might became disorientated in the event of a capsize.

PR2 and PR!

Unlike the PR3 class, rowing technique in PR2 and PR1 classes is altered significantly in comparison to the technique of able-bodied rowers. The alteration presents a modified pattern of injuries among rowers from these two classes.

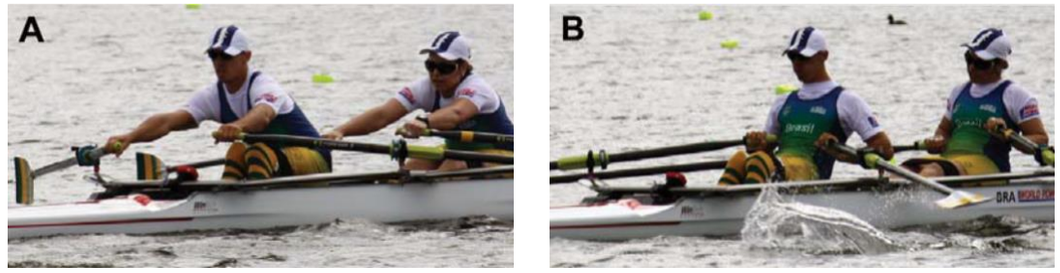


Figure 113: Rowers from the PR2 class: **A** the catch phase, and **B** the finish phase of rowing stroke. PR2 rowers use a strap placed over their extended knees to prevent any movement of their legs whilst rowing. In the PR2 class, the spine and pelvis are used as a rigid lever and the upper extremities will generate and transfer forces during the stroke whilst the body swing and arm pull are utilised .

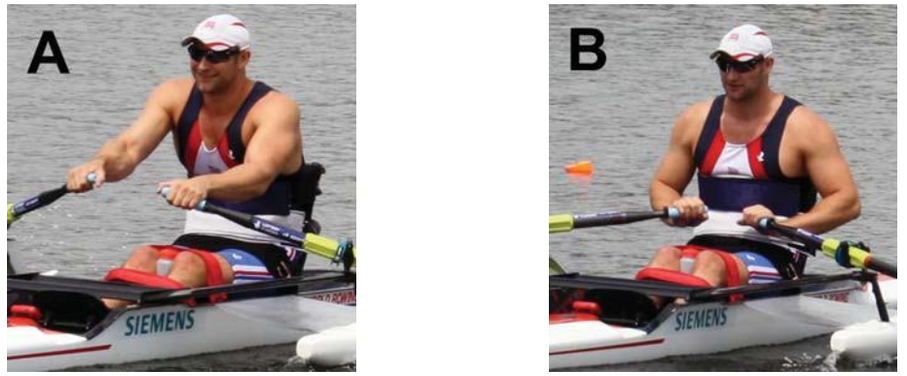


Figure 114: Tom Aggar, a PR1 class rower.: **A** immediately after the catch phase (i.e. early drive phase), and **B** the finish phase of the rowing stroke. In the PR1 class the upper extremities, together with the associated upper thorax will generate and transfer forces to the blade.

The limited joints and parts of the body utilised during PR2 and PR1 rowing result in these joints and body parts repeatedly generating and transferring forces in isolation from larger joints and segments of the body. This impact is further influenced by an increased stroke rate, weight of the boat and length of time of the race.

Stroke rate

While able-bodied rowers orPR3 rowers rate less than 40 strokes per minute during a race, PR1 rowers, (depending on the rigging) can perform more than 45 strokes per minute.

Weight of the boat

PR1 rowers race in heavier boats than able-bodied rowers in the single boat class and utilise less effective methods of force production to move this boat. Additionally, increased drag will be experienced with the use of rigger pontoons which provide lateral stability. This level of drag will depend on the height the pontoons are set at, the water conditions and the rower's ability to maintain a level boat.

Length of race

Race time in the PR1 class is also significantly longer compared to the PR3 class; 1.5 minutes and more than 2 minutes for male and female rowers respectively.

Finally, the goal of maximal stroke length in the PR1 class demands maximal reach leading to loading during the initial to mid-drive phase through large degrees of shoulder flexion angle excursion. Increased shoulder flexion angle excursion has been associated with rib stress fractures in able-bodied rowers.

Figure 115: A rower with missing lower extremities and chest strap

The other reason for a modified pattern of injuries in PR2 and PR1 classes may be due to the adaptation of the equipment. As there are only three classes for a wide range of physical disabilities, adaptive rowing is a very competitive sport. However a wide range of disabilities within each of the three classes places some of the rowers at an advantage over others and the equipment adaptations can compound these advantages. For example, for some PR1 rowers who are missing their lower extremities, the chest strap is the main or the only conjunction for transition of the force between the oars to the boat shell and high pressure of the strap to the rib cage is inevitable.

