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Infographic. Enhancing Performance and Stability: The Role of Abdominal Binding in Wheelchair Rugby.

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1 This infographic offers guidance for sports practitioners and wheelchair rugby (WR) players to
2 enhance performance and stability during WR using abdominal binders. The Paralympic sport
3 of WR is played by individuals with an impairment that affects all four limbs, including cervical
4 spinal cord injuries (tetraplegia), limb deficiencies, polio, cerebral palsy, and other neurological
5 disorders. Spinal cord injury (SCI) results in lesion-dependent impairments in
6 cardiorespiratory, musculoskeletal and autonomic function, due to disruption of the neural
7 pathways that control these systems. This impairment can manifest in many ways, including
8 reduced lung capacity, decreased cardiovascular capacity, and a loss of trunk stability.
9 Abdominal binding may partially offset impaired cardiorespiratory function and reduced or
10 loss of trunk stability in highly trained Para athletes with SCI, despite exercise capacity
11 limitations^{1,2,3}.

12 **What is an abdominal binder?**

13 An abdominal binder is a wide compression belt that encircles the lower torso to apply pressure
14 to the abdomen. These binders are made from stretchy elastic fabric and closed with Velcro.
15 The elastic material mimics the nature of the impaired abdominal muscles by providing
16 abdominal pressure, and allowing the abdomen to expand and recoil during breathing³.

17 **Why use bindings?**

18 The cardiorespiratory system is a primary performance limiting site for Para athletes.
19 Individuals with a SCI may experience a compromised respiratory function, due to intercostal
20 muscles denervation and impaired abdominal muscle function. In a seated position, the
21 unsupported abdominal contents migrates downwards and anterior, drawing the viscera
22 attached diaphragm inferiorly, decreasing its curvature. Mimicking the role of the non-
23 functioning abdominal muscles, binding aids respiratory function by increasing intra-

24 abdominal pressure and raising the diaphragm to a more optimal length-tension position, in
25 order to exert appositional forces laterally and expand the lower ribcage⁴. As well as the
26 physiological benefits of abdominal binders, WR players may also use binding to improve their
27 overall trunk stability, allowing their arms to generate more power on the hand rims and
28 protecting them from losing their balance when they are hit by an opponent^{1,2}.

29 Abdominal binding is a performance enhancing approach that may be used to improve WR
30 performance in highly trained players with cervical SCI. Studies have reported binding induced
31 improvements in pulmonary function³ (preserved tidal volume; +14% increase vital capacity;
32 -50% reduction functional residual capacity; -23% reduction in residual volume); maximal
33 exercise³ (heart rate response maintained; +12% increase peak $\dot{V}O_2$; -16% reduction in Peak
34 blood lactate concentration at high relative power outputs); and performance indicators²
35 (significant improvements in 6/17 field-based exercise responses including -1.7% reduction in
36 time to complete acceleration/deceleration test; +2.9% increase in distance covered during
37 repeated 4min maximal push test).

38 **Drawbacks to using bindings?**

39 Importantly, while abdominal binding offers benefits, excessive strapping can lead to
40 complications such as autonomic dysreflexia⁵, which is an urgent condition which requires
41 immediate medical attention. Sports practitioners should oversee players as they familiarise
42 themselves with wearing abdominal binding. This should include monitoring overall athlete
43 comfort, checking for sudden increases in blood pressure (>20mmHg above baseline), reduced
44 heart rate (reflex bradycardia); flushing and sweating above the level of injury, unexplained
45 blurred vision, and a headache^{4,5}.

46

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63

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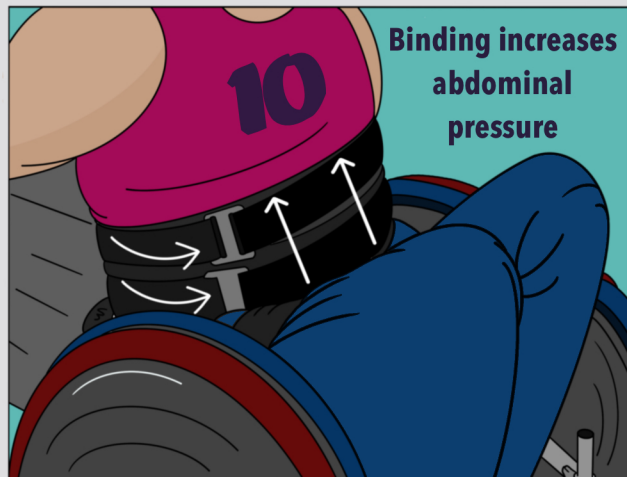
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ENHANCING PERFORMANCE AND STABILITY:

