USTA WHEELCHAIR TENNIS COACHING MANUAL

SECOND EDITION

HOME

TABLE OF CONTENTS

Foreword 3

Contributors 6

History 14

USTA Wheelchair Tennis Today… 18

Qualifications to play Wheelchair Tennis 22

Three Main Differences between Wheelchair Tennis and Able-Bodied Tennis… 26

Medical and Safety Issues 28

The Chair 57

Strapping 60

Mobility 63

The HUB 70

Stroke Production 73

Quad Tennis 84

Singles: Game Styles and Strategies 89

Doubles: Game Styles and Strategies 92

How to Start a Local Program 95

Staging a Wheelchair Tennis Exhibition 103

Closing 107

Appendix/References 109

FOREWORD

USTA Mission Statement: 4

Call to action 4

FOREWORD

Dr. Paul Lubbers, PhD.

USTA MISSION STATEMENT:

"To promote and develop the growth of tennis…"

The USTA mission is clear and concise and a call to action for all of us who care about this great sport. Tennis is indeed a sport for everyone and can change the lives of those who call themselves tennis players. The health benefits of the game are now in the mainstream. One can not only have fun playing and competing on the tennis court, but it is evident that the sport can also help improve one's overall health and emotional and mental well-being by playing tennis on a regular basis. There is one group of players where the game of tennis is truly a life changer and that group is those that play the sport of tennis in the wheelchair.

Perhaps you're a coach like me who knew that tennis was played in a wheelchair but were removed from that part of our great game. Perhaps you're a coach like me who have only worked and coached able body players and never even entertained the thought of coaching a wheelchair tennis player. Perhaps you're a coach like me who never thought about the stories behind the players who play tennis in a wheelchair or have thought about those coaches who are running engaging and effective programs for wheelchair tennis players.

CALL TO ACTION

Now is the time to develop a deeper appreciation of Wheelchair tennis and become more educated about this important component of the sport of tennis. It is important to have a better understanding of the benefits for persons with disabilities to re-engage with their family members and friends to create a community in sport after life-altering trauma. Tennis has the magical ability to bring people together in a manner without much effort, unlike other adaptive sports, which can be difficult to

organize. This is a sport that can change not only one's ability to believe that they too can enjoy the benefits of a healthy lifestyle, but also to have an equal ability to connect socially with people from all walks of life. Tennis, and wheelchair tennis in particular, truly is a sport for a lifetime! Now is the time…

Educate, advocate and get involved…

Paul Lubbers, PhD.
USTA Sr. Director, Coaching Education & Sport Science

HOME

CONTRIBUTORS

Brad and Wendy Parks 7

Jason Harnett 7

Dan James 8

Randy Snow 9

Bal Moore, Ph.D 10

Curt and Lynn Bender 10

Dr. Erin Andrade, MD 11

Matt McCoy 11

Paul Lubbers, Ph.D 12

BRAD AND WENDY PARKS

Regarded as the pioneer of Wheelchair Tennis, Brad Parks began a journey in 1976 that would forever change the landscape of how tennis would be played for the disabled community. Besides being a player, Brad and wife, Wendy, founded the National Foundation of Wheelchair Tennis as the first governing body of wheelchair tennis, being absorbed by the USTA in 1998. Parks also wrote one of the first educational books for the sport in Tennis in a Wheelchair.
He was awarded a gold medal at the 1992 Paralympic Games in Barcelona, Spain and was inducted into the International Tennis Hall of Fame in 2010.

JASON HARNETT

Jason Harnett is currently the USTA National Manager for Wheelchair and Head Coach for Team USA, coming on board in this role in 2016. He became a member of the USTA National Wheelchair Coaching Staff in 1998.

He has coached three different teams in World Team Cup (equivalent to Davis Cup/Fed Cup) for Team USA: the Quad team, the Men's team and the Junior team. He has Captained 9 World Team Cup Championship teams. Harnett has helped coach five former and current World Number One players: Rick Draney, Brian Hanson, Chris Studwell, David Wagner, Nick Taylor, Stephen Welch and Chris Herman (junior).

Harnett served as an Assistant Coach for Team USA at the 2004, 2008, 2012 and 2016 Paralympic Games. He also served as the Assistant Coach for Team USA at the Parapan American Games in 2007, 2011 and 2015. Harnett led the 2019 Parapan Am Team in Lima, as the Head Coach, to an historical 7 medals. US Players have medaled in all of these games since 1988.

In 2008, Harnett received the ITF Wheelchair Coach of the Year Award. He was honored by his players at the 2012 Paralympic Games in London with the Order of Ikkos Medal, a medal given to

coaches by the players themselves. In 2012, he was honored as the USTA/USOC Paralympic Tennis Coach of the Year and was a Finalist for USOC Paralympic Coach of the Year. Currently, Harnett is a member of the ITF Wheelchair Coaches Commission (since 2008) and was selected to the ITF Strategic Task Force in 2017. He is a member of the USPTA, PTR and a certified USTA High Performance Coach.

Harnett has a B.A. in Political Science from the University of Washington (1994), where he played tennis for four years and was named Captain and the Men's Intercollegiate Athletics Representative his Senior year.

Harnett lives in Orlando, Florida (Lake Nona) with his wife, Jennifer, and three children, Benjamin, Angelina and Broderick.

DAN JAMES

Dan James is the former National Manager and Head Coach for Team USA. He was the very first "Manager" for wheelchair tennis, specifically for an NGB, of any country in the world. His tenure was from 2003-2016. His career at the USTA began in 1998 as the assistant coach at World Team Cup in Barcelona, Spain. James went on to become the Head Coach for Team USA in 5 Paralympic Games and 3 Parapan American Games. US athletes medaled in all of the games that he led the team. As the Head Coach of the World Team Cup delegation, James' teams won a total of 10 World Championships, Captaining the 2016 Junior Team to the title.

James has been honored as the ITF Coach of the Year twice, 2007 and 2011. He was honored by his players at the 2012 Paralympic Games in London with the Order of Ikkos Medal, a medal given to coaches by the players themselves. James was also awarded the USTA/USOC Paralympic Tennis Coach of the Year twice, 2008 and 2016. In 2017, James was awarded the "Tennis-Educational Merit Award" from the International Tennis Hall of Fame. He is a member of the USPTA and PTR. James also represented on the ITF Wheelchair Tennis Committee and the ITF Wheelchair Coaches Commission.

James has a B.A. in Speech/Communications from Gustavus Adolphus College (1992), where he played Varsity tennis for four years.

He lives in Seattle, Washington with his wife, Jamie.

RANDY SNOW

Randy Snow is recognized as one of the most successful wheelchair athletes in history. His career spanned four Paralympic Games (1984, 1992, 1996 and 2000), where he won medals in basketball, track and tennis. In 1996, he received the Olympic Torch from President Bill Clinton, and in 2004, he was the first Paralympian inducted into the Olympic Hall of Fame.

Snow dominated national and international tennis, winning 10 US Open singles titles and six doubles titles. He won both the singles and doubles Gold Medals at the Paralympic Games in Barcelona, Spain, the only man to accomplish this feat. He captured the first Masters Championship and was the first International Tennis Federation World Champion in 1991. He played for the United States in nine World Team Cup Competitions, winning seven World Championships.

Snow has greatly assisted the development of wheelchair sports in the United States by conducting hundreds of wheelchair sports camps, lectures and presentations. His contributions to wheelchair tennis were recognized in 2003 when the International Tennis Federation presented him with the prestigious Brad Parks Award. He has been inducted into the Wheelchair Sports Hall of Fame, Texas Tennis Hall of Fame, Boys and Girls Club of New York Hall of Fame, National Spinal Cord Injury Hall of Fame, the United States Olympic Committee Hall of Fame and in 2012 (posthumously) was inducted into the International Tennis Hall of Fame.

He passed away while working at a tennis camp in El Salvador in 2009.

BAL MOORE, PH.D

Dr. Bal Moore began his wheelchair tennis coaching experience in 1989 as the personal coach of World Champion Randy Snow.

A USPTA Master Professional, he was named Coach of the Year by the USPTA in 1992. Moore has coached the US Men's Wheelchair Tennis Team to four World Team Cup Championships as well as the U.S. Men to Gold Medals in both Singles and Doubles in the 1992 Paralympic Games in Barcelona, Spain.

Moore co-authored Wheelchair Tennis, Myth to Reality with Randy Snow in 1994 and developed the first wheelchair teaching certification for the USPTA.

Moore has been inducted into the Alabama Tennis Hall of Fame. He lives in Naples, Florida with his wife and fellow Coach, Marcha.

CURT AND LYNN BENDER

Curt Bender has been playing wheelchair tennis since 1992 and has continued to see the game change in many positive ways. He is actively involved in the Grand Rapids Wheelchair Sports Association (www.grwsa.com), where he serves on the Board of Directors. He is also involved at the sectional level promoting wheelchair tennis across the Midwest and most recently had been involved with the USTA National Committee as its Chairman. Bender is on the ITF Wheelchair Tennis Committee as well.

Lynn Bender began her involvement in 1999 as a tennis coach. After finishing playing collegiate tennis, she found a passion for wheelchair tennis as well as the next phase of her life. Lynn and Curt were married in 2001, which further sparked their combined commitment to seeing the continued growth of wheelchair tennis.

Lynn's involvement has grown into having been the Head Coach for the Grand Rapids Wheelchair Tennis Team and program

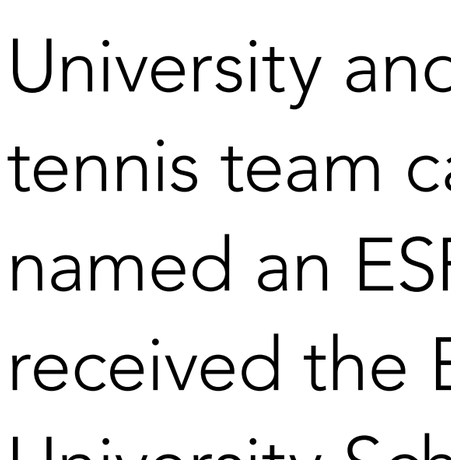
coordinator for the adult, junior and collegiate tennis teams. She is a certified wheelchair tennis coach through the PTR. Lynn also served on the USTA National Committee as volunteer member.

The Bender's are eager to share their experiences and use their successes with the GRWSA to help serve and guide other organizations to become successful and further grow the sport.

DR. ERIN ANDRADE, MD

Dr. Erin Andrade, MD, is a Physical Medicine and Rehabilitation doctor who specializes in neuro-rehabilitation. She manages the medical care of individuals with a variety of conditions, including spinal cord injury, stroke, limb loss, multiple sclerosis and other neuromuscular conditions. She has served on the USTA National Wheelchair Tennis Committee as well as the National Sports Science Committee. She has experience with adaptive sports and injury prevention, helping develop wheelchair tennis programs as well as coach wheelchair tennis. She has volunteered at the National Veterans Wheelchair Games and with the Outdoors for All adaptive recreation program.

She received the Presidential Rector Scholarship to attend DePauw University and graduated Magna Cum Laude. She served as the tennis team captain, is a two time All-American in tennis, and was named an ESPN Third Team at Large Academic All-American. She received the Eli Lilly Foundation Scholarship to attend Indiana University School of Medicine and completed her residency at the University of Washington in Physical Medicine and Rehabilitation. She continues to enjoy playing tennis, but also enjoys trail running, mountain biking, and skiing.



MATT MCCOY

Matt McCoy is a physical therapist and center manager for Baylor Institute for Rehabilitation in Addison, Texas.

He graduated in 2003 with a Masters degree in Physical Therapy from UT Southwestern in Dallas, Texas. Matt

has spent 16 years practicing in the orthopedic rehabilitation setting and is certified by the American Physical Therapy Association as an orthopedic specialist. Matt has been a volunteer with the USTA for 8 years, and serves as the Chair of the USTA Texas Sports Science Committee. He also holds a committee seat on a USTA National Wheelchair Committee. Matt is from San Antonio, Texas where he played high school tennis, and played collegiate tennis at Texas Lutheran University. At the local level, Matt sits on the Dallas Tennis Association Board and continues to play USTA league tennis at a 5.0 level. Matt McCoy lives in Carrollton Texas with his wife Laura, son Chandler, and daughter Brooklyn.

PAUL LUBBERS, PH.D

Dr. Paul Lubbers has been involved in tennis in many capacities including as a player, teacher, coach, writer, speaker and researcher. He currently is the Sr. Director of Coaching Education and Sport Science for the United States Tennis Association working in the Player Development Division.

In his role, Paul works to provide educational experiences and opportunities for America's top tennis coaches and manages and directs and supports activities related to Strength and Conditioning, Medical Services, Sport Sciences and Data Analytics for Player Development Training Centers. Paul is based out of the USTA National Campus in Orlando Florida. Prior to working with the USTA, he served as the head men's and women's tennis coach at the University of North Carolina, Greensboro, from 1991 to 1999.

Paul is a speaker, presenter and educator, contributing to conferences associated with many of the world's tennis organizations including the Intercollegiate Tennis Association, International Tennis Federation, Lawn Tennis Association, Mexican Tennis Federation, Professional Tennis Registry and the United States Professional Tennis Association. As a writer he has contributed to many leading tennis-related publications and websites including Tennis magazine, ITPA, ITF Coaching and Sport Science Review, USTA High Performance Coaching Newsletter,

TennisI-coach.com and TennisPlayer.net. He was a co-author and editor of the “USTA Mental Skills and Drills” manual and is written chapters for many Tennis related books. He has lead the way in creating online learning platforms and courses to support the education of Tennis Coaches in the United States and is known as a team player collaborating to grow and develop the game of tennis across the player pathway

He is currently a member of the United States Tennis Association’s Sport Science Committee, the ITF Coaches Commission and has served on the ITF Sport Science and Medical Commission.

Paul received his bachelor’s degree from Hope College in 1983, earned his master’s degree from Indiana University in 1984 and his Ph.D. in exercise and sports science at UNC Greensboro in 1998, with his research interest focusing on teaching, coaching and sport psychology.

HISTORY

Since its inception in 1976, wheelchair tennis has become one of the most popular wheelchair sports in the U.S. and across the world. This manual is intended to foster even further growth to ensure that any person with a physical disability has the opportunity to participate in tennis programming. It will contain information on the history of the sport, how to play and to coach, how to start a program and numerous drills that can be used to enhance the playing/coaching experience.

Brad Parks

None of this would be possible without a rich history of contributors such as International Tennis Hall of Fame Member, **Brad Parks,** the founder of wheelchair tennis (with Jeff Minnenbraker) and the creator of the National Foundation for Wheelchair Tennis (NFWT). He spent an enormous amount of time traveling across the country promoting the sport and introducing a nation to wheelchair tennis. Parks was not only responsible for creating wheelchair tennis, but was also a Paralympic Gold Medalist in doubles in the 1992 Paralympic Games in Barcelona, Spain.

Randy Snow

Randy Snow was America's first great champion, winning 10 US Open titles, Gold in both Singles and Doubles (with Parks), along with almost every international title. Snow was also designated the first ITF World Champion in 1991. But Snow was not only a great champion; he was driven to give back to the sport that he loved, traveling across America running wheelchair tennis camps for new and experienced players alike. He also co-wrote the wheelchair tennis book, Wheelchair Tennis: Myth to Reality, with his longtime coach Dr. Bal Moore (the first able-bodied U.S. Men's Coach). This book remains the foundation of today's modern mobility. Snow and Moore also compiled drills from great players and coaches alike in the USTA Handbook, 102 Wheelchair Tennis Drills. Randy Snow passed away in 2009 while coaching at a tennis camp in El Salvador.

Nancy Olson

Nancy Olson was the first great female U.S. Champion, consistently ranked in the top five in the World. She led the only Women's Team World Championship at the World Team Cup in 1993 (coached by Marcha Moore) and was a Silver Medalist in Doubles at the 1992 Paralympic Games (with Lynn Seidemann) in Barcelona, Spain and the 1996 Paralympic Games (with Hope Lewellen). Olson also has given back to the game, coaching at numerous adult and junior camps and creating opportunities for others to play wheelchair tennis.

Rick Draney

Rick Draney of Southern California origin, was instrumental in advocating for and helping to implement the Quad Division. Through tireless effort and incredible play (six US Open titles), he made wheelchair tennis for quadriplegics a reality. Draney also served as Tournament Committee Chairperson for the US Open for Wheelchair Tennis for nine

years. He recently served on the USTA National Committee for Wheelchair Tennis as a volunteer. Draney was the recipient of the 2012 USTA Brad Parks Award, for his contributions to the sport and recently was also honored with the 2017 ITF Brad Parks Award for similar distinction on the international level.

Wheelchair tennis has come a long way since Parks first introduced us to the sport. The first wheelchair tennis tournament was held in 1977, hosted by the Los Angeles City Parks and Recreation Department. Today, there are currently over 160 events internationally, in 40 countries on the UNIQLO Wheelchair Tennis Tour and over 60 USTA sanctioned events here in the U.S.. Wheelchair Tennis has also been represented in all four Grand Slam events since 2007, had the inclusion into the Paralympic Games and Parapan American Games and concluding each year with the NEC Singles Masters and UNIQLO Doubles Masters, representing the year-end World Championships for the very best players in the world.

The United States Tennis Association (USTA) assumed responsibility for wheelchair tennis from the NFWT in 1998. A national committee was formed to administer grassroots programming and camps, govern the World Team Cup and Paralympics, as well as oversee the tournaments in the U.S. In 2001, the USTA was named National Governing Body (NGB) of Paralympic Tennis by the United States Olympic Committee (USOC), becoming the first able-bodied NGB to assume the same responsibilities for its Paralympics counterpart. In 2003, the USTA became the first NGB in the world to hire a full-time staff person devoted solely to wheelchair tennis.

WHEELCHAIR TENNIS

HOME

USTA WHEELCHAIR TENNIS TODAY...