As rowers need to be able to flex over the strap as much as possible in order to increase the length of their stroke. Although this may only lengthen the stroke by a few centimeters, (and its length in the PR1 class is very short), the gain can be quite significant during the race. However this 'flexing' will increase the pressure on the ribs, creating a pivot point. The pressure occurring in the area of the strap is further influenced by the momentum which the rowers will utilize during the recovery of the stroke to reach their catch position quickly. Consequently it is not surprising that the chest strap position creates potential for rib stress fractures. Therefore, an PR1 rower with rib stress fracture could benefit from an orthoses which distributes the loading at the catch position across a wide area of padding. Made of thermoformed plastic (polypropylene) and lined with energy absorbing foam (plastazote) it creates a chest mask between the chest strap and rib cage in order to diminish the pressure over the ribs and prevent stress fractures.

Figure 116: Protective Thoraco-Lumbo-Sacral-Orthosis (TLSO) being fitted (left) and in situ (right)

(Courtesy of Jim Ashworth-Beaumont BSc (Hons) HPC MBAPO. Senior Orthotist, Royal National Orthopaedic Hospital NHS Trust, Brockley Hill, Stanmore, Middx, HA7 4LP)

Figure 117: A modern adaptive rower is a high performance rower. High sport performance is the attitude of the rowers that things exist in sport only to be improved and enhanced.

Injuries amongst rowers with SCI

Some PR2 class rowers as well as the majority of PR1 class rowers have sustained a spinal cord injury (SCI). Special attention needs to be paid when designing, instituting or performing exercise programmes for rowers with an SCI. Some of the injury risks will be similar to those experienced by rowers without SCI, although complications such as general overuse may be exaggerated in rowers with SCI, and their occurrence will likely compromise daily activities to a far greater extent.

Like those of the motor system, autonomic nerve tracts descend in the spinal cord. As no sympathetic autonomic nerve tracts exit the spinal cord above the T1 spinal level, individuals with cervical injuries often sustain decentralisation of their sympathetic nervous system. Loss of autonomic outflow to the adrenals is also observed in persons with SCI above the T6 spinal level. Injury above the sacral cord segments abolishes central parasympathetic regulations of genitourinary organs (S2-S4), which explains the common occurrences of neurogenic bowel and bladder after SCI. Autonomic dysfunction that results from thoracolumbar levels of sympathetic nerve outflow is associated with cardiac and circulatory dysfunction, clotting disorders, altered insulin metabolism, resting and exercise immunodysfunction, orthostatic incompetence, osteoporosis and joint deterioration, and thermal deregulation at rest and during exercise.

Beside structural and contractile muscle properties alteration, which limit the ability of totally paralyzed and weakened muscle to sustained intense contractions for extended durations after SCI, rapid bone demineralization is present too. The demineralization is the most obvious during the first year after SCI, after which bone density levels continue to slowly decay. About one-third to one-half of bone mineral density is lost by one year after injury, with primary losses occurring in the supracondylar femur (above the knees). The inevitable course of SCI leads to underhydroxylated and hypocalcific bone with permanently heightened susceptibility to fracture even following trivial or imperceptible trauma. Joints experience similar deterioration and heightened injury susceptibility brought on by cartilage atrophy and joint space deformities.

GLOSSARY

Neurogenic: Starting with or having to do with the nerves or the nervous system.

Thoracolumbar: Relating to the thoracic and lumbar parts of the spinal column.

Sacral: Sacral is a large, triangular bone at the base of the spine and at the upper and back part of the pelvic cavity, where it is inserted like a wedge between the two hip bones. Its upper part connects with the last lumbar vertebra, and bottom part with the coccyx (tailbone).

Risk of Injury in Adaptive Rowers with SCI

Autonomic Dysreflexia

Individuals having cord injuries at or above the T6 spinal level are prone to episodes of autonomic hyperreflexia when exposed to noxious stimuli. The neurological basis for these episodes involves loss of supralesional sympathetic inhibition that normally suppresses the unrestricted autonomic reflex accompanying such exposure. This allows the adrenals to release high concentrations of epinephrine (adrenaline) under reflex control and infralesional adrenergic targets to experience the full measure of reflex noradrenergic stimulation. The most commonly stimuli evoking autonomic dysreflexia are bladder and bowl distension before their emptying. Other stimuli include venous thromboembolism, bone fracture, sudden temperature change, febrile episodes and exercise. The disposition to autonomic dysreflexia during exercise is especially heightened when an electrical current is used to generate muscle movement, or when exercising while febrile or during bladder emptying. Episodes of autonomic dysreflexia are characterised by hypertension and bradycardia, supralesional erythema, piloerection, and headache. In some cases, hypertension can rise to the point where crisis headache results, and cerebral hemorrhage and death might ensue. Recognition of these episodes, withdrawal of the offending stimulus, and the possible administration of a fast-acting peripheral vasodilatator may be critical in preventing serious medical complications. Prophylaxis may be needed prior to exercise. It is known that wheelchair racers have intentionally induced dysreflexia as an ergogenic aid by restricting urine outflow through a Foley catheter, which represents a dangerous and possibly life-threatening practice.

