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# The Impact Of Cerebral Palsy Disability On Athlete's Training Regime Needs And Key Considerations

## Introduction and Definitions

Being a disabled individual does not dictate whether someone can be an athlete or not, having an impairment puts them into a different category to the able bodied athletes which is Para-athletes. Para-athletes have their own event called the Paralympics games which began in 1948 for WWII veterans whom had spinal cord injuries (Swayne & Dodd, 2011). This has developed over time, with their currently being 22 summer Paralympics sports and 6 winter Paralympics sports available to the impaired with 4342 participants that attended the Rio 2016 Paralympic games (Kristiansen, Parent & Houlihan, 2016).

There is a specific criteria in which the international Paralympic committee (IPA) implied into the sporting world to classify whether an individual would fit the criteria for able bodied sporting events or para-athlete sporting events (Camperesi & McNamee, 2018). With their being 10 different IPC disability classifications, not all apply to a specific disability some overlap with one another and some disabilities only fall into a couple of the classifications. Specifically focusing on cerebral palsy (CP) as the disability, some of the main classifications in which qualifies a CP individual as a para-athlete is hypertonia therefore meaning there is an abnormal increase in muscle tension and a reduced ability of muscle to stretch (Singer, 2010) Ataxia which is the lack of co-ordination of muscle movements aswell as balance (Noggle, Dean & Horton, 2011, p. 496) and Athetosis being a movement dysfunction whereby the individual can have slow, unbalanced involuntary movement of different limbs and also there being a difficulty to support a symmetrical posture for a period of time (Naugler, 2019).

Additionally there is a grading system to sports classification within Paralympics. The classification is split into 3 categories; class based system, points based system and in/out based system (Gilbery & Schantz, 2008). All in which focus on different ways of scoring how impaired an individual is. For example class based focuses on different classes for impairment being that there is 10 resulting in the lower the number, the greater the impairment is. Points based scores a para-athlete from 1.0 to 4.5 with 1.0 being the most impaired, resulting in teams only allowed 14 points on the field at the same time split between 5 players. Finally in/out based is based on all individuals whom have impairment to their lower limbs (Gilbery & Schantz, 2008).

In the context of this essay, the major focus will be on the development of body functions like range of motion (ROM), reducing muscle stiffness and strength in cerebral palsy athletes and the key factors that need to be considered when training an individual whom has this disability.

Cerebral palsy is the name for a group of individuals in which have lifelong disorders of the development of movement, postures and co-ordination, resulting in activity limitations. This disability develops before and during birth in the foetal or in infant year's brain affecting 1 in 400 babies in the UK with national statistics figures suggesting 1,700 new cases in children every year (Tulchinsky & Varavikova, 2009). After it has developed the symptoms of cerebral palsy are not visually seen straight after birth, they are generally noticeable when a child is 2 or 3

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years of age (Zitelli, McIntire & Nowalk, 2012). The common symptoms that are experienced are delays of reaching different development milestones such as not being able to walk by 18 months which is something able bodied individuals achieve. Hypotonia/hypertonia, unstable and impaired gait being that an individual will walk scissor like or toe walk. With their also being a decrease muscle mass and impairment to joint mobility (Gage, Schwartz, Koop & Novacheck, 2009). The severity of the symptoms depends on the individual, some experiencing minor problems and others experiencing severe problems.

Furthermore cerebral palsy has 3 main types of classifications based upon the motor impairment status which is reflective on the site of the brain injury. These are spastic CP, Ataxic CP and Athetoid CP.

### **Spastic CP:**

Spastic CP accounting for 70-80% of cases and emerges from motor cortex damage (McCandless, 2010). Motor cortex being the region of the cerebral cortex that's plans, controls and executes voluntary movements of the body (Cramer & Darby, 2005). The main symptom which is experienced by this classification is hypertonia resulting in uncontrolled muscle spasms that can lead to soft tissue injuries (Adkinson, 2018).