Community Tennis 19

Professional Tennis 20

Player Development/High Performance 21

Since 1998, the USTA's programming for wheelchair tennis has grown to include: Community Tennis (Grassroots), Professional Tennis and new engagement with Player Development. Highlights from these programs include:

COMMUNITY TENNIS

All wheelchair tennis played at a local level

- **Grant distribution**—Provide grants to supplement the funding of American wheelchair tennis tournaments and local programming.
- **Coaching/Players Curriculum**—Create collateral materials to educate coaches, players and organizers in how to get involved in wheelchair tennis. In cooperation with the USPTA (United States Professional Tennis Association) and the PTR (Professional Tennis Registry) to educated certified Tennis Professionals.
- **Integration** is tennis played with both wheelchair tennis players and able-bodied players on the same court in singles or doubles. The integration rule has been adopted by both the USTA and the ITF. It states that any person who has medically qualified and plays from a wheelchair may play by the Rules of Wheelchair Tennis (appendix,) against an able-bodied players who must play by the rules of tennis set by Friend at Court (appendix,). This has allowed wheelchair tennis players to participate in USTA League, Jr. Team Tennis, Tennis On Campus, NTRP Tournaments and high school tennis teams, as well as the creation of Run/Roll Tennis events in which doubles teams are comprised of one sitting and one standing player.
- **Red/Orange/Green Dot/Yellow Progression (Net Generation curriculum)**—this is an excellent way to teach all wheelchair tennis players and an opportunity for integration. NetGeneration.com
- **Collegiate Wheelchair Tennis**—Wheelchair players attending college can also compete and represent their University/College on the USTA/ ITF tours, culminating at the Collegiate National Championships. A National Collegiate ranking

system is being created for both individual and school rankings. playerdevelopment.usta.com/collegiatewheelchair/

PROFESSIONAL TENNIS

All tennis played on the UNIQLO Wheelchair Tour, the BNP Paribas World Team Cup and the Paralympic Games.

- **UNIQLO Wheelchair Tour events:** there are over 150 events, in 40 countries throughout the world in which professional wheelchair tennis players compete for prize money and world ranking points. itftennis.com/en/itf-tours/uniqlo-wheelchair-tennis-tour/

- **BNP Paribas World Team Cup:** Wheelchair Tennis' version of Davis Cup and Fed Cup. One week out of the year, more than 30 countries converge on a location to compete in a team format to declare a team World Champion.

- **Paralympics ("beside" Olympics = "Parallel Games"):** the second-biggest sporting event in the world, U.S. athletes compete in a multi-sport event for Gold, Silver and Bronze medals (appendix III, medal winners). paralympic.org/paralympic-games.

- **Deloitte US Open Wheelchair Tennis Competition (Grand Slam)** Wheelchair tennis was integrated completely into all four Grand Slam events in 2007 allowing the masses to witness the best wheelchair tennis players in the world on the grandest stage. USOpen.org

PLAYER DEVELOPMENT/HIGH PERFORMANCE

Development of the future of American wheelchair tennis champions.

- Fund "developing" and professional players to enhance training and travel opportunities, keeping the U.S. competitive with the ever-growing international field of players.
- Provide national coaches to supplement hometown training as well as traveling to events to support performance.
- Maximizing resources made available through the Player Development department at the USTA National Campus in Orlando, FL., and both Player Development Training Centers in Carson, CA., and in New York, NY at the Billie Jean King National Tennis Center.

playerdevelopment.usta.com

HOME

QUALIFICATIONS TO PLAY WHEELCHAIR TENNIS

Eligibility 23

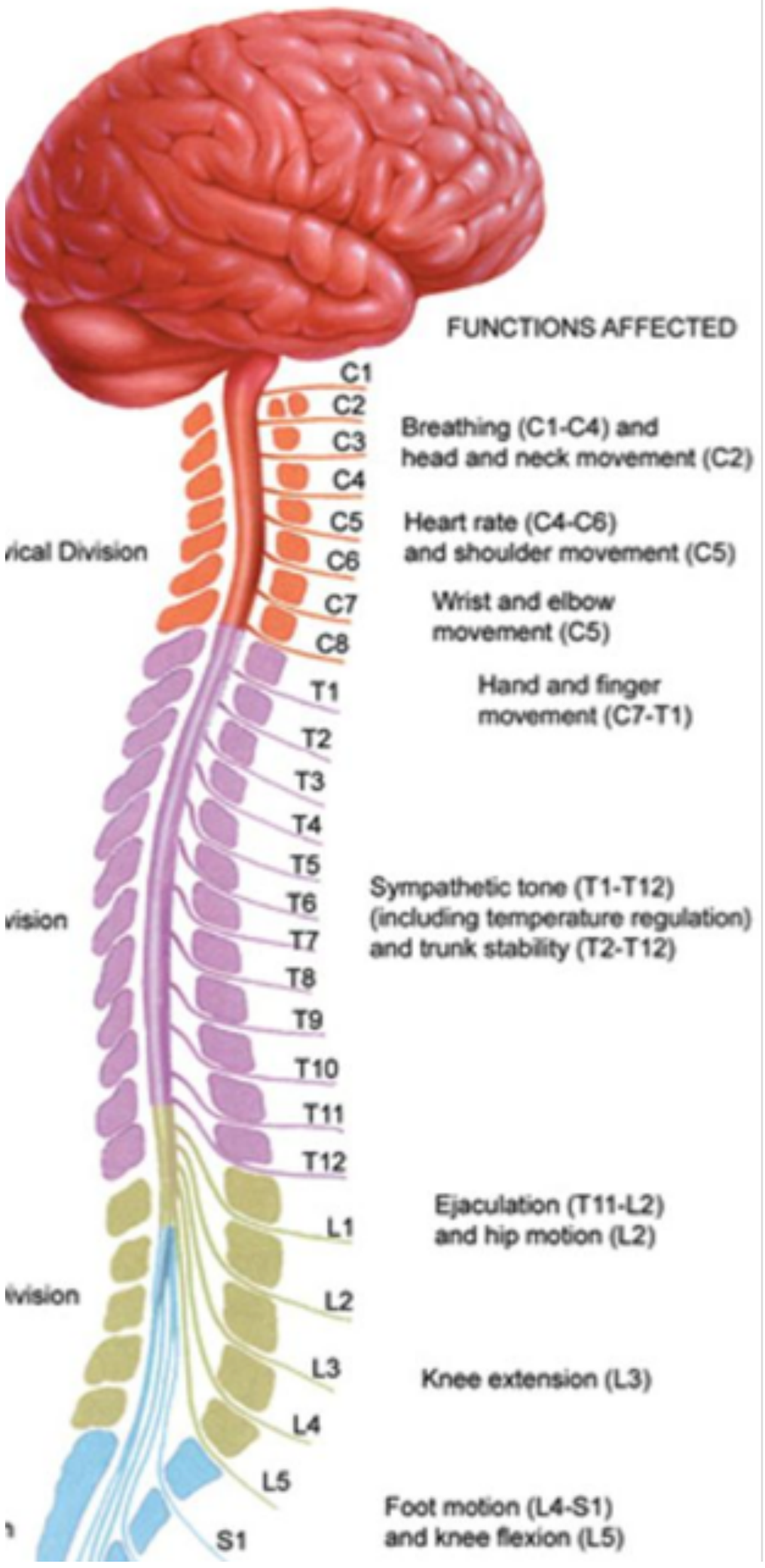
Retirement Policy 25

To qualify as a wheelchair tennis player, you must meet the minimum disability standard the ITF has set. This is defined in the ITF Handbook as:

THE COMPETITIVE WHEELCHAIR TENNIS PLAYER

ELIGIBILITY

1. In order to be eligible to compete in an ITF sanctioned wheelchair tennis tournament, BNP Paribas World Team Cup, ITF sanctioned international games or the Paralympic Games, a player must have a medically diagnosed permanent mobility related physical disability. This permanent physical disability must result in a substantial loss of function in one or both lower extremities. Players must meet one of the following minimum eligibility criteria:



   i. A neurological deficit at the S1 level or proximal, associated with loss of motor function, or;

   ii. Ankylosis and/or severe arthrosis and/or joint replacement of the hip, knee or upper ankle joints, or;

   iii. Amputation of any lower extremity joint proximal to the metatarsophalangeal joint, or;

   iv. A player with functional disabilities in one or both lower extremities

   v. equivalent to i, ii, or iii above.

2. A Quad player must meet the criteria for permanent physical disability as defined above. In addition, the player must have a permanent physical disability that results in a substantial loss of function in one or both upper extremities. A Quad player must meet one of the following minimum eligibility criteria:

   i. A neurological deficit at the C8 level or proximal, with associated loss motor function, or;

   ii. Upper extremity amputation, or;

   iii. Upper extremity phocomelia, or;

   iv. Upper extremity myopathy or muscular dystrophy, or;

   v. A player with functional disabilities in one or both upper extremities equivalent to i, ii, iii or iv above.

3. In addition, a Quad player must have at least one of the four following Functional disabilities with regards to upper extremity use, with or without Limitation of trunk function:

   i. Reduced motor function necessary to perform an overhead service

   ii. Reduced motor function necessary to perform a forehand and Backhand

   iii. Reduced motor function necessary to manoeuvre a manual wheelchair

   iv. Inability to grip the racquet necessitating the need for taping and/or An assistive device in order to play

   The combination of dominant and non-dominant upper limb function and trunk function will be considered when assessing eligibility for Quad status. In order to be deemed eligible for Quad status, a player who can demonstrate a good level of trunk function and control will need to have a greater level of disability in their upper limbs than those with little or no trunk control.

4. In addition, a Quad player must also:

i. Have a minimum of three affected extremities with a permanent physical disability as defined above; and

ii. Satisfy the classification points scoring system, the current version of which appears in the ITF Wheelchair Tennis Classification Manual;

iii. Comply with any specific requirements of the particular classification status assigned; and

iv. Cooperate fully, honestly and in good faith with any classification process and/or related procedure.

A Quad player may not use either foot to propel the wheelchair. Any questions or protest as to a player's eligibility to participate under this rule will be decided under the procedures listed in Appendix C and Appendix. For guidance purposes only a glossary of terms will appear in Appendix E.

5. A player can change divisions, without a change in his/her medical condition, a maximum of twice in his/her career. In addition, a player wanting to return to the Quad division should undertake a classification at his/her own expense. The outcome of this classification is binding.

RETIREMENT POLICY

If a player formally retires by writing to the ITF, then their name shall be removed from the ITF Wheelchair Tennis Ranking with immediate effect.

ITF Wheelchair Tennis Regulations

HOME

THREE MAIN DIFFERENCES BETWEEN WHEELCHAIR TENNIS AND ABLE-BODIED TENNIS...

Two Bounce Rule 27

No Lateral Movement or Ability to Elevate 27

Less Preparation Time 27

TWO BOUNCE RULE

A wheelchair tennis player is allowed to strike the ball after a maximum of two bounces. The first bounce must be within the boundaries of the court; the second bounce can land anywhere. This does not mean the ball must be struck on the two bounces but can be taken on one or in the air, depending on the position in the court and how fast the ball is approaching the player.

NO LATERAL MOVEMENT OR ABILITY TO ELEVATE

A wheelchair cannot move laterally or elevate. This has necessitated unique movement patterns to wheelchair tennis. These movement patterns were created to simulate lateral recoveries used by the able-bodied players enhancing position on the court and maximizing the ability to get to the next ball.

LESS PREPARATION TIME

Wheelchair tennis players must propel the wheelchair using their hands and arms, minimizing the amount of time they have to prepare the racquet. A slight adjustment to the prepared position during the stroke production in wheelchair tennis allows a player to get into position and maximize the time to execute stroke production.

Understanding these three basic differences will help you to see that wheelchair tennis players have the same goals and aspirations as all other tennis Players. They want to a have a sport that creates a healthy lifestyle, offers a competitive arena and enhances a social circle to people with similar interests.

MEDICAL AND SAFETY ISSUES

Introduction 30

Who Can Participate in Wheelchair Tennis? 30

Spinal Cord Injury 31

Paraplegia 32

Tetraplegia or “Quad” 32

Complete versus Incomplete Injury 32

Most Common Types of Spinal Cord Injury 32

Causes of Spinal Cord Injury 32

Amputee 33

Playing Tennis with a Prosthetic Leg versus Using a Manual Wheelchair 33

Medical Considerations for the Wheelchair Athlete 34

Neurogenic Skin 35

Impaired Temperature Control 39

Neurogenic Bladder 42

Impaired Pulmonary Function And Breathing 43

Altered Heart Rate and Impaired Circulatory System 44

Autonomic Dysreflexia 46

Upper Extremity Injuries 50

Bone Health And Osteoporosis 52

(Continued on next page)

HOME

MEDICAL AND SAFETY ISSUES *(Continued)*

Spasticity 53

Mobility Needs And Safety 54

Conclusion 56

MEDICAL AND SAFETY ISSUES

Dr. Erin Andrade, M.D. and Matt McCoy, PT, OCS, CSMT

INTRODUCTION

Wheelchair tennis has been played since the early 1970's. Participation rates have grown substantially over the years and advancements in technology, specifically wheelchair design, has allowed the game to become more competitive. With growing popularity it is important for the wheelchair tennis coaches, tournament directors, and athletes to understand specific medical considerations that are unique to the wheelchair tennis athlete. The following section will provide an overview of key medical considerations for the wheelchair athlete. You should not rely on this information as a substitute for, nor does it replace, professional medical advice from an appropriate healthcare provider.

WHO CAN PARTICIPATE IN WHEELCHAIR TENNIS?

To be eligible to play competitive wheelchair tennis, a player must have a medically diagnosed permanent mobility related physical disability. This permanent physical disability must result in a substantial loss of function in one or both lower extremities. In addition, a "quad" player must have substantial loss of function in one or both lower extremities.

Athletes with a number of medical conditions; such as spinal cord injury, stroke, amputation, multiple sclerosis, neuromuscular disease, and spina bifida; participate in wheelchair tennis. Some athletes may be able to stand and walk, but to improve their mobility and safety; they use a sport specific wheelchair to participate.

Wheelchair tennis players generally fall into two main medical categories:

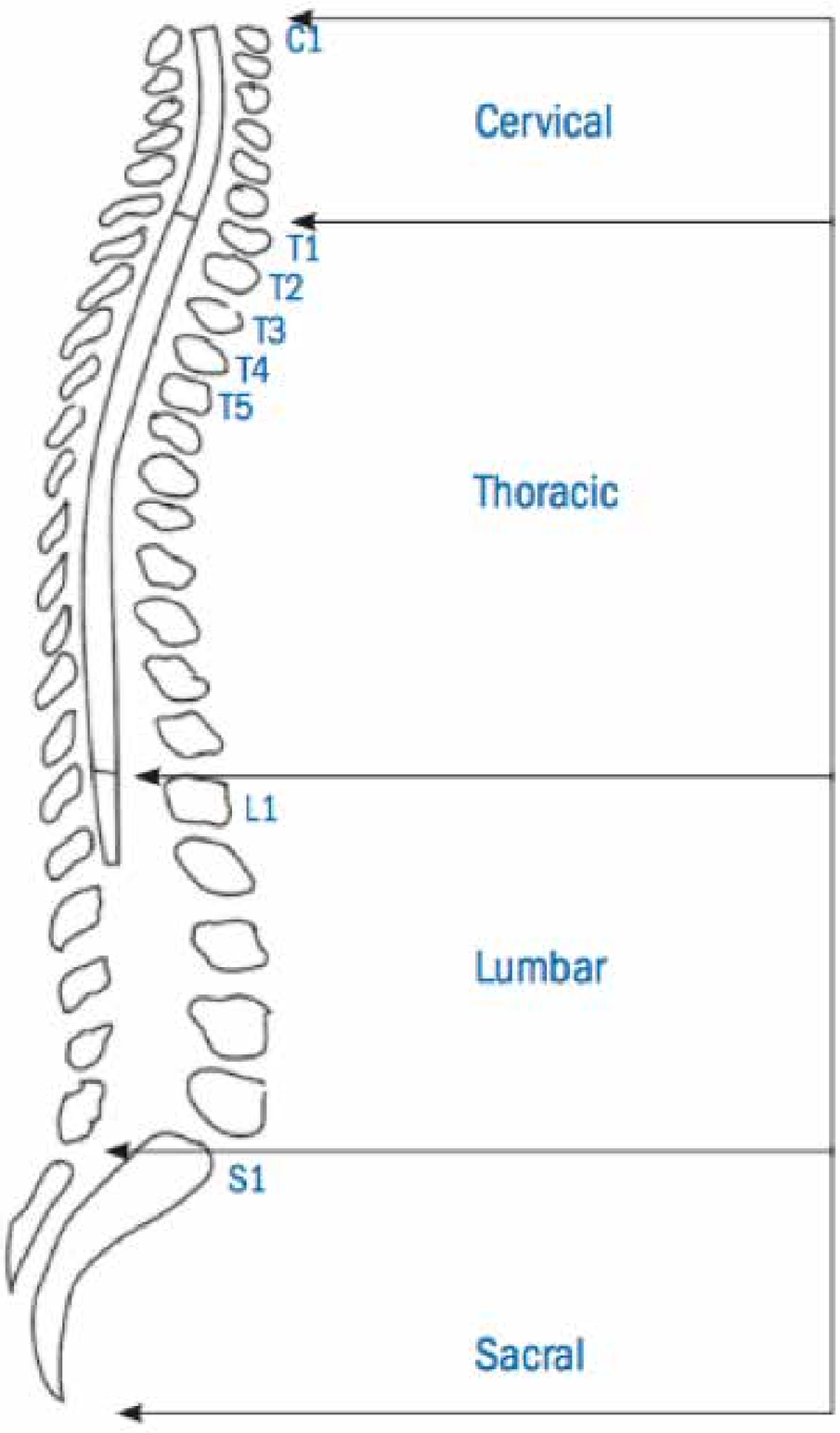
1. Spinal Cord Injury
2. Amputee

Disabilities in both groups of players can be either congenital or acquired. A big difference between those players with a spinal cord injury and those with an amputation is core and trunk stability and control. Both groups of athletes may use a wheelchair for mobility, but the athlete with an amputation tends to have intact core and trunk control, allowing for overall improved function and mobility.