Musculoskeletal Injury

Fractures and joint dislocations of the lower extremities is a risk of participation in exercise by those with SCI, and may be caused by asynergistic movement of the limbs against the force imposed by either electrical stimulation or the device used for exercise. This explains why the activities are contraindicated for individuals with severe spasticity or spastic response to the introduction of electrical current. Precautions to prevent overuse injuries of the arms, shoulders and chest must be taken for those participating in upper extremity exercise. As the shoulder joints are ill-suited to perform locomotor activities, but must do so in individuals using a manual wheelchair for transportation, these injuries may ultimately compromise performance of essential daily activities including wheelchair propulsion, weight relief and depression transfer.

Thermal Deregulation

Rowers with SCI often lack sudomotor responses below their level of injury and are thus challenged to maintain their thermal stability. These responses are less pronounced as the level of the SCI descends, and when exercising in an environment controlled for temperature and humidity (Figure 122). However, even rowers without physical disability are in life danger in case of boat swamping in cold water. Aside from the fact that the sport of rowing is an outdoor activity, adaptive rowers with SCI may suffer in an intemperate environment as their competitions are set in the middle of the day (i.e. between morning and afternoon races of rowers without physical disabilities). If competitions are held during summer time, the temperature is usually very high and so attention should be paid to hydration, protective equipment (hat, rain wear, whitely colored clothes, etc.) and, if possible, limiting the duration and intensity of activities performed in the intemperate environment.

Conclusion

The benefits of participation in sport for people with a disability are well established. However, there are certain risks for injury unique to adaptive rowing, but they may be reduced through awareness and appropriate organization. Experiences gained during a long history of rowing are helpful, but specific differences which are present in adaptive rowing demand an “adapted” approach to these people. It will be important in future studies to examine the differences and similarities of adaptive rowing when compared to able-bodied rowing. Specifically, research is required which addresses the contributing factors to rowing injuries in the PR1 and PR2 classes as these sport classes utilise a significantly different rowing technique.

Figure 118: “Complete waterman” is a term used in the sport of rowing which perfectly describes a rower in the boat during rain. Water is below the rower (i.e. below rower’s boat and seat), above the rower (i.e. on rower’s rain wear), and the most important it is below rower’s rain wear (i.e. rower’s cloth is imbibed either from perspiration or from the rain). The water and its evaporation decreases the body temperature of rowers with SCI, and influences their limited thermoregulation. Also, the wet clothes can alleviate development of a pressure sore which is a potentially life threatening condition amongst rowers with SCI.

Appendix

Supplier list – Adaptive rowing equipment

ITEM	SUPPLIER	ADDRESS
Adaptive Boats – Liangjin	Oxbridge Boats	www.oxbridgeboats.co.uk/adaptive.php
Adaptive Boats – Swift	Wintech	www.swiftinternational.biz/ROWING/rw_11_adaptive.php
Adaptive Boats - Wintech	Oarsport UK	www.oarsport.co.uk
Restraints / Straps (pinch & buckle style)	Wintech	www.wintechracing.com
Standard Restraints (100mm width self-closing Velcro, neoprene lined)	Concept 2 UK	http://www.concept2shop.co.uk/
Adapt 2 Row Postural Support & Complimentary Balance Seats	Concept 2 UK	http://www.concept2shop.co.uk/
Monorail Clamps for Adapt 2 Row Seats	Concept 2 UK	http://www.concept2shop.co.uk/
Vicair Allrounder – Pressure Sore Prevention	Gerald Simonds	www.gerald-simonds.co.uk
Akton Gel Pad – Pressure Sore Prevention	Concept 2 UK	http://www.concept2shop.co.uk/
Active Hands (gloves for rowers with limited hand function)	Active Hands	www.activehands.co.uk
IBSA Zero Vision Mask	Targe Equipment, Canada	http://targe.ca/

Note: British Rowing does not 'approve' suppliers of adaptive equipment – you will need to discuss your needs with your supplier to ensure that the equipment you purchase is suitable for your purposes.