### **Ataxic CP:**

Ataxic CP being the least diagnosed type and accounting for 5-10% of all cases (McCandless, 2010). This type of cerebral palsy is caused by damage being inflicted upon the cerebellum in which is responsible for ensuring movement are accurate and adaptive. Functions in particular are to maintain balance and posture of the body, coordination of voluntary movements and also cognitive functions such as language and speech. The symptoms that are experienced are movement tremors which occur in the arms, trunk and legs when carrying out fine motor tasks (New & Cochran, 2007).

### **Athetoid CP:**

Athetoid CP being the last classification accounts for 10-20% of cases and is developed as a result of damage to the developing brain, in particular damage to the basal ganglia and/or the cerebellum (McCandless, 2010). Individuals who have this type of CP experience both hypertonia and Hypotonia resulting in the inability to control and regulate muscle tone. Additionally they also get symptoms which makes it hard to walk or grasp objects due to voluntary movements in the hands, arms, feet and legs.

### **Impact on function:**

CP also split into 4 categories based upon the regional impairment an individual has. Hemiplegia being that only one side of the body is affected. Monoplegia is a restriction of one limb being affected and potentially paralysis. Diplegia is when there is paralysis of corresponding parts on both sides of the body for example both legs or both arms and finally Quadriplegia being that there is full loss of movement to all four limbs and torso of the body resulting in both sensory and motor lost (Canale & Beaty, 2012). All in which has an impact on the functions of the body. All CP conditions will have a likelihood of overuse injuries as a result

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of the constant poor mechanical loading through the muscles, joints, ligaments and soft tissue (Rimmer, 2007).

Moreover, there are many potential injury mechanism that athletes with CP will encounter but generally speaking as an overview for all, they will lack the ability of being able to exert force in comparison to able bodied athletes (Magee, Zachazewski, Quillen & Manske, 2010). Hemiplegia athletes will suffer from overuse injuries as a result of asymmetry during gait, whereas on the other hand diplegic and quadriplegic athletes are more incline to experience lower limb overuse injury due to distorted gait which is where they walk scissor like or toe walk (Kaufman, 2007). As an example, specifically focusing on spastic cerebral palsy individuals as a result of them experiencing an abnormal amount of high muscle tone compared to an able bodied person they are susceptible to overuse injuries whether that is to be associated with muscle tone, stability, posture or mobility around joints and structure specifically affected.

With there being many key injury mechanism CP athletes can encounter and severe functional detriments of the body, a training approach is a key process in which all coaches need to adhere to when working with any type of disabled athletes (Schmoll, 1987). The process is to consider what the sport demands are and what it takes from an individual to win. The physiological and biomechanical requirements of the sport and the movement needs are analysed with disability specific considerations taken into account. Whilst the injury risk factors are key considerations to consider, with a strength and conditioning programme being the end result.

With this training approach in mind, S&C coaches are then able to come up with a training programme which is adapted to the needs of a spastic cerebral palsy athlete taken into account physical performance variables that need to be considered. Some specific physical considerations include, ROM, their regional impairment, strength, hypertonia and being cautious of the injury they are most likely to sustain. For example a rehabilitative strategy which can be implemented is strength training.

## **Implications & Applications:**

For an athlete whom is not able bodied and suffers from CP, training sessions and interventions are tailored to reduce the risk of further injuring the already affected area (Sheen, 2003). Important factors regarding training cerebral palsy individuals that should be considered is the environment, for some athletes that suffer from cerebral palsy working out in cold temperature in the winter season can have a detrimental effect upon the body and performance (Miller, 1995). Another factor for a strength and conditioning coach (S&C) is that no two people with the same condition are the same, resulting in the coach having to take into consideration Asymmetry, adaptation potential, restoring function, injury risk, the exercise selection/options available and classification/function.