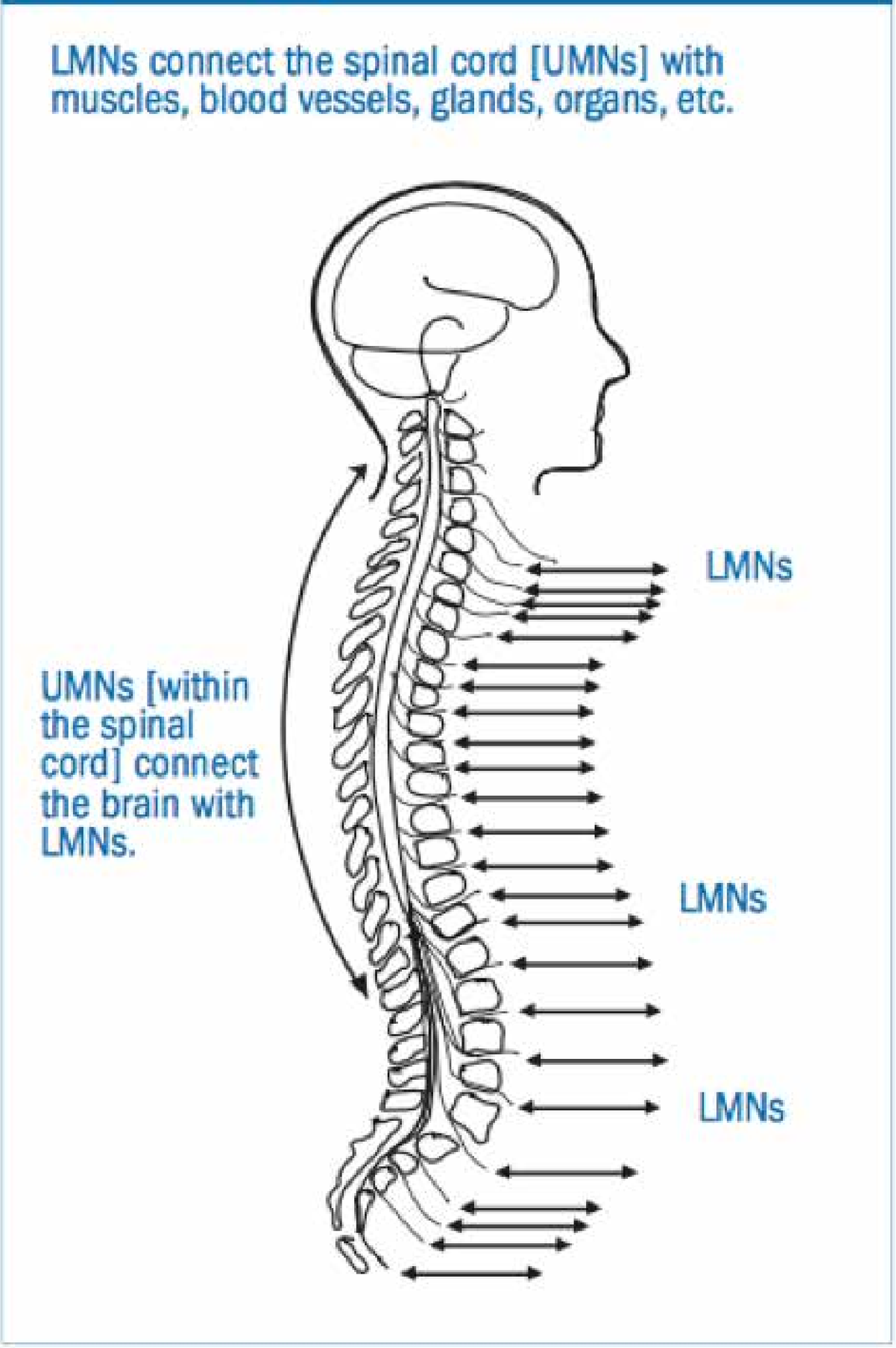
SPINAL CORD INJURY

Damage to the spinal cord can cause changes in movement, feeling, bladder control, or other bodily functions. The changes depend on where and how badly the spinal cord was injured. The main problem is that the connection between the brain and the body below the injury is impaired or broken. Figures 1.a.2 and 1.a.3 demonstrate spinal cord anatomy and how the upper motor neurons (UMNs) of the central nervous system are connected with the lower motor neurons (LMNs) of the peripheral nervous system.

[Figure 1.a.2] The Spinal Cord



[Figure 1.a.3] Spinal Nerves



There are nearly 270,000 people living with a spinal cord injury in the United States. Eighty-two percent of spinal-cord-injured patients are male and the average age of injury is 42 years. The two

main types of spinal cord injury are paraplegia and tetraplegia, or "quad".

PARAPLEGIA

An injury sustained to the spinal cord in the thoracic or lumbar spine generally results in paraplegia that is either complete or incomplete paralysis of the lower limbs and often involves the trunk. An incomplete injury means one may have either partial sensation or strength below the level of injury to the spinal cord. A complete injury means one has loss of strength and sensation below the level of injury.

TETRAPLEGIA OR "QUAD"

An injury sustained to the spinal cord in the cervical spine generally results in tetraplegia that is either complete or incomplete paralysis of the upper and lower limbs and often involves the trunk. Those individuals with tetraplegia have impairments in function in arms, trunk, legs, and pelvic organs.

COMPLETE VERSUS INCOMPLETE INJURY

An incomplete injury means one may have either partial sensation or strength below the level of injury. A complete injury means one has loss of strength and sensation below the level of injury.

MOST COMMON TYPES OF SPINAL CORD INJURY

- 40.6% incomplete tetraplegia
- 18.7% incomplete paraplegia
- 18.0% complete tetraplegia
- 11.6% complete paraplegia

CAUSES OF SPINAL CORD INJURY

1. Congenital, such as spina bifida (where the fetal cord fails to develop normally)
2. Acquired

i. Motor vehicle accident (36.5%)

ii. Falls (28.5%)

iii. Gunshot wounds or violence (14%)

iv. Sports/recreation activities (9%)

3. Tumor/Cancer

4. Neurologic pathology: such as multiple sclerosis

AMPUTEE

There are nearly 2 million people living with limb loss in the United States. Among those living with limb loss, the main causes are the following:

- Vascular disease (54%) – including diabetes and peripheral arterial disease
- Trauma (45%)
- Cancer (less than 2%)

In amputees, the congenital problems tend to be related to developmental limb defects, whereas the acquired injuries are normally the direct result of trauma, such as motor vehicle accident or workplace injury, or disease, such as a tumor or vascular disease.

PLAYING TENNIS WITH A PROSTHETIC LEG VERSUS USING A MANUAL WHEELCHAIR

Amputees can play tennis standing with the use of a prosthetic leg, but there are some challenges that come with wearing a prosthetic leg. Lateral movement and change of direction is limited on the tennis court for the player using a prosthetic leg. How well the prosthesis fits can limit overall mobility for the athlete. Dehydration can affect the shape of the residual limb and cause the prosthesis to not fit securely. With these challenges, athletes will often decide to use a wheelchair to play tennis to improve their overall mobility, allowing them to play and compete with greater success.

MEDICAL CONSIDERATIONS FOR THE WHEELCHAIR ATHLETE

Athletes who sustain a spinal cord injury suddenly find that, in addition to the significantly reduced muscle power below the level of their spinal cord lesion, they also have to manage other associated medical problems. Athletes with other underlying medical conditions may also have similar medical considerations, so it is important to be familiar with the athlete's medical history. The following are a few key medical considerations for the wheelchair athlete, which will be covered in the following sections:

1. **Neurogenic Skin**
    i. Pressure Ulcer Characteristics and Concerns
    ii. How Frequently and How to Perform Pressure Releases
    iii. Time and Process for a Pressure Ulcer to Heal
    iv. Wounds and Infection
    v. Loss of Sensation: Caution When Using Cold or Heat as Treatment
    vi. Sun Protection
2. **Impaired Temperature Control**
    i. Heat Related Illness
    ii. Prevention Strategies
3. **Neurogenic Bladder**
    i. Causes of Urinary Tract Infections
    ii. Common Signs and Symptoms of a Urinary Tract Infection
    iii. Preventing Urinary Tract Infections
4. **Impaired Pulmonary Function and Breathing**
5. **Altered Heart Rate and Impaired Circulatory System**
    i. Cardiac Function
    ii. Edema

iii. Blood Clots

iv. Pulmonary Embolism

6. **Autonomic Dysreflexia**

   i. Possible Causes of an Episode of Autonomic Dysreflexia

   ii. Signs and Symptoms of Autonomic Dysreflexia

   iii. Treatment of Autonomic Dysreflexia

7. **Upper Extremity Injuries**

   i. Causes of Rotator Cuff Impingement Syndrome

   ii. Treatment of Rotator Cuff Impingement Syndrome

   iii. Other Common Upper Extremity Injuries

8. **Bone Health and Osteoporosis**

9. **Spasticity**

   i. Common Triggers of Muscle Spasticity

   ii. Advantages of Spasticity

   iii. Problems Caused by Spasticity

   iv. Treatment of Spasticity

10. Mobility Needs and Safety

    i. Anti-tippers and Other Safety Equipment

NEUROGENIC SKIN

Key Points

- **Definition:** skin is more susceptible to break down and does not heal well
- Even small areas of non-blanching erythema/redness could indicate deeper tissue damage
- Encourage the athlete to modify sitting position or possibly withdraw from play if concern of a pressure injury

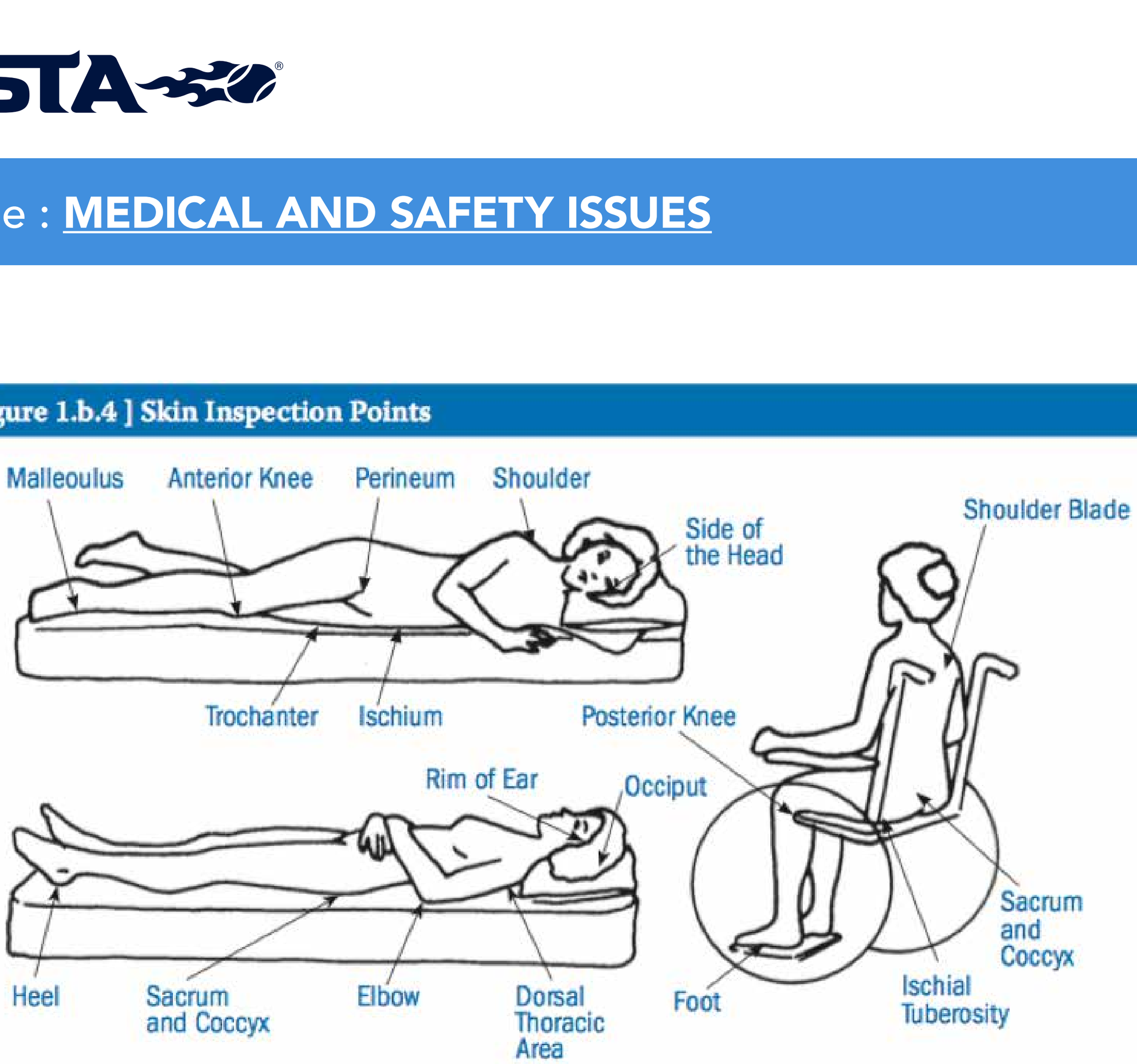
Many wheelchair athletes have altered sensation and innervation to the skin, which poses a significant risk for development of skin injury. Table 1.b.A discusses how skin is affected by a spinal cord injury and how to prevent common skin issues.

[Table 1.b.A] How Skin Is Affected by SCI and How to Prevent These Problems

FUNCTIONS	CHANGE	YOU NEED TO
Protection	No change.	Avoid breaks in your skin.
Sensation	Decrease in or no feeling of touch, pain, pressure, and temperature below the level of your SCI.	Substitute specific protective habits to prevent injury to skin and underlying tissues; for example, perform pressure releases when sitting in your wheelchair, avoid applying hot packs to skin that doesn't have feeling, wear appropriate clothing outside when it is cold.
Temperature Regulation	Less sweat to evaporate and cool you below the level of your SCI.	Control temperature of your environment [stay out of sun, use air conditioning]. When in the sun, drink plenty of fluids.
	May have excessive sweating above the level of your SCI.	Bathe more frequently. Possibly take medication to control sweating and/or use antiperspirant in skin folds.
Fluid Regulation	Lack of voluntary muscle action below the level of your SCI can produce edema, swelling of the tissues due to pooling of fluids	Elevate swollen parts to reduce/control. Wear compression stockings.

A few common areas of skin breakdown are the buttocks area, such as the sacrum and ischium, because they are areas of high pressure while sitting. Many athletes use custom cushions to help relieve these high-pressure areas. Other vulnerable areas include the shoulder blades, hips, heels, ankles, and feet. Figure 1.b.4 illustrates key points to inspect for possible skin breakdown. It is also important to ensure that clothing and shoes are not too tight, since pressure on affected limbs can result in pressure areas and sores that will then be slow to heal and often difficult to manage. Making sure to avoid development of excessive moisture, with frequent clothing changes, can also prevent skin breakdown.

[Figure 1.b.4] Skin Inspection Points

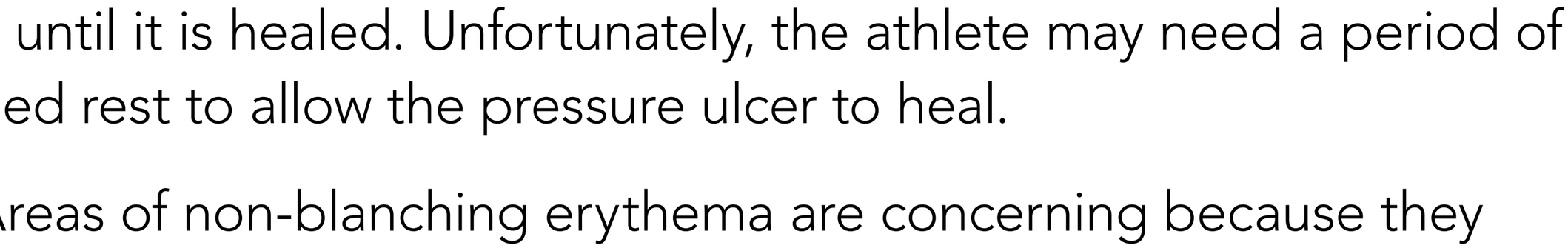


Pressure Ulcer Characteristics and Concerns

If the athlete develops skin redness after having pressure on a bony area of the body, it is important to monitor how long the redness takes to fade. If it takes longer than 15-20 minutes or does not fade at all, the pressure was too great and immediate action is required. Do not massage these areas. Do not put pressure on the area until the redness fades completely. Check the wheelchair cushion and look for other possible areas of friction and pressure. If the athlete develops a pressure ulcer, it is important to get off it and stay off it until it is healed. Unfortunately, the athlete may need a period of bed rest to allow the pressure ulcer to heal.

Areas of non-blanching erythema are concerning because they are stage I ulcers. Reduced circulation in the affected limbs also increases the risk of pressure sores, and the skin damage is more difficult to heal. Figure 1.b.6 demonstrates different stages of pressure ulcers, from Stage 1 to Stage 4.

[Figure 1.b.6] Pressure Ulcer CPG



How Frequently and How to Perform Pressure Releases

Especially during long matches, the athlete will need to make sure to perform pressure offloading, and skin checks should be performed routinely.

- The athlete should ideally perform pressure releases **every 15 minutes** to take the pressure off the tailbone and sit bones
- Push up out of the seat of the wheelchair and hold for **30-60 seconds**
- Lean side to side, staying in a side-leaning position for **30-60 seconds**
- Bend the chest forward onto the knees and **hold the position for 30-60 seconds**
- Tilt the wheelchair back and **hold for 1-2 minutes**

Time and Process for a Pressure Ulcer to Heal

Depending on the depth and size of the wound, it can take days to even several months for deeper wounds to heal.

First Stage of Healing: wound area becomes red and hard to the touch. The body sends red and white blood cells to help get rid of dead tissue and fight infection.

Second Stage of Healing: new blood vessels are created to help deliver oxygen and nutrition to the area. The tissue may appear bumpy and red. As new cells are formed at the bottom of the wound, the wound gets smaller and scar tissue starts to form.

Third Stage of Healing: scar tissue becomes stronger and begins to fade. Tissues may continue to remodel over the next year or two.

Wounds and Infection

Additionally, if tissue is moist or wet, it is at risk for developing an infection. It is important to make sure that athletes frequently change garments when they become sweaty to prevent creation of a wet environment that can increase the risk of infection.

Signs and Symptoms of Infection:

- Increasing redness around the wound
- Purulent (pus) drainage that is white or smelly
- Fevers
- Generally feeling poorly

Loss of Sensation: Caution When Using Cold or Heat as Treatment

In addition to injury from direct pressure, injury can also occur from other modalities commonly used to manage joint and muscle pain. Great care must be taken with extremes of heat and cold. Particularly when using heat packs for tight muscles, cold packs for soft tissue and joint swelling, or ice for cooling; it is important to monitor for burn injuries or frostbite. If using ice or chemical cold packs for swelling, wrap it in a towel. Do not ice for longer than 10 minutes at a time. Try to avoid using a heating pad or chemical hot packs on skin the athlete cannot feel.

Sun Protection

Just as with able-bodied athletes, it is important to prevent sunburns. Using sunscreen and wearing protective clothing can help prevent sunburns. Additionally, if a wheelchair is exposed to the sun for prolonged periods of time, it could become sun-heated. Make sure to check the temperature of the wheelchair before sitting in it to avoid burn injuries.

IMPAIRED TEMPERATURE CONTROL

Key Points

- **Definition:** difficulty controlling one's core temperature
- Some athletes may overheat at lower temperatures than typically cause heat related illness
- **Treatment:** if the athlete overheats, get them out of the heat and use ice or fans to cool them, monitoring for frostbite or cold injuries if altered sensation

After having some type of injury to the central nervous system, there may be loss of autonomic control, which can include bodily

functions, such as sweating. Since many athletes are unable to sweat efficiently, their body cooling systems become defective and they are particularly susceptible to heat-related problems. There is often no sweating below the level of the spinal cord injury, while the sweat rate above the level of the injury may increase up to six-fold. When sweating increases, the sweat just drips off, rather than evaporates from the skin, and thermoregulation becomes ineffective. Temperatures not considered “high risk” to cause heat related illnesses may pose a danger to athletes with impaired ability to control their core temperature. The heat index table demonstrates heat stress risk with exposures to different environmental temperatures and relative humidity. This table was designed with “healthy” individuals in mind. Those with impaired temperature control may be susceptible to heat illness at even lower temperatures and relative humidity.