The following table outlines the adaptive rowing safety considerations that clubs and regatta organisers need to take into account for rowers within the specific diagnostic groups:

Adaptive Rowing – Safety Considerations for Clubs and Regatta Organisers within Diagnostic Groups		
Risk	Diagnostic Group	Mitigation
Atlanto-axial instability	Intellectual Impairment • May be present in rowers with Down's syndrome	• If suspected or declared refer to rowers' doctor for further investigations (may require X-ray). If confirmed caution with hyper-extension of neck during rowing. Obtain approval from the rowers' doctor that there are no medical contra-indications for rowing activity.
Autonomic Dysreflexia	Spinal Cord Injury • (see Spinal Cord Injury section) • Sudden increase in blood pressure with corresponding decrease in heart rate. Occurs in individuals with complete injuries at T6 and above.	• Require 'declaration of medical conditions' from rowers. A history of dysreflexia should be declared on medical form. Should rower be predisposed to dysreflexia, individual should either carry relevant medication in a waterproof chest pocket or with coach. The individual will be aware of symptoms together with coach and use some form of signing to rescue boat. Encourage SCI rowers at risk to empty bladder prior to training/competition.
Capsize	ALL Physical • strapping/prosthetic/orthotics Visual • disorientation, may be wearing zero vision (light eliminating) eyewear. Intellectual • unpredictable response in capsize scenario	• Ensure that all rowers have demonstrated their ability to swim or are wearing correct buoyancy aid/lifejacket. • Carry out 'controlled' capsize drill in swimming pool. • Ensure that safety boat is 'fit for purpose' – low freeboard and/or drop-bow.
Capsize/ entrapment	Physical Impairment • Strapping • Prosthetics/Orthotics	• Ensure that participants evaluate safety of trunk; leg; hand strapping with controlled capsize drill. All straps should be single-point release with no mechanical buckles. Hand strapping should be quick mouth-release. • All rowers wearing prosthetics/orthotics should ensure that they can release quickly and safely in event of a capsize.
Collision (increased risk of)	Hearing Impairment • unable to hear other water users Visual Impairment • May be unable to see other water users or obstacles	• Factor this into training sessions and competition, informing other water users, officials • Ensure that the coach is present, increase on water safety cover. Consider using radio-link to boat.
Pressure Sores (Decubitus)	Spinal Cord Injury • (see Equipment and Regulations section and Spinal Cord Injury section)	• Ensure you have the correct interface between rower and seat. Recommend water users wear appropriate footwear to protect feet. Ensure that sharp corners, objects or straps that could create a potential pressure mark are identified. • Encourage rowers to 'weight- shift' periodically during training.
Thermal Regulation	Spinal Cord Injury • SCI above T6 are particularly at risk; can become poikilothermic (where body assumes same temperature as environment). Vasoconstriction (ability to shiver) and vasodilatation (ability to sweat) is compromised	• Select the correct clothing for training/competition and exposure to extremes in temperature. Expedient removal from water in event of a capsize.
Trip-hazards	Visual Impairment	• High visibility markings for all pathways (including stairs) throughout boat/clubhouse/venue. Ensure boathouse floor is clear of seats/riggers and other hazards to VI rowers.

Safety – the following safety considerations are intended to supplement the existing British Rowing Row Safe Policy: *A Guide to Good Practice in Rowing*. 2008-V1 (3.3 Adaptive Rowing)