Firstly targeting ROM and hypertonia which is the increase in muscle tension using passive stretching and passive movement has become the most commonly known rehabilitation strategy to aid cerebral palsy athletes. Pin, Dyke and Chan (2006); Theis, Korff, Kairon and Mohagheghi (2013) studies state that after using passive stretching for 10-20 minutes there was a significant difference during pre and post stretching. Both studies found doing a sustained amount of stretching longer than normal improved ROM and also reduced spasticity of muscles around the

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affected joints area. Additionally muscle fascicles length increased a significant amount as a result of passive stretching, which for athletes whom have cerebral palsy is an important factor due to the reduced ability of the muscle to stretch. Passive stretching known to increase ROM and lengthen muscle fascicles within CP athletes more effectively than active stretching, this is because there is an external force being applied either by a partner or physiotherapist to intensify the stretch compared to active stretching which requires one to hold a position with no assistance except from the strength of their agonist muscle (Hales, 2006). As a result of cerebral palsy individuals on most occasions not having control over some muscles, passive recovery should be prioritised by an S&C coach into a programme for 10-20 minutes due to the increase in fascicle length allows for the muscle to stretch. Therefore, incorporating passive stretching before a CP athlete starts to do exercise whether in competition or following an S&C coaches programmes will allow for there to be a decrease in the risk of injury and also an increase in the amount of control the athlete has over posture and muscles group whilst doing exercise as they would have strengthened it in the pre exercise stage (Alter, 2004).

Moreover another physical therapy intervention which should be included in a CP athletes programme is strength training. This would be the most logical starting point for a coach who is helping a cerebral palsy athlete. Previous research states that children who suffer from cerebral palsy, spastic Diplegia to be specific whom had only 50% of normal strength and spastic hemiplegia who had 20% strength asymmetry in comparison to able bodied athletes had significant strength gains in the muscles which were targeted. Furthermore there was also a higher gait velocity resulting from an increase of cadence having a greater impact on walking (Damiano & Abel, 2004). Taylor, Dodd and Larkin (2009), study also supporting the assertion that strength training can help a CP individual with strengthening affected muscles, posture and balance. Final results of the study stating, CP individuals taking part in 10 week's worth of strength training interventions increase leg strength by 22.0%, arm strength by 17.2% and improved performance of sit to stand.

On the other hand as much as strength training contributes to CP athlete's performance greatly and benefits them in everyday life, there are precautions and risks that need to be lowered and taken into consideration. An S&C coach will need to make some adaptations for CP athletes and which category they fall under regional impairment. For example specifically focusing on strengthening the quadriceps, a leg extension would be the exercise to perform (Houbolt & Denman, 1998). For an athlete who suffers from quadriplegia meaning the whole body being affected, it is very likely they would not be able to transfer themselves from a wheelchair to a machine so the exercise would be adapted using ankle/leg weights and performing the exercise in the wheelchair. Another example would be an athlete suffering from hemiplegia CP would need assistance in keeping balance when performing a bicep curl with free weights without the extra support of keeping the body upright there is an increase in injury to the affected area and also to whole body with posture and balance being restricted (Woude, Hoekstra & Groot, 2010). In regards to repetitions and weight size, this is something that a coach would also need to keep an eye on more than they would with able bodied athletes due to constant and continual of both can cause coordination problems and increase the risk of injury and fatigue if not monitored correctly (Taylor, Dodd, McBurney & Graham, 2004).

Additionally balance training is another key aspect of a training programme that is very important to develop stability in postural balance in CP athlete. El-Shamy and El-Kafy (2013); Nam, Kim and Yun (2017), study supports this assertion as a result of their study showing an individual who suffers from diplegic CP had significant improvement of postural balance control

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when including 30 minutes, 3 times a week for 3 months into training. Balance training mainly focusing on further increasing the strength of muscles that hold the body upright including legs and core (Auld & Johnston, 2014). In terms of all the exercises that would be prescribed to an able bodied athlete by an S&C coach, these can be applied to all populations but would require some adjustments in regards to the disability which is being dealt with and also the requirement of the sport. In most cases as stated above there are ways of adapting exercises to suit everyone's needs.

## Conclusion:

In conclusion the main findings of this study was, there are multiple different CP that an individual can have. Also CP can affect different parts of the body resulting in many different diagnosis and impairments. When a S&C coach is training or producing a programme specifically for CP athletes there are specific factors that need to be taken into consideration but most exercises that would be prescribed to an able bodied athlete can be used with some adjustment if needed. Finally, there are rehabilitation strategies in which S&C coaches may not include in able bodied training programme because that specific area does not need to development further as an improvement where as it is vital in a CP programme.

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