THE ROLE OF ABDOMINAL BINDING IN WHEELCHAIR RUGBY

If you have a spinal cord injury (SCI), incorporating abdominal binders into training routines and wheelchair rugby (WR) competitions, can potentially mitigate the challenges of impaired cardiorespiratory function and enhance overall performance and safety. There are three key benefits to using abdominal bindings:



(1) IMPROVED CARDIORESPIRATORY FUNCTION

Binding mimics abdominal muscle function bringing improvements in respiratory efficiency and enhanced trunk stability.

Binding \uparrow muscle blood flow and O_2 delivery

+14% \uparrow in vital capacity

-50% \downarrow functional residual capacity

-23% \downarrow in residual volume

+12% \uparrow in Peak $\dot{V}O_2$

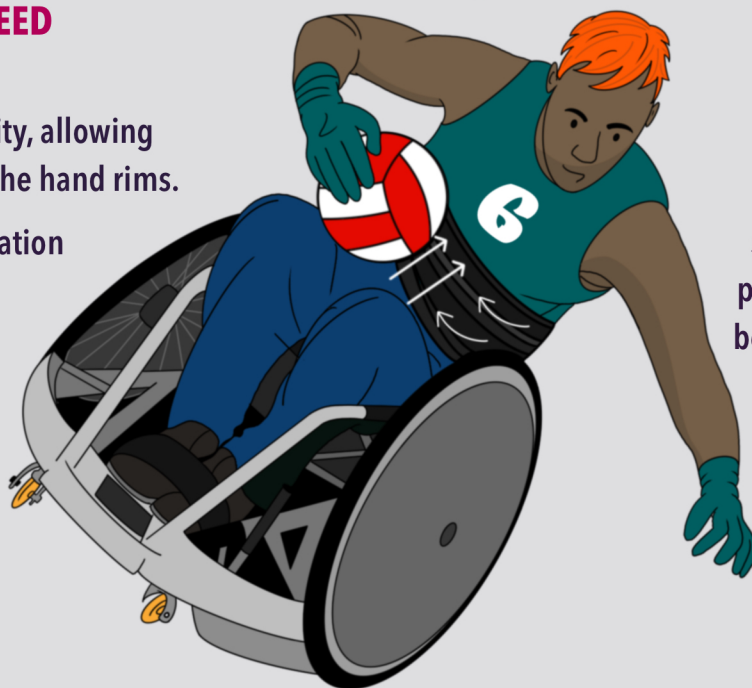
(2) IMPROVED WHEELCHAIR SPEED AND AGILITY

Binding improves overall trunk stability, allowing the arms to generate more power on the hand rims.

-16% \downarrow in peak blood lactate concentration at high relative power outputs

-1.7% \downarrow in time during acceleration/deceleration test

+2.9% \uparrow in distance covered during repeated 4min maximal push test



(3) IMPROVED TRUNK STABILITY

Bindings provide stability for upper body power and strength, and better postural control to resist falls following a collision or hit by an opponent.

COACHING TIPS

PERSONALISATION: Ensure the abdominal binding fits snugly around the torso, over training clothes. It should provide support without restricting breathing. Work closely with your coach to identify the right level of tension for your abdominal binding, based on your performance needs (e.g. \uparrow trunk stability often results in \downarrow trunk mobility). Finding the right balance is crucial for optimising performance while maintaining comfort and safety.

AVOID EXCESSIVE TIGHTNESS: While abdominal binding offers benefits, excessively tight strapping can lead to complications, such as autonomic dysreflexia, a potentially life-threatening condition experienced by those with a SCI. Pay attention to the body's response to binding, check for sudden \uparrow blood pressure ($>20\text{mmHg}$ above baseline), \downarrow heart rate, and a headache. **NOTE:** Often the first symptom is sweating and red blotchy skin above the level of injury.



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