HEAT INDEX

	ENVIRONMENTAL TEMPERATURE (F°)										
	70°	75°	80°	85°	90°	95°	100°	105°	110°	115°	120°
Relative Humidity	**Apparent Temperature***										
0%	64°	69°	73°	78°	83°	87°	91°	95°	99°	103°	107°
10%	65°	70°	75°	80°	85°	90°	95°	100°	105°	111°	116°
20%	66°	72°	77°	82°	87°	93°	99°	105°	112°	120°	130°
30%	67°	73°	78°	84°	90°	96°	104°	113°	123°	135°	148°
40%	68°	74°	79°	86°	93°	101°	110°	123°	137°	151°	
50%	69°	75°	81°	88°	96°	107°	120°	135°	150°		
60%	70°	76°	82°	90°	100°	114°	132°	149°			
70%	70°	77°	85°	93°	106°	124°	144°				
80%	71°	78°	86°	97°	113°	136°					
90%	71°	79°	88°	102°	122°						
100%	72°	80°	91°	108°							

*Combined index of heat and humidity...what it "feels like" to the body.

APPARENT TEMPERATURE	HEAT STRESS RISK WITH PHYSICAL ACTIVITY AND/OR PROLONGED EXPOSURE
90° - 105°	Heat cramps or heat exhaustion possible
105° - 130°	Heat cramps or heat exhaustion likely, Heatstroke possible
130° and up	Heatstroke highly likely

Source: National Oceanic and Atmospheric Administration.

(from USTA Emergency Care Guidelines)

Heat Related Illness

Heat related illness threatens the athlete and can lead to dangerous conditions such as hyperthermia, heat exhaustion, or heat stroke. All athletes are prone to these conditions, but an individual with impaired autonomic regulation is at a particular risk, as the ability to regulate core temperature may be compromised. For this reason, since the body's mechanisms to regulate temperature are impaired; one will need to utilize environmental cooling methods such as shade, fans, and ice. When using ice to cool one's core temperature, given that some individuals may have impaired sensation, it is important to monitor for cold-induced injuries.

Follow proper hydration and recovery guidelines to prevent heat related illness

Prevention Strategies

- Keep a spray bottle of water to mist oneself if hot weather
- Wear a broad brimmed hat
- Drink more liquids than usual to help accommodate loss of fluid from fever or heat

NEUROGENIC BLADDER

Key Points

- **Definition:** impaired ability to urinate or a change in bladder function
- Athletes tend to be at greater risk of developing urinary tract infections (UTI)
- Athletes may not have common symptoms of illness and just say they "feel off" if they develop a UTI
- Encourage drinking plenty of liquids and refer athlete to physician for further work-up if concerned about illness

Due to an underlying medical condition, the athlete may have impaired ability to volitionally urinate or sense when he or she needs to urinate. For this reason, bladder management often poses a challenge for the wheelchair athlete. Bladder management options can vary from athletes using an indwelling foley catheter to performing an intermittent self-catheterization program. These management options can be inconvenient to perform during training and matches. As a result, players can have a tendency to become dehydrated because they avoid drinking sufficient fluids so that they do not have to urinate frequently. Unfortunately, being dehydrated can make an athlete susceptible to developing urinary tract infections.

Causes of Urinary Tract Infections

Individuals with a neurogenic bladder are at risk for developing urinary tract infections for a variety of reasons including hygiene, bladder spasms, or altered anatomy. Adequate hydration, good

hygiene, and proper emptying of the bladder can help prevent urinary tract infections. Individuals with chronic conditions may have altered bladder anatomies, such that their storage capacity is decreased, and they may require more frequent restroom visits. Urinary tract infections can present in atypical ways.

Common Signs and Symptoms of a Urinary Tract Infection

- Reports of malaise or feeling off
- Increased spasticity
- Bladder or abdominal spasms
- Fever
- Foul-smelling urine
- Burning on urination
- Autonomic dysreflexia
- Nausea

If suspicious of a urinary tract infection, one should notify the individual's primary provider, who may pursue further evaluation with urinalysis and urine culture and appropriate treatment.

Preventing Urinary Tract Infections

It is important to promote adequate hydration to help prevent a urinary tract infection in the first place. Coaches should encourage the athletes to take the time to empty their bladders with appropriate frequency and to practice good hygiene habits. If the bladder is not emptied frequently enough, the athlete can be susceptible to incontinence, causing clothing to get moist. Moist clothing around the groin can promote an environment for infections to develop. When going to a new tennis facility, it is important to be aware of the location and accessibility of restroom facilities.

IMPAIRED PULMONARY FUNCTION AND BREATHING

Key Points

- **Definition:** breathing and coughing may be impaired by muscle weakness

- Athletes may be at increased risk of developing lung infections

The athlete's muscles of breathing may be impacted, depending on the type or level of injury. Table 1.c.A gives a summary of key muscles involved in breathing and coughing, and how they may be impacted if one has muscle weakness. One may not be able to produce an effective cough to clear secretions. Some athletes may even need to perform a cough with physical assistance or the assistance of a cough assist device. Athletes with respiratory muscle weakness can be at increased risk of developing an upper respiratory tract infection or pneumonia.

[Table 1.c.A] Some of the Muscles Used in Breathing and Coughing

RESPIRATORY MUSCLES	FUNCTION	SPINAL CORD INJURY LEVEL AND ITS EFFECT ON BREATHING
Diaphragm	The main muscle of breathing. It is found just underneath your lungs.	An injury above C5 may require the use of a ventilator [breathing machine] for a while or permanently, because the diaphragm and most other muscles may not work.
Intercostals	These muscles run in between your ribs. They are used in coughing and deep breathing.	An injury above T8 will reduce the strength of these muscles, but diaphragm and neck muscles can help you breathe.
Abdominals	These muscles help you cough. They run between your ribs and hips.	An injury above T12 will reduce the strength of these muscles, but intercostal, diaphragm, and neck muscles can help.

ALTERED HEART RATE AND IMPAIRED CIRCULATORY SYSTEM

Key Points

- **Definition:** the athlete may have slowed heart rate and circulation may be impaired
- The athlete may be at risk for leg swelling or developing a clot in the legs
- Adjust heart rate based training zones depending on athlete's cardiac function
- Improve edema by elevating legs or wearing compression stockings
- Deep venous thrombosis can present with pain, leg swelling, or redness

Cardiac Function

Cardiac function when exercising will be affected since the maximum heart rate generally tends to be lower in athletes with a spinal cord injury. This heart rate difference is particularly apparent in quadriplegic players, whose maximum heart rate may be as low as 110-130 beats per minute – and this will be a maximum that will not alter with improved fitness levels. It is therefore vital that great care and awareness is taken when setting training zones for fitness work. If the athlete cannot raise the heart rate when exercising, it could cause him or her to feel lightheaded or dizzy.

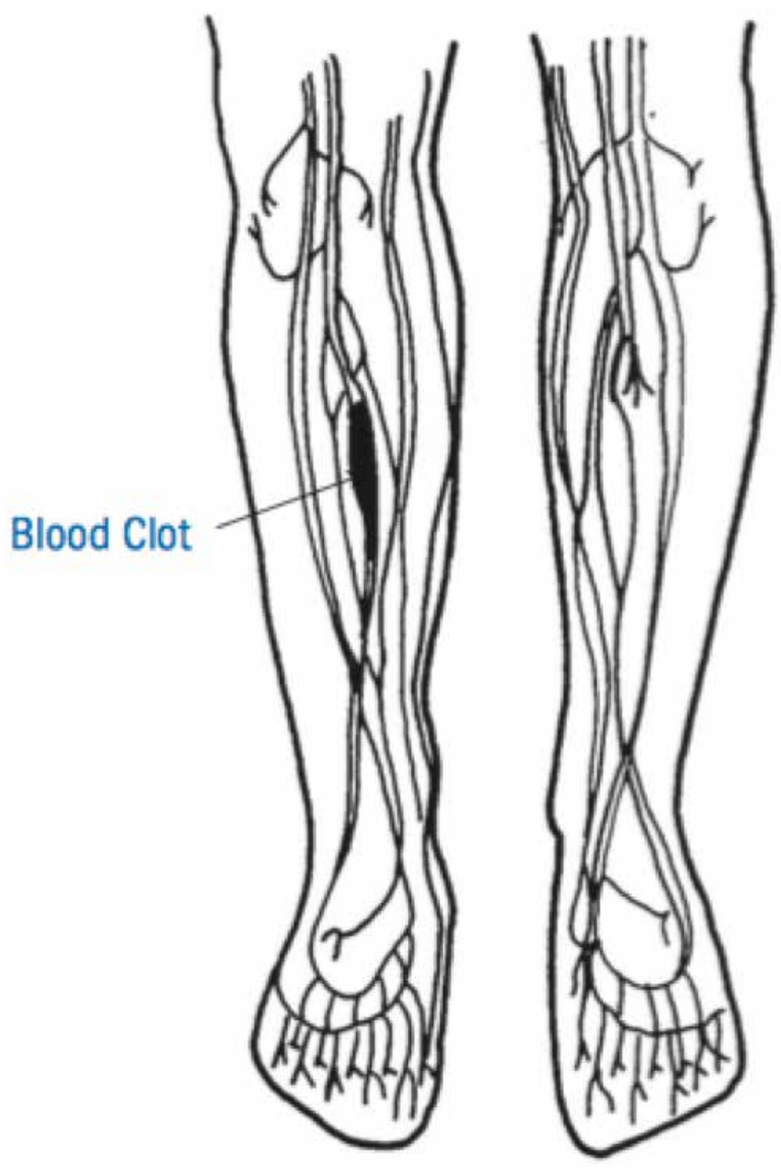
Edema

Sitting in a wheelchair for long periods can result in swollen ankles and feet that can then make the player more susceptible to lower-limb skin problems. When not competing, it can be helpful to have the athlete elevate the legs to help manage the swelling. Compression garments can also help manage edema.

Blood Clots

Many people are aware of the danger of a deep venous thrombosis (DVT) when sitting for prolonged periods on long-haul flights. Most wheelchair tennis players are also sitting for prolonged periods in their wheelchairs, making them particularly vulnerable to developing a DVT. Signs of a DVT may include leg swelling or bruising. Athletes with intact sensation may report pain in an extremity. If there is concern of a deep venous thrombosis, do not increase activity level, do not perform range-of-motion exercises, and do not move the leg. Increasing activity level could cause the clot to break loose. These blood clots can break loose and potentially travel to other parts of the body. When they travel to the lungs, it is called

[Figure 1.h.3] Blood Clot [thrombus] in Leg



a pulmonary embolism. Figure 1.3.h demonstrates a blood clot (thrombus) in the leg.

Pulmonary Embolism

A pulmonary embolism can be life threatening and common signs and symptoms may include:

- Sudden shortness of breath
- Tightness in chest
- Pain in side, chest, or back
- Worse pain with deep inspiration
- Cough with sputum or phlegm that is slightly pink or red

AUTONOMIC DYSREFLEXIA

Key Points

- **Definition:** body's increased autonomic response to painful stimulus; only in athletes with a spinal cord injury at 6th thoracic vertebrae or higher
- Can cause dangerous elevation in blood pressure; and also sweating, flushing, and pupillary constriction
- Ask athlete what blood pressure usually is, because even 20-30 mmHg greater than resting could indicate an episode of autonomic dysreflexia
- **Treatment:** sit athlete upright, loosen tight clothing, and may need to seek further medical care to address hypertension

Autonomic dysreflexia (AD) is a condition that can result in dangerous elevations of blood pressure. This condition is unique to individuals who have a spinal cord injury. Specifically, those athletes with an injury level at T6 or above are susceptible. It is caused by the loss of descending central sympathetic control and hypersensitivity of receptors below the level of the lesion. An episode of AD may be caused by a painful stimulus below the level of the lesion that causes the body to react in an uncontrolled manner. Figure 1.i.1 describes how autonomic dysreflexia happens.

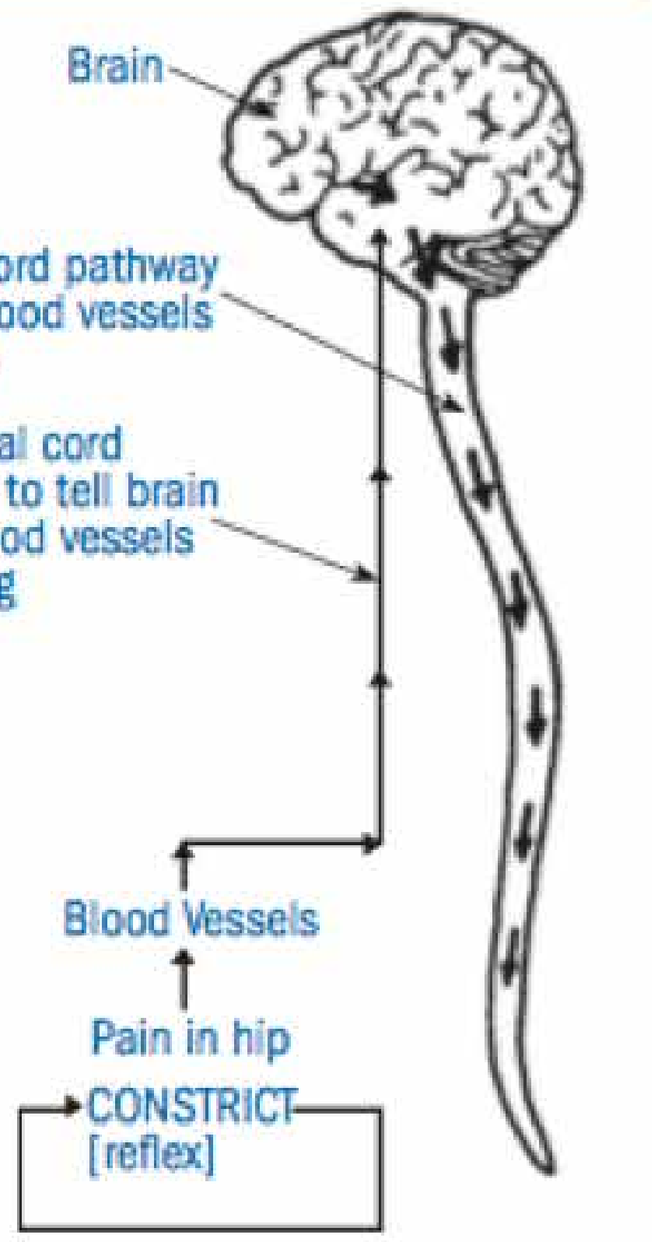
Of note, an individual with a spinal cord injury may have a baseline resting blood pressure in the 90-100 mmHg systolic range. For this reason, elevations of blood pressure 20-40 mm Hg above baseline are characteristic of an episode of AD.

[Figure 1.1.1] How Autonomic Dysreflexia Happens

THE BODY'S RESPONSE TO PAIN

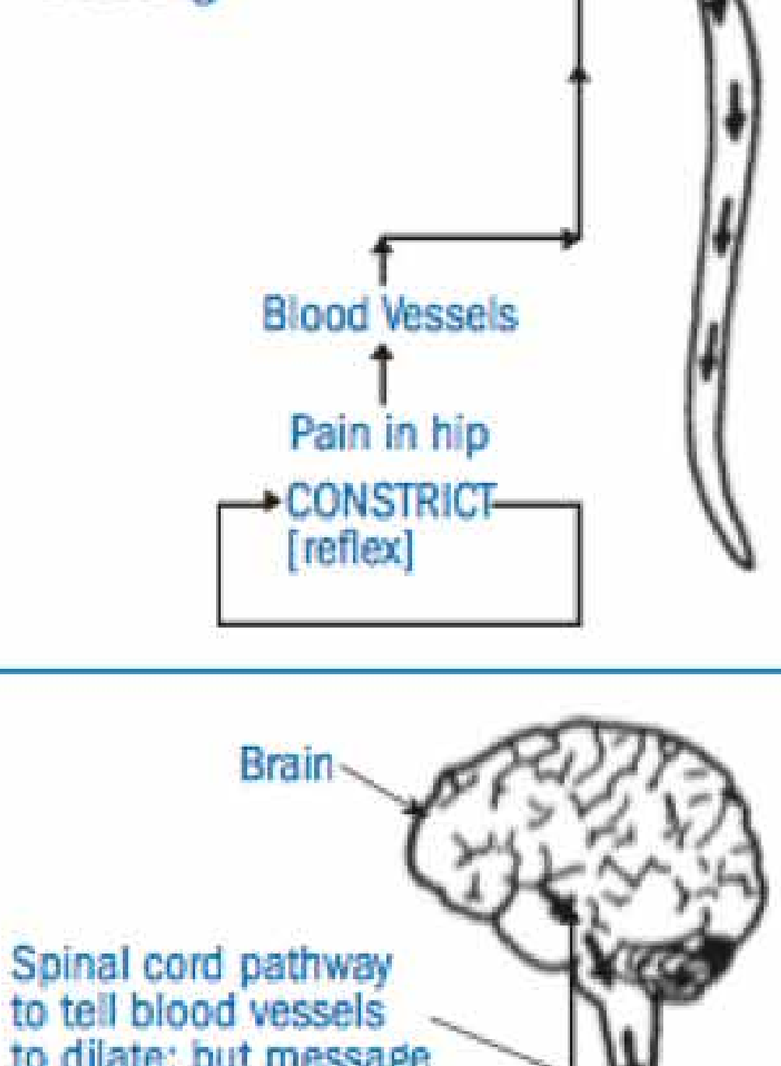
BEFORE SCI

1. Blood vessels constrict by reflex action in response to pain and raise your blood pressure.
2. Nerves send messages up to your brain through your spinal cord, and you feel the pain.
3. Your brain senses that the blood vessels are constricting and your blood pressure is too high.
4. Your brain sends a message down through the spinal cord to dilate [open up] your blood vessels, which lowers your blood pressure.



AFTER SCI

1. Blood vessels constrict by reflex action in response to pain and raise your blood pressure [same as before SCI].
2. You will most likely not feel the pain because the messages can't pass through the injured spinal cord and up to your brain.
3. Your brain senses that the blood vessels are constricting and blood pressure is too high [same as before SCI].
4. The area from T7 to T10 of the spinal cord sends messages to many of the blood vessels in your body. If your injury is at or above T6 level, your brain can't get the dilation message back down to the blood vessels below your injury. Your blood pressure stays high because the shut-off valve to lower it doesn't get the signal.