Glossary of Terms

Abduction	A type of movement which draws a limb away from the median plane of the body.
Acquired Brain Injury	A brain damage caused by events after birth, rather than as part of a genetic or congenital disorder.
Anachronistic	Something that is chronologically out of place
Anterolateral	Situated anteriorly and to one side
Anthropometrics	The study of human body measurement for use in determining an individual's physical attributes for a sport
Areflexia	The absence of reflexes
Apraxia	A disorder caused by damage to specific areas of the cerebrum, characterised by loss of the ability to execute or carry out learned purposeful movements despite having the desire and the physical ability to perform the movements.
Arthrodesis	Arthrodesis, also known as artificial ankylosis or syndesis, is the artificial induction of joint ossification between two bones via surgery
Ataxia	Wobbliness, lack of co-ordination and unsteadiness due to the brain's failure to regulate the body's posture and regulate the strength and direction of limb movements.
Athetosis	Involuntary writhing movements particularly of the arms and hands.
Atlanto-Axial Instability	A condition affecting the two bones at the top of the spinal cord, often referred to as AAI.
Atrophy	The partial or complete wasting away of a part of the body.
Autism	A disorder of neural development characterised by impaired social interaction and communication, and by restricted and repetitive behaviour. These signs all begin before a child is three years old.
Autonomic Dysreflexia	Autonomic dysreflexia, "AD" also known as "autonomic hyperreflexia or Hyperreflexia, is a potentially life threatening condition which can be considered a medical emergency requiring immediate attention. AD occurs most often in spinal cord injured individuals with spinal lesions above the (T6) spinal cord level.
Axons	An Axon is a long fibre of a nerve cell (a neuron) that acts somewhat like a fibre-optic cable carrying outgoing messages. The neuron sends electrical impulses from its cell body through the axon to target cells.
Bradycardia	Bradycardia (heart slowness), in the context of adult medicine, is the resting heart rate of under 60 beats per minute, though it is seldom symptomatic until the rate drops below 50 beat/min. It may cause cardiac arrest in some individuals, because those with bradycardia may not be pumping enough oxygen to their heart.
Cerebral Palsy	An abnormality of motor function (the ability to move and control movements) that is acquired at an early age, usually less than a year of age, and is due to a brain lesion that is non-progressive.
Chondromalacia Patellae	Chondromalacia patellae is damage to the cartilage at the back of the kneecap.
Chorea	An abnormal involuntary movement disorder
Cognition	Cognition is the scientific term for "the process of thought" to knowing. Usage of the term varies in different disciplines; for example in psychology and cognitive science, it usually refers to an information processing view of an individual's psychological functions.
Condyle	The round prominence at the end of a bone, most often part of a joint. And articulation with another bone.

Congenital	A condition existing at birth and often before birth, or that develops during the first month of life.
Contusion	An injury in which the skin is not broken; a bruise.
Costovertebral Subluxation	The costovertebral joints are the articulations that connect the heads of the ribs with the bodies of the thoracic vertebrae. Subluxation occurs when there is a partial abnormal separation of the articular surfaces of a joint
Decubitus	Lesions caused by many factors such as: unrelieved pressure; friction; humidity; shearing forces; temperature; age; continence and medication; to any part of the body, especially portions over bony or cartilaginous areas such as sacrum, elbows, knees, and ankles.
Denervation	Denervation means an interruption of the pain-carrying nerves
De Quervain Syndrome	De Quervain syndrome is a tendinosis of the sheath or tunnel that surrounds two tendons that control movement of the thumb.
Diplegia	When used singularly, refers to paralysis affecting symmetrical parts of the body.
Dorsiflexion	The movement which decreases the angle between the dorsum (superior surface) of the foot and the leg, so that the toes are brought closer to the shin. The movement moving in opposite directions is called plantarflexion
Down's Syndrome	A congenital disorder, caused by the presence of an extra 21st chromosome, in which the affected person has mild to moderate learning disability, short stature, and a flattened facial profile. Also called trisomy 21.
Dyslexia	Is a broad term defining a learning disability that impairs a person's fluency or accuracy in being able to read, write, and spell
Dyspraxia	Is a motor learning difficulty that can affect planning of movements and co-ordination as a result of brain messages not being accurately transmitted to the body.
Epicondylitis	Epicondylitis refers to an inflammation of an epicondyle. Types include lateral epicondylitis, also known as tennis elbow and medial epicondylitis, also known as golfer's elbow.
Epidemiological	Epidemiology is the study of patterns of health and illness and associated factors at the population level.
Etiology	Is the study of causation, or origination.
Exertional Compartment Syndrome	Is a condition that causes pain in the leg or arm. Rowers typically experience the pain after a period of activity or exercise, and it is quickly relieved by rest. The pain from exercise-induced compartment syndrome can be quite severe, and it often limits a rower's activity level.
Exoskeleton	An external skeleton that supports and protects an animal's body, in contrast to the internal skeleton (endoskeleton) of, for example, a human.
Flaccid Paralysis	Weakness or loss of muscle tone resulting from injury or disease of the nerves innervating the muscles.
Gastrocnemius	Is the calf muscle that is visible from the outside of the body. It attaches to the heel with the Achilles Tendon and originates behind the knee on the femur, crossing two joints.
Glucocorticosteroids	Glucocorticoids are a class of steroid hormones characterised by an ability to bind with the cortisol receptor and trigger similar effects.
Hemiplegia	Total paralysis of the arm, leg, and trunk on the same side of the body.
Hydrocephalus	Also known as "water on the brain," is a medical condition in which there is an abnormal accumulation of cerebrospinal fluid (CSF) in the ventricles, or cavities, of the brain.

Hyperkinetic	Refers to an abnormal increase in muscular activity.
Hyperreflexia	Also known as "autonomic hyperreflexia" is a potentially life threatening condition which can be considered a medical emergency requiring immediate attention. It occurs most often in spinal cord injured individuals with spinal lesions above the (T6) spinal cord level.
Hypertension	Or high blood pressure is a chronic medical condition in which the systemic arterial blood pressure is elevated. It is the opposite of hypotension.
Hypotension	An abnormally low blood pressure. This is best understood as a state, rather than a disease. It is often associated with shock, though not necessarily indicative of it. Hypotension is the opposite of hypertension.
Hypertonicity	Having a greater degree of muscle tone or tension.
Infarction	Localised necrosis (death) resulting from obstruction of the blood supply.
Infralesional	Sub-mucosal
Iliotibial band Syndrome	Iliotibial band Syndrome is one of the leading causes of lateral knee pain in rowing.
Intraarticular	Intraarticular fractures are those in which the break crosses into the surface of a joint. They always result in some degree of cartilage damage.
Intradermal	Within or between the layers of the skin.
Ischial Tuberosities	A rounded protuberance of the lower part of the ischium. It forms a bony area on which the human body rests when in a sitting position
Ischium	The ischium forms the lower and back part of the hip bone
Kinaesthetic	Kinesthetic learning is a learning style in which learning takes place by the student actually carrying out a physical activity, rather than listening to a lecture or merely watching a demonstration. It is also referred to as tactile learning.
Meniscal Tear	A meniscus tear is a common knee injury that can cause pain in the joint. When the meniscus tear becomes symptomatic, surgery may be necessary.
Metatarsal	Or metatarsal bones are a group of five long bones in the foot located between the tarsal bones of the hind, mid-foot and the phalanges of the toes.
Monoplegia	Paralysis of a single limb, usually an arm. It is frequently associated with cerebral palsy.
Multiple Sclerosis	A disease of the central nervous system (CNS) marked by numbness, weakness, loss of muscle co-ordination, and problems with vision, speech, and bladder control.
Neurogenic	Starting with or having to do with the nerves or the nervous system.
Neurological	Dealing with the study of the brain; neurology
Orthostatic Hypertension	A form of hypotension in which a person's blood pressure suddenly falls when the person stands up. The decrease is typically greater than 20/10 mm Hg.
Orthosis	A support, brace, or splint used to support, align, prevent, or correct the function of movable parts of the body.
Osteochondral	Starting with or having to do with the nerves or the nervous system.
Osteochondritis Dissecans	A joint disorder in which cracks form in the articular cartilage and the underlying subchondral bone. OCD is caused by blood deprivation in the subchondral bone.
Osteoporosis	Osteoporosis is a disease of bones that leads to an increased risk of fracture. Osteoporosis literally means 'porous bones'.
Paralysis	Loss or impairment of motor function in a part due to a lesion of the neural or muscular mechanism; also, by analogy, impairment of sensory function (sensory paralysis).

Paraplegia	An impairment in motor or sensory function of the lower extremities. The word comes from the Greek for "half-striking". It is usually the result of a spinal cord injury or a congenital condition such as spina bifida which affects the neural elements of the spinal canal.
Parasympathetic Nervous System	The parasympathetic nervous system (PSNS) is one of the two main divisions of the autonomic nervous system. The parasympathetic system specifically is responsible for stimulation of activities that occur when the body is at rest.
Pathophysiology	Pathophysiology is the study of the changes of normal mechanical, physical, and biochemical functions, either caused by a disease, or resulting from an abnormal syndrome.
Patellar Tendinopathy	Patella Tendinopathy is usually characterised by degeneration of the tendon
Periarticular	Surrounding a joint.
Peripheral Vasodilatator	An agent, such as a nerve or hormone, that widens the blood vessels, which in turn decreases resistance to blood flow and lowers blood pressure.
Peritendinous	Peritendinous adhesions are the most important complication of flexor tendon injury.
Piloerection	Erection of the hair of the skin.
Plantar flexion	Plantar flexion is the movement which increases the approximate 90 degree angle between the front part of the foot and the shin, as when depressing an automobile pedal. The word "plantar" is commonly understood in medical spheres as the bottom of the foot - it translates as "toward the sole". The movement in the opposite direction is dorsiflexion.
Plica Syndrome	Plica syndrome of the knee is a condition that can cause pain within the knee joint. It is caused by irritation to synovial tissues of the knee.
Posterolateral	Is situated on the side and toward the posterior aspect, away from the midline.
Prosthesis	An artificial substitute or replacement of a part of the body such as a leg.
Poliomyelitis	Poliomyelitis is a viral disease that can affect nerves and can lead to partial or full paralysis.
Post-Poliomyelitis syndrome	A condition that affects approximately 25–50% of people who have previously contracted poliomyelitis—a viral infection of the nervous system. Typically the symptoms appear 15–30 years after recovery from the original paralytic attack, at an age of 35 to 60. Symptoms include acute or increased muscular weakness, muscular pain, and fatigue. The same symptoms may also occur years after a non-paralytic polio (NPP) infection.
Prophylaxis	A measure taken for the prevention of a disease or condition.
Proprioception	The unconscious perception of movement and spatial orientation arising from stimuli within the body itself.
Radial Deviation	A position of the human hand in which the wrist is bent toward the thumb.
Rowing Ergometer	Is a rowing machine that consists of a flywheel connected to a chain and handle. The rower emulates the normal rowing action, and pushes their body backwards with the legs, then pivots their back, and pulls on the handle, causing the flywheel to spin. The flywheel has a braking mechanism (air or water) applied that is intended to simulate the feel of an oar moving through water. Depending on the machine, the rower either moves back and forth as part of the rowing action, or the rower remains stationary and the flywheel mechanism moves. Examples: Concept 2 - www.concept2.co.uk WaterRower - www.waterrower.co.uk Rowperfect - www.rowperfect.co.uk