Possible Causes of an Episode of Autonomic Dysreflexia

Typically, some type of noxious or painful stimulus triggers an episode of autonomic dysreflexia. Possible causes include the following:

- Urinary tract infection
- New skin lesion/injury
- Severe constipation
- Injury
- Overfull bladder (often caused by clogged or twisted catheter)
- Ingrown toenails
- Hot or cold temperatures
- Blisters of sunburn
- Tight clothes
- Pressure on testicles or penis
- Severe menstrual cramps

Signs and Symptoms of Autonomic Dysreflexia

Common signs and symptoms of autonomic dysreflexia include

- High blood pressure (20-40 mmHg above baseline)
- Headache
- Sweating
- Flushing
- Hypertension
- Bradycardia or tachycardia
- Piloerection (goosebumps)
- Pupillary constriction

Treatment of Autonomic Dysreflexia

The initial management involves sitting the patient upright and loosening tight clothing, identifying and removing the noxious stimulus, and monitoring and controlling blood pressure. Particularly, bladder issues can often trigger an episode of AD, so it is important to check for a kinked foley catheter.

Of note, an individual with a spinal cord injury may have a baseline resting blood pressure in the 90-100 mmHg systolic range. For this reason, elevations of blood pressure 20-40 mm Hg above baseline are characteristic of an episode of AD. Medication management is typically initiated for a blood pressure of >150 mmHg systolic. Players who know they are susceptible to autonomic dysreflexia will sometimes carry the drug NIFEDIPINE with them for this emergency. One could also apply topical NITRO PASTE above the level of injury. If these symptoms do not go away or the blood pressure cannot be brought down, it is important to seek further medical evaluation and treatment. Figure 1.i.2 further describes treatment options. These cards can be copied to give to athletes or medical personnel treating the athlete.

[Figure 1.i.2] Wallet Size Card for Autonomic Dysreflexia

CUT ON SOLID LINES FOLD ON DOTTED LINES

Fold

Medical Alert Card for Autonomic Dysreflexia

The bearer of this card,

_____,

is at risk for autonomic dysreflexia, a life-threatening complication of spinal cord injuries above the T7 level. It is caused by an exaggerated sympathetic nervous system response to a noxious stimulus below the level of injury. The usual etiologies of AD are inadequate emptying of the bladder, a full bowel, tight clothing, ingrown toenail, etc.

The symptoms can include elevated blood pressure, headache, nasal congestion, bradycardia, and flushing [above the level of injury]. Please note the normal blood pressure for an SCI patient is 90/60. If the AD is unresolved, it may result in myocardial infarction, stroke, retinal hemorrhage, or death. It is essential that the source be identified and the elevated BP be resolved immediately. Please see reverse of card for details of treatment.

Autonomic Dysreflexia Treatment

1. Raise the head of the bed up to 90 degrees or sit the person upright.
2. Check for the source of the AD: full bladder or bowel, tight clothing, ingrown toenail, pressure ulcer, or any other noxious stimulus. Removing the cause will usually eliminate or decrease the symptoms.
3. Monitor the blood pressure and pulse every 5 minutes.
4. Drain or irrigate the bladder, using a topical anesthetic jelly for catheterization.
5. Check the rectum for stool, after first applying an anesthetic ointment to the rectal wall. If stool is present, begin digital stimulation to promote reflex defection.
6. If systolic blood pressure (SBP) is above 160, apply one inch of nitro paste to hairless skin, and cover with clear occlusive wrap.
7. If elevated SBP continues, apply one additional inch of nitro paste to equal two inches.
8. Wipe off nitro paste when SBP decreases to 130.
9. If SBP remains elevated despite two inches of nitro paste, give 10 mg of hydralazine. If SBP remains elevated after 10 minutes, give an additional 10 mg of hydralazine.
10. If SBP remains refractory to the above treatments, give 10 mg of bite-and-swallow nifedipine. If nifedipine is given, the patient is at risk for hypotension once the AD is controlled and must be monitored closely for several hours after administration of nifedipine.

Fold

Fold

Fold

UPPER EXTREMITY INJURIES

Key Points

- These injuries could impact independence for daily activities such as transfers and self care
- Common injuries include shoulder impingement, rotator cuff injuries, carpal tunnel syndrome, and blisters
- May need further evaluation and possibly withdrawal from play to help athlete stay independent with self-care

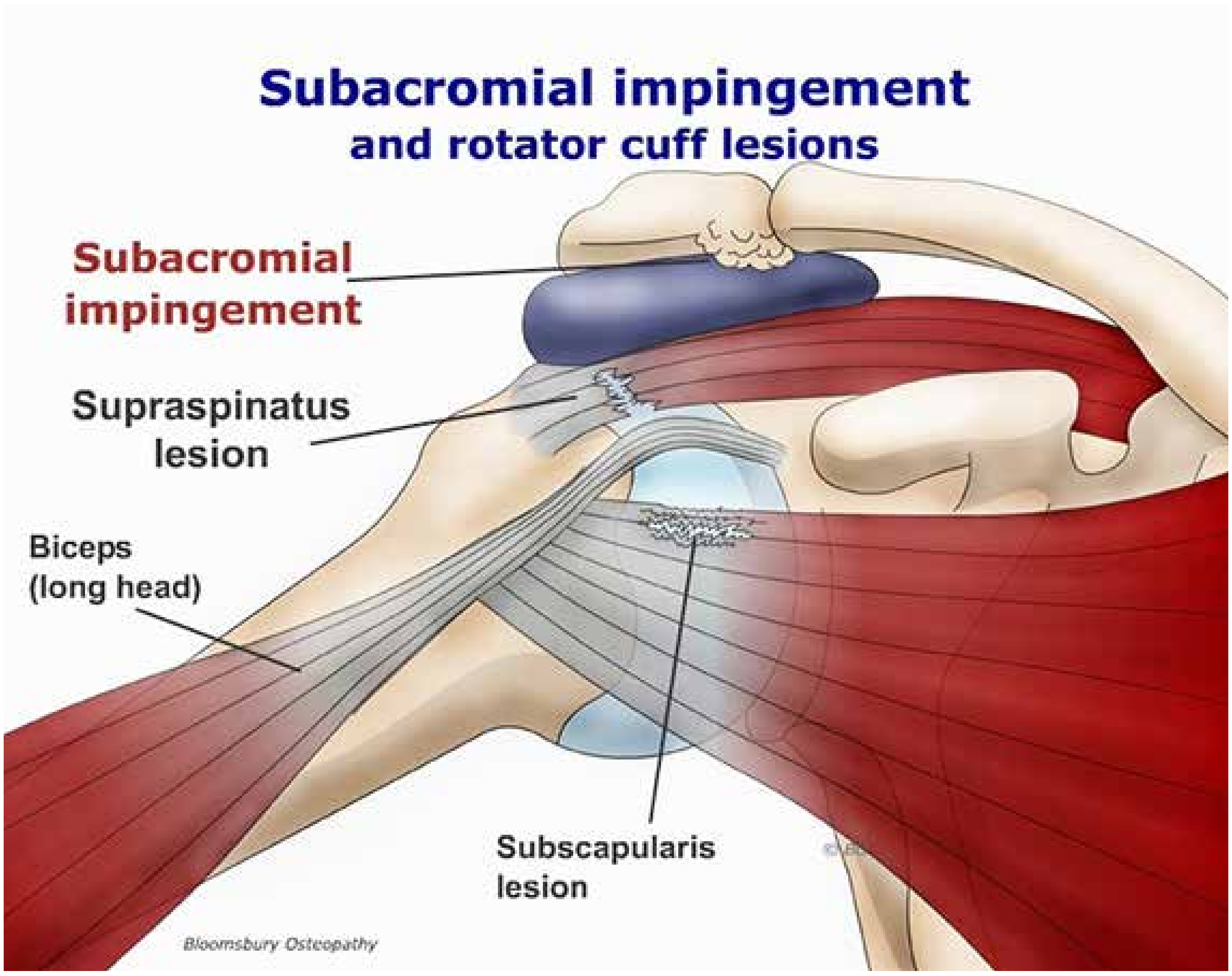
The wheelchair athlete often requires the use of the upper extremities to not only play tennis, but for mobility and other aspects of functional independence. For this reason, it is crucial to immediately evaluate and manage upper extremity pain and injuries. The wheelchair tennis athlete is prone to similar pathologies as the overhead or throwing athlete, most commonly including rotator cuff impingement and bicipital tendinitis.

Causes of Rotator Cuff Impingement Syndrome

Impingement syndrome occurs when tendons around the shoulder become compromised and are "pinched" between the ball and socket joint and the top of the shoulder. This area is called the "subacromial area" and anatomically does not have much space. Manual wheelchair users may also be at higher risk for these injuries due to the increased demand on the shoulders for mobility purposes, posture deficits associated with using a wheelchair, as well as muscle imbalances.

Treatment of Rotator Cuff Impingement Syndrome

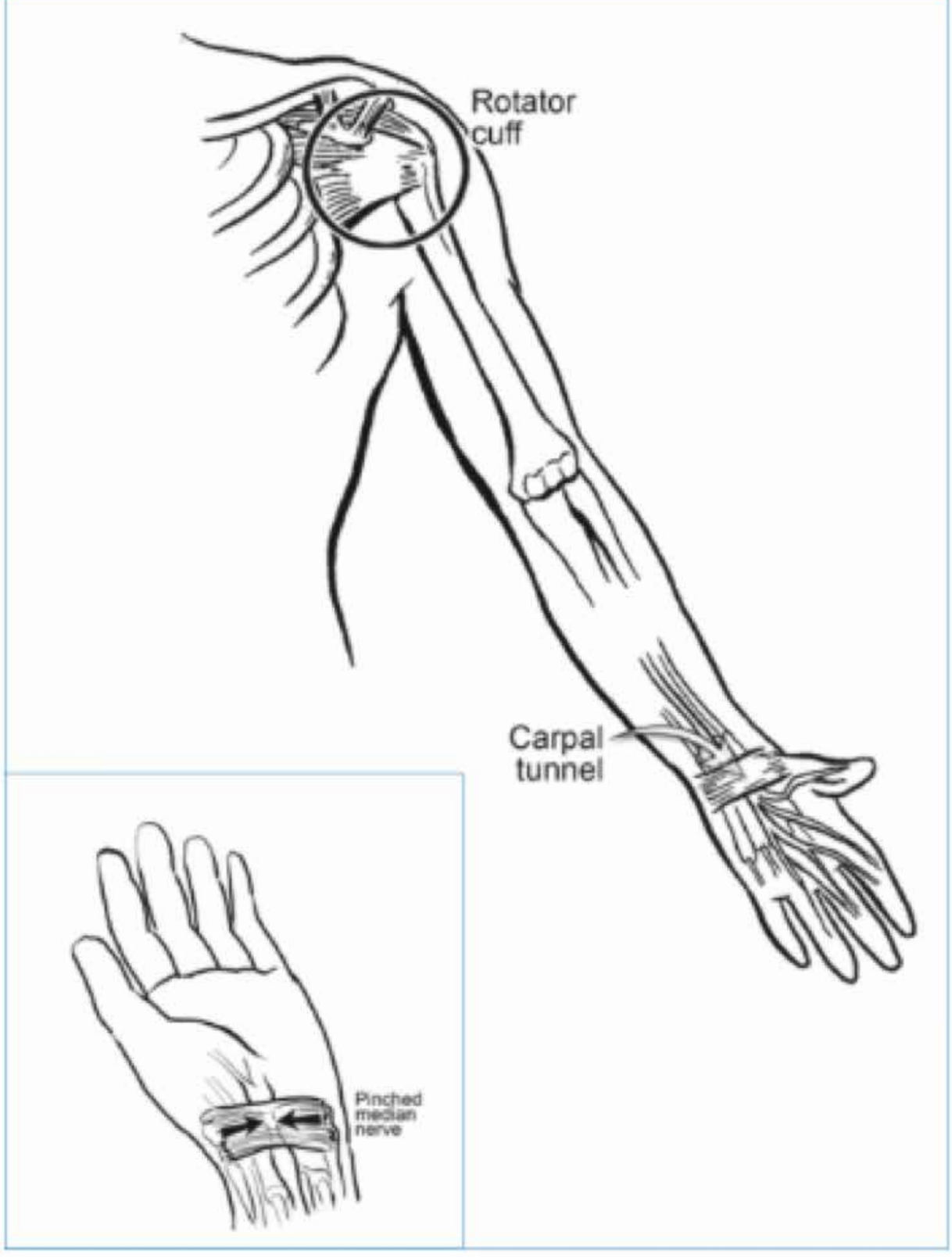
With rotator cuff pathology, there is often found to be weakness in the rotator cuff and muscles that surround the shoulder blade. If these muscles are not performing at their best, these muscle imbalances can lead to increased pain and dysfunction. A shoulder protection program should include stretching the front/anterior shoulder muscles, strengthening the back/posterior shoulder muscles and rotator cuff muscles, and avoiding motions that squeeze or put pressure on tendons or nerve.



Other Common Upper Extremity Injuries

The athlete may also be prone to other injuries such as median or ulnar neuropathies, lateral epicondylitis, or arthritis. Figure 2.c.1 demonstrates the rotator cuff muscles location as well as a common area of median nerve injury at the carpal tunnel. The key concept to keep in mind is that a wheelchair athlete may rely on his or her upper extremities to maintain his or her independence. New upper extremity pain or weakness may impact the ability to perform transfers, to mobilize, and to perform other aspects of self-care. For this reason, one should encourage prompt management of new pain.

[Figure 2.c.1] Carpal Tunnel



BONE HEALTH AND OSTEOPOROSIS

Key Points:

- **Definition:** bones become weaker and have greater risk of breaking
- Sitting causes bone loss and the athlete may have higher fracture risk
- Evaluate even small falls and look for bruising or swelling; which could be concerning for fracture

Sitting without bearing weight through the limbs can lead to early bone loss. The area of bone loss, if from a spinal cord injury, preferentially affects the area below the level of injury. This bone loss is defined by severity, with osteoporosis being more severe than osteopenia. Osteoporosis is the loss of bone mineral density, defined as a DEXA T score <-2.5 and osteopenia is a DEXA T score <-1.0 to 2.5.

The legs are commonly affected because they may not be bearing weight to keep them strong. Even minor trauma can cause fractures to the weak bones, so it is important to take every fall or injury seriously. People with a spinal cord injury have double the rate of broken leg bones as the general population. Most of the leg fractures are caused by low-speed, low-impact activities such as the following:

- Twisting a leg during a transfer
- Hitting a leg on something while driving a power wheelchair
- A seemingly small fall from the wheelchair

Medical personnel need to evaluate even small falls. When evaluating the athlete, ask if they have a prior history of fracture. Especially if there is significant bruising or swelling, the athlete may require further workup to rule out fracture.

SPASTICITY

Key Points:

- **Definition:** velocity dependent increase in muscle resistance across a joint
- Uncontrolled limb movement could cause player to fall out of chair
- May need medication, such as BACLOFEN, or leg straps to help control these movements

Spasticity is a term to describe increased muscle reflexes or muscles moving on their own involuntarily. Muscles can become overactive after some type of central nervous system impairment. Some athletes may experience straightening of arms or legs. Others may have bending of joints. During spasms, people may have the appearance of their foot repeatedly tapping, which is called “clonus”, and the leg may shake.

Common Triggers of Muscle Spasticity

- Touching skin
- Changing body position

- Stretching muscles
- Overstretched bladder
- Infection, such as a wound or urinary tract infection
- Cold weather can make spasticity worse

Advantages of Spasticity

Spasticity can be helpful to maintain muscle and bone strength and help improve circulation. Spasticity may increase in response to some type of noxious stimulus, and increases in spasticity may be an early indicator of illness or infection.

Problems Caused by Spasticity

Spasms can lead to skin trauma. For example, a spasm can result in an ankle hitting a calf rest pad and cause injury. Spasticity or other lack of muscle control may necessitate the use of straps to secure one's legs to make sure they stay on the footplate so that the leg does not catch on the ground and cause the athlete to fall out of the wheelchair. If spasticity gets in the way of day-to-day activities, stretching, bracing/straps, and medications can help manage spasticity.

MOBILITY NEEDS AND SAFETY

Key Points

- Athletes use a manual or power wheelchair for mobility
- Anti-tippers help prevent the chair from tipping backward, but not all athletes use them
- Players should bring their own tools to adjust or fix their wheelchairs
- Make sure to evaluate the individual needs of an athlete and skill level to make sure the wheelchair has appropriate modifications to keep the athlete safe.

A variety of neuromuscular conditions may impact the functional mobility of an athlete. The use of a wheelchair can help improve the mobility of an athlete. Depending on the type of injury, a manual wheelchair or power wheelchair may be more appropriate for

the athlete. For example, if an athlete could not propel a manual wheelchair in a functionally significant way, he or she could utilize a power wheelchair. Additionally, not all wheelchair athletes use a manual wheelchair for all of their mobility. Some individuals may have sufficient strength or balance to ambulate household or short community distances using a walker or other assistive device. In order to mobilize distances more quickly and safely, they may be more stable using a manual wheelchair to play tennis. Of course, a few key safety factors should be considered when using manual wheelchairs, such as using anti-tippers or suspension systems.

Anti-tippers and Other Safety Equipment

Tennis, with the overhead reaching and leaning, can pose a risk to one tipping backward. Anti-tippers can be added to a wheelchair to help prevent the athlete from tipping over backward. Those athletes who do not use a manual wheelchair for their daily activities or are new to wheelchair tennis should strongly consider using anti-tippers, see Figures 1 and 2. For those athletes with poor trunk control or balance, waist restraints can help secure the athlete to the chair. Spasticity or other lack of muscle control may also necessitate the use of straps to secure one's legs to make sure they stay on the footplate.