Sacral	Sacral is a large, triangular bone at the base of the spine and at the upper and back part of the pelvic cavity, where it is inserted like a wedge between the two hip bones. Its upper part connects with the last lumbar vertebra, and bottom part with the coccyx (tailbone).
Sacroiliac Joint Dysfunction	Is a condition in which the joint is locked, partially dislocated
Soleus	Is a powerful muscle in the back part of the lower leg (the calf). It runs from just below the knee to the heel, and is involved in standing and walking.
Spasticity	Is a feature of altered skeletal muscle performance occurring in disorders of the central nervous system (CNS) impacting the upper motor neuron in the form of a lesion.
Spina Bifida	A condition in which the spine does not develop properly before birth; can cause varying degrees of disability.
Spondylolysis	Spondylolysis is a defect of a vertebra. The vast majority of cases occur in the lowest of the lumbar vertebrae (L5), but spondylolysis may also occur in the other lumbar vertebrae, as well as in the thoracic vertebrae.
Stroke	Is the rapidly developing loss of brain function(s) due to disturbance in the blood supply to the brain.
Subluxation	In simplest terms, a subluxation is when one or more of the bones of your spine (vertebrae) move out of position and create pressure on, or irritate spinal nerves.
Sudomotor Responses	Injury of the autonomic part of peripheral nerve which causes changes as loss of sweating.
Supracondylar	Pertaining to an area above a condyle.
Supracondylar Femur Fracture	A supracondylar femur fracture is an unusual injury to the femur just above the knee joint. These fractures often involve the cartilage surface of the knee joint, and must be treated with this cartilage injury in mind. Patients who sustain a supracondylar femur fracture are often at high risk of developing knee arthritis later in life.
Tarsal	Any of several short, angular bones that make up the ankle
Tendinopathy	Tendinopathy refers to a disease of a tendon.
Tendinosis	Tendinosis, sometimes called chronic tendinitis, tendinosus, chronic tendinopathy or chronic tendon injury, is damage to a tendon.
Tenosynovitis	The word literally means 'inflammation of the tendon sheath' and commonly occurs in the wrist affecting the tendons which control thumb movements. Tenosynovitis of these tendons is called De Quervain's Sheath (called the synovium) that surrounds a tendon. The injury normally occurs when a rower grips the oar too tightly for an extended period of time; e.g. in rough waters or to compensate for an unbalanced boat. It also frequently occurs with excessive movement of the wrist during feathering or if the wrist is not kept in a neutral position throughout the rest of the stroke.
Tetrahedrons	Is a polyhedron composed of four triangular faces, three of which meet at each vertex.
Tetraplegia	Also known as quadriplegia, is paralysis caused by illness or injury that results in the partial or total loss of use of all their limbs and torso.
Thoracolumbar	Relating to the thoracic and lumbar parts of the spinal column.
Tibial tubercle	The tibial tubercle is a large oblong elevation on the anterior aspect of the tibia, just below where the anterior surfaces of the lateral and medial tibial condyles end.
Transcutaneus Nerve Stimulation	Is the use of an electric current produced by a device to stimulate the nerves for therapeutic purposes.