CONCLUSION

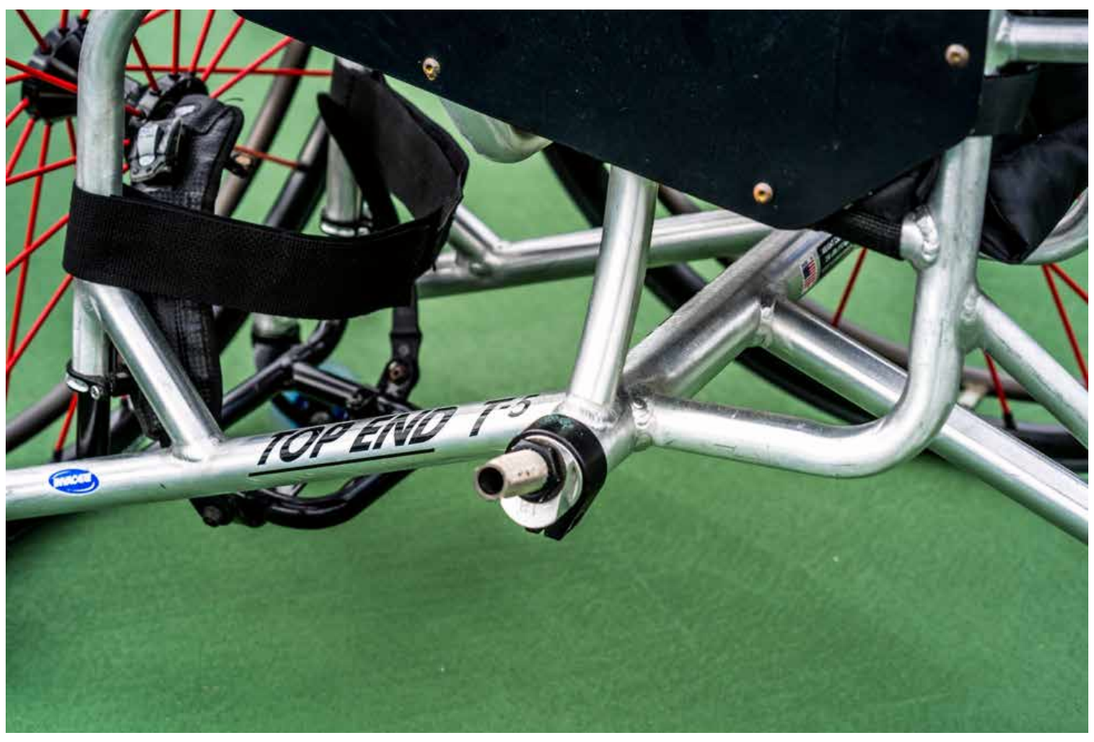
One should be aware of specific medical considerations unique to the wheelchair athlete. As long as coaches and athletes can acknowledge and understand these conditions, the athlete can be kept safe. Being more knowledgeable about the medical needs of the athletes can help ensure long-term success and safety.

THE CHAIR

THE CHAIR

The modern tennis wheelchair is built for stability and speed. It is vastly different from the everyday chairs you are used to seeing. Everyday chairs are made to fit through doorways and tight spaces that are a part of everyday life. The wheels are generally perpendicular to the ground, reducing the stability when turning or moving quickly.

The tennis chair is built to maintain speed and balance when executing the skills necessary to play tennis. The **wheels** are generally 24 – 27 inches in height. The higher the wheel, the more difficult the first push will be. The wheels have **spokes** that are either metal or carbon fiber with push rims. The wheels also contain some degree of **camber.** Camber is the angle of the two larger wheels for increased speed and stability. Camber generally ranges from 16 - 20 degrees. The fifth wheel of a tennis wheelchair rests on a tube extending from the rear of the chair. This is known as the **anti-tip** wheel. This is used for the balance while shifting weight within the wheelchair. This is also a safety measure, keeping the athlete from rolling backwards while the weight is transferred to the rear. The small front wheels are known as **casters.** They are generally rollerblade wheels.


TOP END T5

Top End Pro

TOP END T5

QUICKIE

Top End Pro
TOP END T5

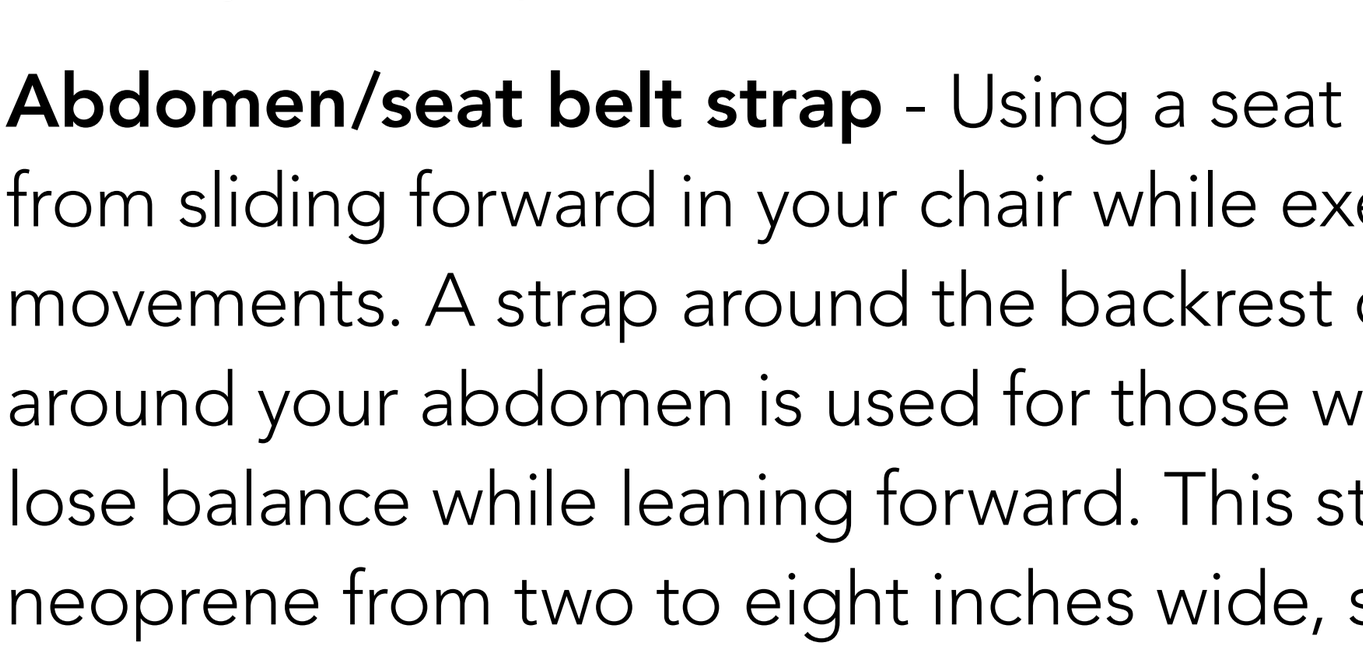
HOME

STRAPPING

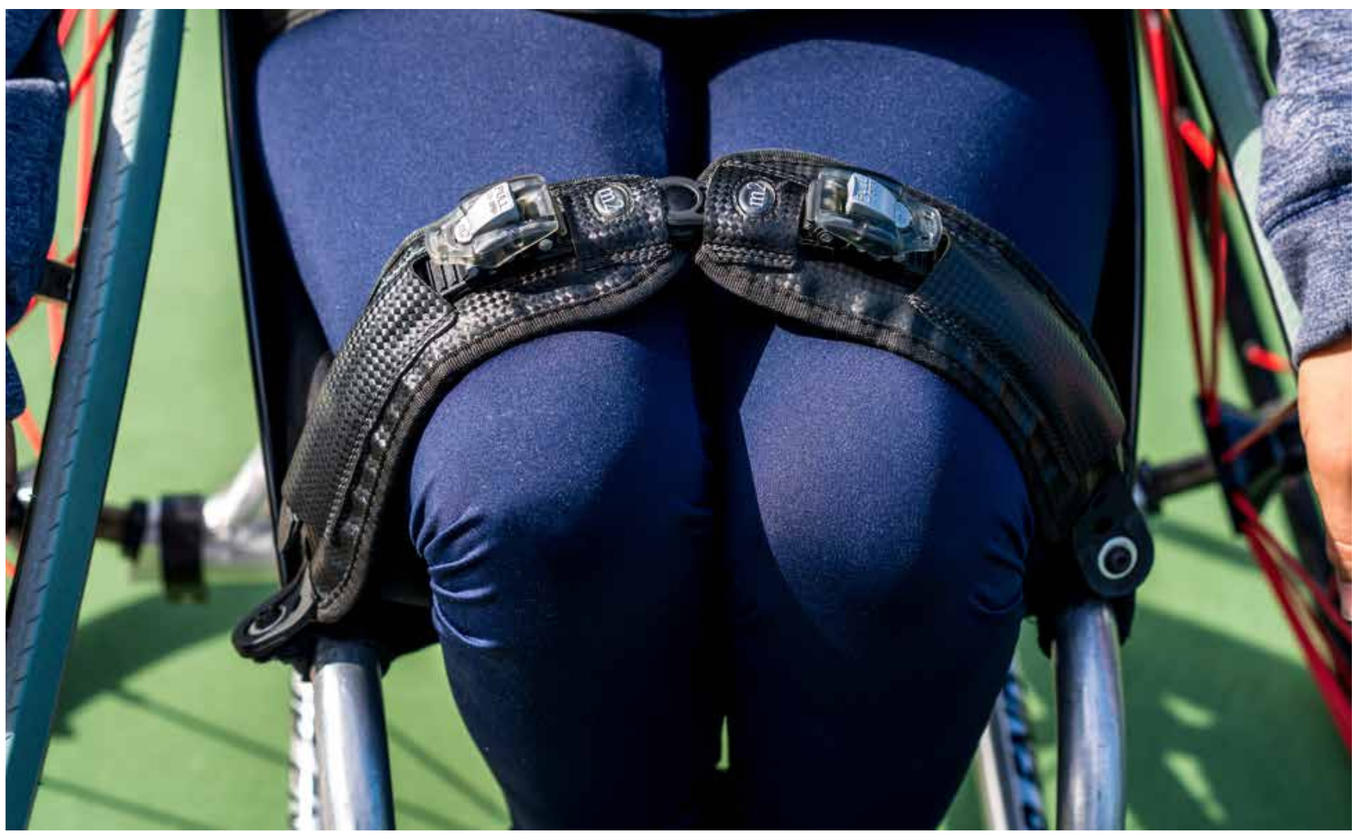
STRAPPING

Making the tennis chair as much a part of your body as possible will greatly enhance balance and speed while playing wheelchair tennis. Due to specific injuries, strapping the paralyzed extremities will reduce extra motion and increase speed and agility. There are three basic ways to strap into a tennis wheelchair:

a. **Abdomen/seat belt strap** - Using a seat belt will stop you from sliding forward in your chair while executing abrupt movements. A strap around the backrest of your chair and around your abdomen is used for those without “abs” who lose balance while leaning forward. This strap is primarily neoprene from two to eight inches wide, secured with snaps or Velcro.



b. **Leg straps** - Leg straps are secured around the thighs just above the knees. These straps are used to keep the legs from spreading apart when making an aggressive movement. This will increase confidence while executing turns and stroke production.



c. **Foot straps** - Foot straps are used to keep the feet from falling off of the foot rest. For people who have uncontrollable spasms or the inability to press down on the footplate, this is excellent for balance and imperative for safety.

If there is any doubt as to whether a wheelchair tennis player needs a strap, it is best to experiment with strapping to see what works best. Initially, the use of the straps can seem uncomfortable or cumbersome, so allow enough time to see if the experimentation was a success.

MOBILITY

Grips— Uses, advantages and disadvantages 64

Pushing the Tennis Chair 66

Role of the Hands 67

Turns 68

MOBILITY

Mobility is an all-encompassing skill that crosses many different elements in wheelchair tennis. These include grips, different kinds of pushes, role of the hands, turns and the HUB mobility pattern. Putting all of these elements together in one process defines the skill of wheelchair tennis mobility.

Mobility must be learned and practiced. Strong mobility skills greatly enhance your ability to cover the court and strike the ball using proper stroke production. This is not an easy skill to learn for a wheelchair player. It takes time to become comfortable pushing the chair with a racquet in the hand and to master the necessary mobility patterns to get to every ball. Understanding the basic skills and patterns will make this process much easier to master.

A major part of pushing the wheelchair comes from understanding the grips used to hold the racquet while striking the ball in tennis. This will determine what grip should be used to push the chair. The grips used in wheelchair tennis are identical to those used in able-bodied tennis.

GRIPS— USES, ADVANTAGES AND DISADVANTAGES

1. **Semi-Western Forehand**

   i. *Advantages*: best combination of spin, power, leverage, very good "pushing" grip, good on handling a higher hit ball, can leave grip for inverted topspin backhand

   ii. *Disadvantages*: none?

2. **Eastern Forehand**

   i. *Advantages*: good for hitting a flatter ball, good for "pushing", strong leverage with playing hand behind the racquet

ii. *Disadvantages*: not strongest "pushing grip", lack of spin development, difficult to handle higher hit balls, grip change needed for inverted topspin backhand

3. **Full-Western Forehand**

i. *Advantages*: very good spin production, strong against higher hit balls, no grip change to hit an Eastern backhand

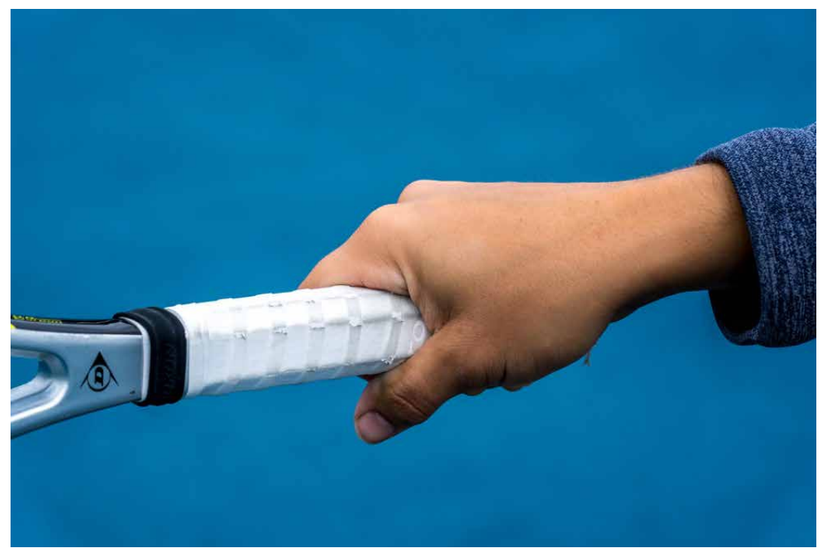
ii. *Disadvantages*: handling of lower hit balls, difficult "pushing" grip, difficult to "drive" the ball

4. **Continental**

i. *Advantages*: multiple uses (serve, slice and volley), handling of lower hit balls

ii. *Disadvantages*: difficult "pushing" grip, no topspin, lack of strength on high forehand volley

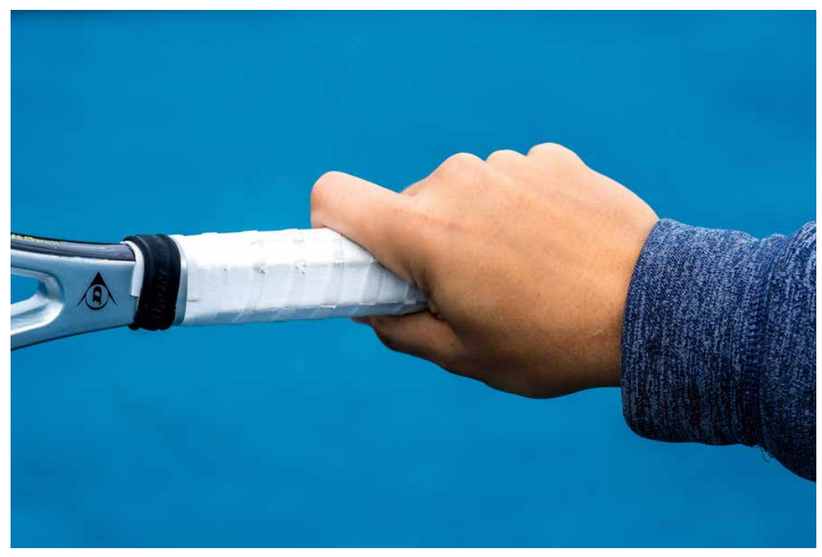
5. **Eastern Backhand**



i. *Advantages*: traditional learning line, good for driving the ball with leverage behind the racquet,

ii. *Disadvantages*: poor "pushing" grip, weak handling of high balls to the backhand side

6. **Inverted Backhand** (semi-western forehand)



i. *Advantages*: creation of strong spin (similar to a forehand), ability to remain offensive off of a high ball to backhand side, do not have to change one's grip once ball is hit in order to push, can have an effective slice backhand without change of grip, helps create balance drive and spin

ii. *Disadvantages*: more difficult to handle low ball, highest of hit balls will be a challenge and drive the player to possibly slice

PUSHING THE TENNIS CHAIR

The first step in pushing the tennis wheelchair is to identify the contact points of the racquet and the racquet hand on the push rims (or push rim/wheel combo) of the chair. This can be done by using several different techniques. What first must be determined, is which grip the player will use to push. Typically, most players will use either the Semi-Western forehand grip, Eastern forehand grip or a combination of the two. These grips, from a leverage point and the fact that the player will already be in a strong forehand grip position to strike immediately, will provide the best contact on either the push rim or a combination of the push rim and wheel itself. This is done by holding the racquet in said grip, leaving the thumb free, while the other four fingers hold the handle. One technique is to place the thumb and heel of the hand on top of the push rim in order to push. Another would be to place the top of the racquet handle, above the fingers, against the push rim and/or wheel, to get enough "grab" to push the chair. The player's hand size will also help determine which technique will work best. Most players will use a smaller sized grip handle in order to get the cleanest contact points to achieve maximum strength in their push.

A new player should be allowed to push the chair once these contact points have been learned without worrying about the other skills of tennis. Each individual has a dominant side that is decidedly stronger than the non-dominant side. The dominant side is normally the side that has the racquet in hand, thus making it markedly weaker while pushing. Due to this weakness the chair will normally veer to the dominant side with more force coming from the non-dominant side. This is known as an **unbalanced push.** Players will naturally balance their momentum with time spent pushing with a racquet in hand.

There are **three basic pushes** in wheelchair tennis:

1. **First push** - The first push occurs when the wheelchair is in a stopped position. This is by far the most difficult push requiring the most strength and exertion. The hands are placed in a "12 o'clock" position, if the wheels were the face of a clock. The arms are snapped forward with a push originating from the shoulders and the hands release off of the wheel at "2 o'clock". A player will utilize this push two to three consecutive times to gain speed quickly from a stopped position.

2. **Speed Pushes** - Speed pushes occur after momentum has been gained by the first push. These pushes start at "11 o'clock" and end at "2 o'clock". While first pushes occur in rapid succession to gain momentum, speed pushes are fewer in frequency. Each time a player touches the wheels to push, due to the friction, the chair is initially slowed due to the contact. Thus, the speed pushes are longer and fewer in order to maintain or increase speed.

3. **Maintenance Pushes** - Maintenance pushes are used simply to maintain speed. They are slightly longer than speed pushes and even less frequent, produced in a circular motion around the wheel. These pushes normally occur when a player is traveling a long distance (i.e. when a player is pushing from the net to the baseline) with ample time. The frequency and strength of these pushes can also adjust the speed of the chair, depending upon where the ball and opponent are on the court.