Traumatic Brain Injury	Also called intracranial injury, occurs when an external force injures the brain traumatically. TBI can be classified on severity, mechanism (closed or penetrating head injury), or other features (e.g. occurring in a specific location or over a widespread area).
Triplegia	A medical condition is which the patient has paralysis of three limbs. It is frequently associated with cerebral palsy, although it is a consequence of other conditions such as a stroke. Triplegia has also been found to be due to an increase in intracranial pressure associated with hydrocephalus resulting from a traumatic brain injury.
Quadraplegia	Also known as tetraplegia, is paralysis caused by illness or injury to a human that results in the partial or total loss of use of all their limbs and torso.
Ulnar Deviation	Ulnar deviation, also known as ulnar drift, is a hand deformity in which the swelling of the metacarpophalangeal joints (the big knuckles at the base of the fingers) causes the fingers to become displaced, tending towards the little finger.
Vasoconstriction	Is the narrowing of the blood vessels resulting from contraction of the muscular wall of the vessels. The process is the opposite of vasodilation, the widening of blood vessels.
Vasodilation	Refers to the widening of blood vessels resulting from relaxation of smooth muscle cells within the vessel walls. The process is essentially the opposite of vasoconstriction, or the narrowing of blood vessels.
Venous Thromboembolism	Thromboembolism is a blood clot that forms within a vein. (Thrombosis is a specific medical term for a blood clot that remains in the place where it formed).

Acronyms

Acronym	Definition
AAI	Atlanto-Axial Instability
ABI	Acquired Brain Injury
ADLs	Activities Of Daily Living
AK	Above-Knee amputation
AD	Autonomic Dysreflexia
AS	Arms and shoulders
ASIA	American Spinal Injury Association
ASL	American sign Language
BK	Below-Knee amputation
BMD	Bone Mineral Density
BPA	British Paralympic Association
BSL	British Sign Language
CNS	Central Nervous System
CP	Cerebral Palsy
CPISRA	Cerebral Palsy International Sports & Recreation Association
FES	Functional Electrical Stimulation
FISA	Fédération Internationale des Sociétés d'Aviron
IBSA	International Blind Sports Association
ID	Intellectual Disability
INAS-FID	International Sports Federation for Persons with Intellectual Disabilities
IPC	International Paralympic Association
IQ	Intelligence Quotient
LTA	Legs, trunks and arms
MR	Magnetic Resonance
MS	Multiple Sclerosis
PD	Physical disability
PPS	Post-Poliomyelitis Syndrome
SCI	Spinal Cord Injury
SO	Special Olympics
TA	Trunks and arms
TBI	Traumatic Brain Injury
TLSO	Thoraco-Lumbo-Sacral-Orthosis
TUE	Therapeutic Use Exemptions
UKSA	UK Sports association for People with a Learning Disability
VI	Visual Impairment
VO2	Maximal oxygen consumption, maximal oxygen uptake, peak oxygen uptake
WHO	World Health Organisation

Acknowledgements for contributions

(Cover photograph courtesy of Dr Roberto Nahon (BRA), FISA International Medical & Technical Classifier

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Brian Andrews is Professor at Brunel University's Institute for bioengineering and Consultant at the National Spinal Injuries Centre, Stoke Mandeville, and a Professor of Cybernetics at the University of Reading. He is also a Visiting Professor at the Oxford Orthopaedic Engineering Centre, University of Oxford and Technical Director of the Neural Engineering Clinic, Augusta, Maine, USA. Brian is Consultant to the Functional Electrical Stimulation Assisted Rowing (FES) programme at London Regatta Centre. His current research work is on the development of advanced neural prostheses with a focus on applications in spinal injury.

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Tom joined British Rowing as a coach to the Adaptive team in 2007 and coached the TA double at the Beijing Paralympic Games in 2008. He is currently Lead Coach for the Adaptive Programme. He has established himself as a specialist coach in the field of adaptive rowing and coached Tom Aggar to gold at the 2009 and 2010 World Championships.

Klaus Filter (GER)
Klaus is a Naval Architect and founding member of FISA's Materials Commission, serving as Head of the Commission from 1990-2000.

In 1960, Klaus developed the world's first composite rowing shell, one of the most significant developments in the sport's history.

Klaus is now Wintech's Director of Research and Development and Chief Engineer, designing the FISA standard adaptive boats that are used in international competition.

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Paul is a Naval Architect specialising in the design and construction of yachts. A six time USA national champion in the lightweight single, he also medalled four times at World Championship level in the M2x and M1x. In 1977 and 1980 he won the America's Cup as a crew member on Courageous.

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Dries is currently Head of Knowledge & Innovation at Diabetes Fonds (Dutch Diabetes Research Foundation) and formerly Head of Policy and Research at BackCare. Dries was a volunteer for the GB Adaptive Rowing Team 2003-2005 and a member of the 2006 World Rowing Championships Organising Committee.

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FISA Level 1 International Medical Classifier.

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