Watch Video of All Pushes

ROLE OF THE HANDS

Each of the hands has a specific set of duties while playing wheelchair tennis. The dominant hand must multitask at all times. It not only has to hold the racquet, push, and turn but also strike the ball. Since the dominant hand spends so much time off of the wheel, it is essential that the non-dominant hand is on the chair almost 100% of the time. The non-dominant hand does a high percentage of the turning, last second adjustments for optimal ball striking position and strength for balance when reaching.

TURNS

Turning the wheelchair is done by either by putting pressure on or grabbing the push rim on the side in which the turn is desired. From a stopped position, grabbing the push rim and pulling back will be necessary to execute a turn. When momentum exists, a choice must be made between the two. Grabbing the push rim when momentum exists will create a tighter, faster turn but will reduce speed; whereas putting pressure on the push rim will create a longer turn, but momentum will be maintained. This decision should be based on one's court position and time available during the point.

There are **five basic turns** in wheelchair tennis:

1. **Inside turn ("turning in")** - An Inside turn occurs when the initial movement brings the chair forward into the court. For example, on the right side (deuce side) of the court, a left turn would be an inside turn or "turning in" to the court. The inside turn is most commonly used during forehand stroke production and is offensive in nature.

Watch Video of Inside turn

2. **Outside turn ("turning out")** - An Outside turn occurs when the initial movement brings the chair toward the back fence behind a player. For example, on the right side of the court (deuce side), a right turn would be the outside turn or "turning out". This turn forces a player to turn his or her back on the court. While in able-bodied tennis turning your back on the court is never desired, in Wheelchair tennis it is often the correct movement to execute. The Outside turn is most commonly used during backhand stroke production.

Watch Video of Outside turn

3. **Reverse turn (reverse mobility)** - A reverse turn or reverse mobility occurs while a player is recovering toward the back of the court after executing a shot and the ball is hit behind him or her. Because the chair is pointed towards the back fence, the shortest turn is done by turning the back to the court and the

ball. While this maintains speed, it is difficult to find the ball and opponent again, so it should only be a quarter turn (45 degree angle), with the chair still advancing back into the court.

[Watch Video of Reverse Turn]

4. **Cross-handed turn** - A cross-handed turn occurs when the non-dominant hand is brought across the body to the dominant wheel and to grab in order to execute a turn. This is advanced mobility and requires a great deal of strength and speed to execute. The most common place for it to be used is on a defensive forehand or an offensive backhand moving forward into the court.

5. **Over Turn (emergency recovery)** - An over turn occurs when a player is well inside the court and must get back behind the baseline as quickly as possible. It is an inside turn that is held longer so the player almost completely reverses his or her field.

THE HUB

Hub Mobility Pattern 71

THE HUB

This particular mobility pattern is equally as important as the mechanics of mobility in wheelchair tennis. The foundation of this pattern is called the HUB. **The Hub** is a location, three to eight feet behind the baseline, that a wheelchair player will recover to after a shot hit. There are essential components to this pattern that will increase the chances of a player getting to the next ball in the proper position.

The first component is **continuous forward motion.** There should only be one first push during each point whenever possible and a player should almost never move backwards. This continuous motion allows for easier turns and faster court coverage. The second is always to move at a **45-degree angle** (or as close to it as possible). Straight lines parallel to the baseline require a complete loss of momentum to change direction. Straight lines perpendicular to the baseline minimizes the ability to rotate in stroke production. The third and last, ALWAYS to create a **line of vision** with the other side of the court so a player is aware of where the ball and opponent are at all times.

Watch Video of The Hub

HUB MOBILITY PATTERN

The Hub mobility pattern begins at the ‘hub” or home base and moves forward into the court. A player will move at a 45-degree angle (ideally) towards the ball. When striking the ball on the dominant side (forehand typically), a player will execute an “inside” turn (turning in), recovering back to the hub on a similar path in which he or she approached. When the player strikes the ball on the non-dominant side (backhand typically), a player will execute an “outside” turn (turning out), again recovering back to the hub on a similar path in which he or she approached.

This pattern will be essential for stroke production as much of the power in wheelchair tennis comes from the speed and rotation of the wheelchair. The mobility pattern should often be practiced without a ball to create the unconscious competence (knowledge

without having to “think”). For a new player, this is easily forgotten when introducing the ball.

[Watch Video of The Hub Mobility Pattern]

HOME

STROKE PRODUCTION

The Forehand 74

The Slice forehand 75

The Backhand 76

The Traditional Backhand 77

The Inverted Backhand: 78

The Slice Backhand: 79

The Serve 80

The Volley 82

STROKE PRODUCTION

Stroke Production in wheelchair tennis is almost completely congruent with its able-bodied counterpart. A player will use his/her racquet-wielding arm to hit the ball on either side and above the body. Technique and momentum are used to create variations of spins and shots in order to win points. In able-bodied tennis, the "core" (trunk and legs) are used for balance, leverage and power. The Hub pattern is used to simulate the core for the wheelchair player by utilizing the pattern itself. This pattern helps create the proper wheelchair positioning to create power and control through the angle of approach to the ball, followed by rotating the chair through the hit itself.

THE FOREHAND

Striking the ball on the dominant side of the body is called the Forehand. The technique used in the topspin forehand (ball rotates forward end over end) can be broken into three easy steps:

1. **Preparation** - While moving into the ball, a player will take back the racquet in a backswing, racquet head slightly above the dominant hand, utilizing the semi-western grip, on the dominant side. This will occur on the bounce before contact with the ball.

A "loop" fashioned swing is the most commonly used by players. The first move in the swing, once the racquet is taken completely back, is to drop before beginning the move forward to strike the ball. The racquet head should drop below the dominant hand, allowing the wrist to engage in creating swing speed just before contact. There is tolerance for a lower backswing, hence having the racquet head drop below the dominant hand much earlier in the swing. Power will be sacrificed due to lesser momentum in the swing because of a lack of "drop" as utilized in the "loop", however some players may feel as though they have more time to prepare with this method.

2. **Contact** - The preparation portion should allow the racquet to now be in position to begin the swing towards contact with the ball. The player will approach the ball in the tennis wheelchair from a 45-degree angle. As the racquet begins its move forward from the backswing, the swing should begin to lift from a position below the bal l into a contact point.

The tennis chair will rotate around into a front facing position as the racquet meets the ball, utilizing the rotation of the chair for power. The contact with the ball should be done near the knees with a relatively extended arm and at this point the racquet face should be as close to vertical as possible and lifting into a finishing position.

3. **Finish** - As contact is made, the arm will continue in an upward direction, rotating over the ball so that when the racquet is in front of the face the arm is fully extended and the strings are angled toward the ground. The momentum continues bringing the racquet past the non-dominant side ear with the elbow bent just below the chin. The tennis chair should continue rotating in one fluid motion so that by the time the player has reached the finish point of the stroke the chair has already begun to angle back towards the Hub.

Watch Video of Forehand

THE SLICE FOREHAND

(Ball rotates opposite as topspin when moving forward - “under”) is used to create “underspin”. This stroke is excellent for low balls, balls well above the shoulders, defensive shots and to change pace. The technique can be broken down into the same three steps as before:

1. **Preparation** - The racquet is taken back using the continental grip, with the racquet head slightly above the ball and the dominant hand.

2. **Contact** - From the prepared position, the arm and racquet will come down slightly and forward to meet the ball just behind the knees. The tennis chair will rotate forward as in the topspin forehand, however, the arm will continue forward without any upward motion or rotation.

3. **Finish** - The stroke is completed by extending the arm forward and opening the face of the racquet slightly while the tennis chair rotates back towards the Hub.

THE BACKHAND

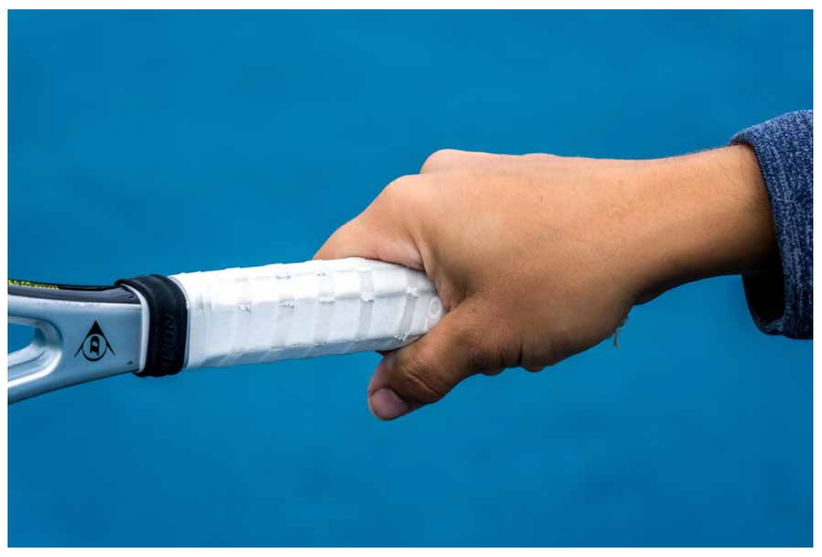
Striking the ball on the non-dominant side by bringing the dominant arm across the body is called the **backhand.** Note: a wheelchair tennis player will not utilize a two-handed backhand. The non-dominant hand is needed to remain on the pushrim or wheelchair for position adjustments or balance. There are two types of backhands used in tennis: **Topspin and Slice (underspin).**

The **topspin** backhand can be broken down into two distinctive types: the **Traditional** (eastern backhand grip) and the **Inverted** (semi-western forehand grip). The Inverted topspin backhand was born due to the difficulty a wheelchair player has switching his/her grips from the standard pushing grip of the semi-western forehand. **Grip changes** occur between taking the dominant hand off of the wheel and contact with the ball. The player must rotate the racquet handle in the dominant hand until the correct grip is found. With enough practice this is simple to do, but often there is not enough time to make the change. Players independently created stroke production that allowed them to maintain sound technique. The Inverted topspin backhand is the result of this kind of ingenuity. The technique for both backhands is very similar, however, there are distinctive differences as well. We will break them both down into three steps for your understanding.

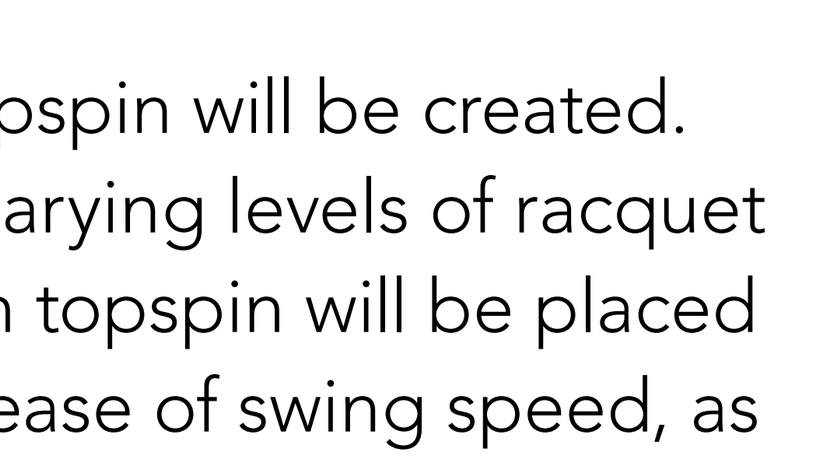
Let us start with the Traditional:

THE TRADITIONAL BACKHAND

1. **Preparation** - The player approaches the ball on a 45-degree line. Just as the player takes their racquet back in their backswing, they will switch their grip from the semi-western forehand grip to the eastern backhand grip. The Eastern backhand grip is found by placing their base-knuckle on their index finger on the grips #1 bevel to establish the proper grip. From there the racquet will continue back with the racquet head well above the dominant hand. Once the backswing is complete, the first move for the racquet will be downward, like the topspin forehand, before moving forward towards the contact point.



2. **Contact** - The entire arm will begin to move **forward and up** to meet the ball. At the moment of contact, the arm should be almost entirely extended, to maximize leverage, and the racquet face should be vertical.
By lifting the racquet on this upward path, with this vertical racquet face, topspin will be created. How steep one's swing is, along with varying levels of racquet swing speed, will determine how much topspin will be placed on the ball. For more topspin, the increase of swing speed, as contact is approached, is critical. Depending upon the level of disability the athlete is at, the player may or may not need to grab the wheel on the non-dominant side of the tennis chair for stability and balance.



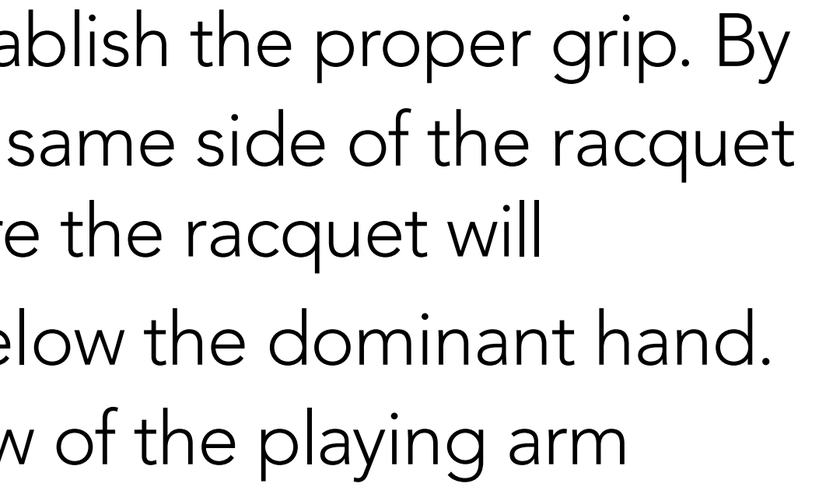
3. **Finish** - After contact, the playing arm will continue to move forward and up, possibly opening the front shoulder up to the court, slightly. The racquet will have started on the

non-dominant side will end on the dominant side above the point of contact. Depending upon the force of the swing, the player may use either an inside (possible cross-handed turn) or outside turn. This will be determined by whichever turn is the shortest to recover to the Hub.

Watch Video of Traditional Topspin Backhand

THE INVERTED BACKHAND:

1. **Preparation** - The player approaches the ball on a 45-degree line. As the player takes their racquet back in their backswing, unlike the Traditional backhand with an Eastern grip, where they will have to change their grip from the forehand position, they will not switch their grip from the semi-western forehand grip to the eastern backhand grip. They will keep the semi-western grip in place. The semi-western grip is found by placing their base-knuckle on their index finger on the grips #4 (3 ½) bevel to establish the proper grip. By doing this, the ball will be struck on the same side of the racquet face as the topspin forehand. From there the racquet will continue back with the racquet head below the dominant hand. This is assisted by the bend of the elbow of the playing arm being put into a 90-degree angle, with the elbow itself being at nose-level. Once the backswing is complete, the first move for the racquet will be forward and up, as it moves toward the contact point.



2. **Contact** - The fully extended arm should begin to move up and forward to meet the ball. The arm will unfold, or straighten, as the racquet face gets closer to the ball. At the moment of contact, the arm should be near completely extended and the racquet face should be at almost a vertical position.

The more vertical the swing path, the more topspin that will be produced. The acceleration and steepness from the backswing to the contact point on the ball is critical when producing power and revolutions on the ball.

3. **Finish** - After contact, the playing arm will continue to move forward and up, possibly opening the front shoulder up to the court. The racquet will have started on the non-dominant side will end on the dominant side above the point of contact. Depending upon the force of the swing, the player may
use either an inside (turn-in or possible cross-handed turn) or outside turn (turn-out). This will be determined by whichever turn is the shortest to recover to the Hub.

Watch Video of Inverted Topspin Backhand

THE SLICE BACKHAND:

1. **Preparation** - While moving to the ball, a player will take the racquet back with an almost straight and relaxed arm in the continental grip on the non-dominant side. The arm should be taken back above the ball, with the racquet face at ear level, above the hand. This will occur on the bounce before the contact with the ball. The player should utilize a slight turn of the tennis chair just before contact, turning the chair almost parallel to the net.

2. **Contact** - The arm should move down and forward from the prepared position to meet the ball. The racquet face will be slightly open, but the forward motion will keep it from going straight up. Contact with the ball should occur just in front of the knees if the tennis chair is parallel to the net. If the tennis chair is slightly angled forward, contact with the ball will be just behind the knees. Keeping the wrist in a firm position, keeping the racquet head on the same plane as the hand (it is tolerable if the racquet head drops slightly below the hand, if the ball location

dictates it to be necessary), will create underspin, making the ball stay low on the return to the other side of the court.

3. **Finish** - The arm will continue to move slightly down and forward toward the target, extending the arm as far as possible. Upon full extension of the arm, the palm of the hand will be the ground at the completion of the swing. As the swing finishes, the player should be executing an **outside turn (turn-out),** angling back toward the Hub.

Watch Video of Slice Backhand

THE SERVE

The serve is the most important shot in tennis because it starts every point of a match. It is hit from behind the baseline into the service box diagonally across from the server. The Serve is hit by tossing the ball high enough for the dominant arm to fully extend, striking the ball at its highest point (using the clock analogy: roughly 1:00 for right handed players, 11:00 for left handed players). This requires a great deal of extension both in the arm and in the body. It is important to note that some disabilities in which the "core" (abdominal muscles) are affected, may limit the amount of reach a player is capable of producing due to a lack of stability and/or balance. There are 5 segments to the serve that we will discuss: **Chair Position, Grip, Toss, Swing and Rotation**

1. **Chair Position:** The server will position the tennis chair behind the baseline based upon his/her "function". For the player who has limited trunk function, positioning the chair at a 45-degree angle toward the net post on their dominant side will be an appropriate starting position. If the player has more core function, the position of the chair can be set parallel to the baseline to provide more "turn" in their body position, creating more power. Either position should create an opportunity to start turned in order to create more rotation, either through use of core strength or turning of the chair into the ball. The ball itself will rest in the non-dominant hand, ready to begin the motion and go into the toss.

2. **Grip:** The serve is typically hit with a **Continental** grip. For the beginner levels, the Eastern-forehand grip can be used at the first stages. The Continental grip will be the most versatile grip for intermediate level players and up when serving and allow the player to develop spin easier than any other grip, creating the rotation on the ball in order to get it to drop into the service box. The ability to get the ball to drop is especially important for a wheelchair player who is serving from a lower height position, generally at a maximum of four and one half feet tall.

3. **Toss:** The first motion in this sequence begins with both hands either starting on their respective sides wheels or in front of the body. In a traditional starting position, with both hands side by side or the non-dominant hand (with ball) underneath the dominant hand (racquet holding hand), at the 12:00 position, in front of the body. From this position, both arms will begin simultaneously moving down towards the players lap and lift back up again. There should be a slight break in the congruence of the arms at this point, with the dominant-arm (racquet wielding) gently lagging behind the tossing arm. This change in speed will allow the toss time to rise to its APEX point (1:00 for right handed players, 11:00 for left handed players) and allow the release point to be just above eye level for most players.

4. **Swing:** The server's entire body and dominant arm will swing up to full extension to meet the ball at its highest point. The initial motion should be moving up to the ball and the momentum of the swing should carry the dominant arm and racquet down to the non-dominant side. This should all be done in one fluid motion without hitches or breaks in the swing path. The tempo should be controlled, with light acceleration happening throughout, with the fastest part of the swing being at the point of contact.

5. **Rotation:** The rotation in the serve can be acquired in one of **two ways** in wheelchair tennis. The **"free-hand" method** allows the server to rotate the chair without placing the non-

dominant hand on the chair or wheel. The non-dominant arm will typically fall across the chest/stomach area of the server once the ball is struck in order to provide stability. This technique is utilized by players with typically higher levels of function, although there are examples of players with less function who enjoy this method. Balance is a factor and can be compromised if used by someone with deficit in their core region (abdominals, lower back). The **"stabilization" method** allows the player to grasp the wheel/pushrim on the non-dominant side of the chair in order to have better balance upon contact. Typically a player with abdominal/lower back strength deficit will use this method. With this method also comes the ability to **pull backwards** on the non-dominant sides wheel as one swings, in order to simulate abdominal function and rotation in order to generate more swing speed and power.

Watch Video of The Serve

THE VOLLEY

With today's very aggressive style of play and all-court abilities of players, learning how to come forward and take the ball out of the air in order to take time away from one's opponent is imperative. The volley is not only a technical shot, but it is also a tactical shot used to end a point. This a shot that is executed with almost no backswing and very little follow through. It is designed to "redirect" the ball using the pace of the ball coming in from one's opponent to the desired target. There are five steps that are covered on the volley.

1. **Grip:** The volley is hit with the Continental grip. There is very little time to act when sitting up at the net, making a grip change extremely difficult. The Continental grip allows the player to hit both backhand and forehand volleys without a grip change, saving much needed time.

2. **Compact swing:** The racquet head will only move approximately 18 to 24 inches depending on the amount of time a player has to make a play. The racquet head should remain above the wrist in a firm position and in front of the player's torso throughout

the swing. The player should never lose sight (using one's peripheral vision) of the racquet when volleying. The volley is hit with a slight high-to-low motion, creating a small amount of underspin. The strings should be pointed toward the target upon finishing the stroke.

3. **Non-dominant hand:** It is essential that the non-dominant hand remains on the push-rim/wheel at all times while at the net for balance and fast chair positioning adjustments.

4. **Approach:** Momentum is essential to maximize reach and coverage at the net for the wheelchair tennis player who is attempting to volley. The forward motion of approaching the net should be utilized once. If the player does not win the point on that particular hit, he/she must attempt to recover back to the Hub behind the baseline or execute circular mobility.

5. **Circular Mobility:** When a player hits a volley and does not finish the point, he/she must re-create momentum in order to volley successfully. This is done by turning the chair so the player's back is facing his/her opponent, pushing back behind the service line (a new Hub location much further into the court) and then turning back into the court so as the opponent strikes the ball he/she has forward momentum. This can only be done when there is time and is most often executed in doubles.

Watch Video of Forehand/Backhand Volley

HOME

QUAD TENNIS

Racquet Setup 86

Chair Setup 86

Heat Issue (regulation of body temperature) 87

Stroke Limitations 87

Open Dialogue 88

Classification 88

QUAD TENNIS

Quadriplegic (Tetraplegic) wheelchair tennis differs from paraplegic or non-Quad tennis in that the upper extremities are affected by paralysis or some other kind of deficiency. This paralysis or deficiency may have an impact upon a player's range of motion and overall upper body and hand/grip strength. Everything else that is mentioned in this manual can apply to Quad tennis as it has in other forms of wheelchair tennis.

These differences in disability/function require unique adjustments including: racquet setup, chair setup (manual and powerchairs can vary in setup, less so in the powerchair), management in regulating one's body temperature ("heat issue") if there is an issue, stroke limitations and open conversations with a coach about what you can or cannot do (at least in belief) physically based upon your functional limitations. These areas focus on the complicated nature of Quad tennis it presents to its players.

RACQUET SETUP

First and foremost, a player must conclude whether or not he/she can actually hold a racquet with his/her dominant hand. It might seem like a simple answer, however, some players who were right-handed before an injury might not have the same function in that hand post-injury. Therefore, the non-dominant hand may actually have more function at this point and may need to be used in order to play. The next question is whether or not an "assistive device" is necessary to hold the racquet in place. Examples of these assistive devices could be: ace bandages, velcro straps, prosthetic molds, duct tape, gloves and most commonly used, athletic tape. There are some Quad players who will not need these devices at all, as their hand function and strength allows them to play without them. Once an effective device is chosen to help hold the racquet in place (if needed), one must decide, based upon their particular strengths (grip strength and range of motion), which grip would be most suitable for their ability. It is also important for a Quad player to realize that an assistive device may be necessary for the non-playing hand for wrist support and grip tackiness when pushing the tennis chair (i.e. gloves or athletic tape).

Watch Video of Racquet Taping

CHAIR SETUP

Finding the best sitting position in the tennis wheelchair is as important as finding the right pair of shoes to an able-bodied player and then some. The tennis chair must move as one with the body of the player and provide the right amount of balance for a given disability. Some paraplegics and almost all Quad players must set up the chair to counteract any strength and balance deficiencies. The player must consider the following positions the chair can be set in for their correct setup:

1. The "dump" of the chair - measurement of pitch (seat height) between the front of the seat to the rear of the seat
2. The actual seat height, width and depth
3. The backrest height

4. Footplate placement
5. The Center of Gravity setup of the chair

All of these aspects are critical to the comfort and performance of the chair for the player. Without proper setup in these five areas, the players overall experience will be compromised.

Also to be considered is how the player will establish balance and stability in the chair. This can be done by utilizing different strapping methods to make the player one with his/her chair. Straps (made typically long and 2-3" wide Velcro) will be used across the thighs, waist and midsection (sometimes a weightlifting belt will be used here) in order to provide the optimum amount of balance and stability possible and in a comfort level that the player enjoys. Accomplishing the perfect chair setup can have the biggest impact on performance and cannot be underestimated in its importance.

HEAT ISSUE (REGULATION OF BODY TEMPERATURE)

The "heat-issue" surrounding the Quad division of wheelchair tennis (for those players who suffer from an inability to perspire/sweat efficiently or at all) is integral to health and safety. Without an ability to cool down one's core temperature in a timely fashion (i.e. between points or changeovers), a player's performance will suffer dramatically. There are strategies that can be utilized in order to combat this issue, such as: hats (some with an extended piece of material to cover the neck area), water spray bottles (to give a misting action on the skin, in lieu of sweating), ice-coolers on court to keep ice handy for placement in a hat to cool the head down, cold water or ice wrapped in a towel, then placed around the neck to cool upper extremities, sunblock and overall hydration using water or sport drinks that have been cooled. These are the most common methods used by experienced Quad players who have dealt with these unique issues.

STROKE LIMITATIONS

Recognizing the physical limitations in range of motion and strength are essential for a Quad player to understand before starting play. If a player is to learn how a basic tennis stroke works, whether it is a groundstroke, volley or service motion, understanding physical

limitations will expedite the learning process. An example of a limitation that would require a decision in the learning process might be whether or not to use an overhand or underhand service motion. It will be through trial and error that this player will make their decision as to whether or not the overhand serve will be possible or effective enough to use in competition or ultimately decide that the underhand serve will be the only way he or she can get the point started. It is a painstaking process, yet it is essential information that the player must acquire to move forward in learning the different stroke productions within tennis.

OPEN DIALOGUE

Keeping the previous four points in mind, the Quad player must maintain an open dialogue with his or her coach. Some coaches have not had the experience of working with athletes with disabilities before and might have some questions of their own. This is where the student becomes the teacher. The player must share as much information as possible with the coach so that together they can tackle the obstacles that lay ahead. This shared information can help a well-qualified coach to present sound and realistic game plans and goals for an athlete. It is most important at this stage for the player to be open-minded to try new ideas. A player may fear failure, but as four-time Paralympian and multiple Gold Medalist Nick Taylor has stated, “Don’t necessarily look at the player and focus solely on what they can and cannot do. You will naturally do that. Try to convince the player to try to do the things they believe they cannot do…”. Therein lies the gold dust…

CLASSIFICATION

Currently, the International Tennis Federation has established rules of classification for all players desiring to compete in the Quad Division. Please refer to the current ITF Wheelchair Tennis Handbook for the specific rules and regulations of being classified as a “Quad” player.

View ITF Overview and Rules

View ITF Wheelchair Classification Rules

HOME

SINGLES: GAME STYLES AND STRATEGIES

Defensive Player 90

Offensive Player 90

All-Court Player 91

SINGLES: GAME STYLES AND STRATEGIES

Wheelchair singles is a diverse game in strategies and positions. Player's game styles match the skill set they bring to the court, maximizing their strengths and minimizing their weaknesses. Some players exhibit exceptional patience while others exceptional power and there are those who have the ability to do it all.

DEFENSIVE PLAYER

A defensive player's strategy is typically one of attrition. He or she wants to hit one more ball in the court than his or her opponent on every point. Relying on your opponent to miss requires a great deal of mobility skills, stamina and patience. The defensive player relies on an ability to chase both left and right directions in the court in order to keep the ball in play.

The Hub of a defensive player is deeper behind the baseline, creating as much court space as possible to get to the ball. While it is difficult to hit offensive shots from this position, it is equally difficult for their opponents to put the ball away. The defensive player will use safe targets, never hitting close to the lines and will always have ample net clearance.

OFFENSIVE PLAYER

An offensive player's strategy is to end the point by force as early as possible. This strategy requires vertical movement, strength and accurate, aggressive stroke production. The offensive player will move their Hub as close to the baseline as possible, looking for the opportunity to move inside the court to remove his or her opponent's time and space. An offensive player is almost completely reliant on vertical mobility. He or she must exhibit the ability to hit all strokes (including volleys) with force and accuracy. This player will make more unforced errors but will also create more point-ending shots. If the points are short, the offensive player is most likely winning. A tactic of Serve/Return plus-one shot tends to be this players "go-to" strategy. It is the first ball after the serve or return that this particular player tries to inflict the most damage and to either win the point outright or at the very least take control of it.

ALL-COURT PLAYER

Most wheelchair tennis players fall into the category of an all-court player. These individuals have the ability to play many different game styles. They play defensively or offensively depending on which is the winning strategy. They are very adept at moving their Hub in the middle of a point from deep in the court to close to the baseline. They are very good at going from defense to offense in the middle of a point and tend to be better at changing strategies. All-court players also tend to be the mobility experts, able to cover left, right, forward and back with equal ease.

Watch Improve Your Game - Singles Strategy Video

HOME

DOUBLES: GAME STYLES AND STRATEGIES

Two Back 93

One Up, One Back 93

All-Court 94

DOUBLES: GAME STYLES AND STRATEGIES

The most exciting element of wheelchair tennis is the game of doubles. The points are long, the court coverage immeasurable and the shot-making is astounding. Seeing four wheelchair tennis players move in and out of mobility patterns is incredible to watch and even more incredible to play.

All four players remain in constant motion whether they are hitting the ball or not. This means that there are four individual HUBs on the court of play at all times. Whether a player hits the ball or their partner does, a recovery must occur after every ball struck on a side. Once the constant motion of doubles becomes comfortable, a doubles team must choose a style they wish to play.

TWO BACK

A doubles team that chooses to play with both players behind the baseline is similar to the defensive player in singles. The lateral movement and court coverage are keys for this team as they will not advance inside the baseline. They will wait for their opponent to make a mistake. Oftentimes they will isolate the player they feel is the weakest on the other team, removing any offensive threat they may face. The team that is playing two back is banking on long points, which may include lobs to neutralize a more offensive team attempting to garner a mistake from their opponents. This game style is also how all beginners should start playing doubles.

ONE UP, ONE BACK

Many wheelchair tennis doubles teams are created specifically for this style. One player is a defensive player or neutralizing player, while the other is the designated offensive player. In this partnership, the defensive/neutralizing player Hub will be deep behind the baseline. Their role is to remain consistent, neutralizing the other team's offensive player to give their partner opportunities to finish the point at the net.

Their partner is the offensive player. Their Hub will be inside the court, nearing the service line, where they will look to volley the ball

to the open court for a winner. The offensive player must execute circular mobility throughout the point when not hitting the ball.

The roles in this team never waiver. Since the offensive player is at the net, a good strategy to use against this team is the lob. If a ball goes over the offensive player's head, the defensive player must move across the baseline to their partner's side to strike the ball. The offensive player will move to the other side vacated by the defensive player. This is known as a lateral switch and should be verbally communicated by both players by a loud call of "Switch". With practice, the team will move and switch seamlessly, making it difficult to get the ball through them.

ALL-COURT

A doubles team comprised of two all-court players holds to no rule of position. The Hubs on their side move according to the situation in the point rather than the role on the team. Each player will have the ability to go to the net and each player will have the ability to stay behind the baseline to be consistent. Both players will look for opportunities to hit the ball inside the baseline offensively or even advance to the net. If one player is advancing and the ball is hit too short to their partner's side, they will execute a vertical switch. The player who was at the net will retreat to the baseline while the player who was back will advance on the ball moving forward. The vertical switch could occur several times, especially against a defensive two back team. Most teams at the highest level play this style.

Watch Improve Your Game - Doubles Strategy Video

HOME

HOW TO START A LOCAL PROGRAM

Finding Players 96

Finding Coaches, Hitting Partners, and Volunteers 98

Running Your Program 98

Making Your Program Grow 99

Advanced Program Development 100

Common Characteristics of a Successful Local Program 101

HOW TO START A LOCAL PROGRAM

By Curt and Lynn Bender

FINDING PLAYERS

Finding players for a local wheelchair tennis program is often incredibly challenging. It takes hard work and patience in the beginning. There are an amazing number of places you can access people with physically disabling conditions who may be perfect for the program that you are starting.

- **Rehabilitation Hospitals** - If you are fortunate enough to have a local rehabilitation hospital in your hometown, begin your search there. Call and make a point of introducing yourself, your plan, what it is you want to do and what you are looking for. Visit with the physical therapists, occupational therapists, recreational therapists and outpatient therapists. Let them know what is available for their patients after discharge.

- **Amputee Centers** - Drop off flyers, make a face-to-face first impression and introduce yourself. There are many therapy centers that may not be aware of opportunities for single or double amputees.

- **DME's (Durable Medical Equipment supply companies)** - This is where you will have contact with the local wheelchair suppliers and manufacturers. They may have several ideas as to where potential athletes may be; drop of flyers so they are familiar with what you are doing. They are also great potential sponsors to help support future events, tournaments and rehab repair stations. It's always a perk to send business their way as well as a way for them to get their name out there.

- **Local Universities/Small Colleges/High Schools** - Call the local education establishments and ask to speak with the student disability organizations on campus. The local high

schools are great to contact, although they might not have a specific disability counselor; you can speak instead with administration/athletic or guidance counselors. Maybe out of five schools you call, two or three might have a student or two who uses a chair and is unaware of wheelchair sports.

- **Support Groups** - Check your local newspapers and magazines for local amputee, spinal cord injury and spina bifida support groups. Find out where they meet and when and make a phone call to see if you could be a guest speaker at their support group.
- **Fitness Centers** - Many local gyms and health clubs will often support individuals coming to do their therapy at the fitness center or know of individuals who already are being proactive and are in a gym working out for whatever reason.
- **Tennis Clubs** - Not only will you introduce yourself to other people who share a passion for tennis, but you could seek out volunteers at the tennis clubs, meet with the tennis pros, explain what you are doing and put up flyers. You may get just a couple of people who really want to volunteer or help out in some way. If you stop in, ask to post flyers or have the pro announce it in their classes to club members about a new local tennis program. A great opportunity to touch all local tennis clubs is to recruit as ball runners both kids and adults or kids who have volunteer hours they need for school. It's an excellent opportunity to train and educate the youth, and you may find future sponsors at the tennis clubs as well who support what you are doing. Be visible at the clubs.
- **Local CIL's (Center for Independent Living)** - This is a huge resource for individuals with a variety of disabilities in your entire area. Most larger cities have these available in the phone book.
- **Veterans Facilities/PVA (Paralyzed Veterans Association)** - Contact your local agency and speak with Activity Directors and Departments and therapists. Stop in and drop off flyers. It's even a perfect opportunity to do an exhibition/mini-clinic

or simply provide education/entertainment (e.g., mini nets/ foam balls on a basketball court will make do if no tennis court is available.)

- **Friends/Family/Word of Mouth** - Sometimes the people are right around you and you don't even know it. Many times, someone will know someone in a chair who is a friend or relative of someone. Have them come out with the individual so it's more comfortable.

- **Advertising/Television/Newspaper/Magazine Articles** - Be proactive! If you think you have a great idea and a programming need, sell it! Call the local paper or news station and tell them you have a great story idea and you want them to come out and take a photo of a practice, or send them a photo and tell them of a new program being offered in the community. They will not know unless you share it with the community and the news reporters. They are always looking for new, creative, and unique stories to write about.

FINDING COACHES, HITTING PARTNERS, AND VOLUNTEERS

Begin by starting with people you know. Maybe it's a friend or a family member who plays tennis. If you don't know of people, contact your local tennis club by going in and explaining what you are looking for, and recruit travel team club players - people who love to play tennis and are passionate about it. Other options include: asking your local college players who need volunteer hours or high school students who need service hours or a small part-time job once a week feeding balls. Set a specific time and day and stick to it. The more people see you on the courts consistently, the more people who will become curious about what it's all about. A player in a chair can feed to another player as well.

RUNNING YOUR PROGRAM

Set a specific time and day of the week to practice and stick to it. Keep each other accountable; call to confirm that they are coming. Never assume. Early on, everyone is new at this stage and it's

easy to let things slip by or just not show up. For beginner players, start small, with making the wheelchair player feel successful, with stationary feeding near the net and gradually move back. Have them invite a friend they know - most players will know of another couple of people they have met to invite out.

If you need indoor courts for the winter season, approach your local club by going in and explaining what your purpose is to see if they will either donate the court time or give you a discounted rate. You may have an odd time for practicing to work around club players' schedules, so be ready for later in the evening or a weekend if they give you whatever is available. As always, be courteous and thankful; learn and perform proper tennis etiquette. The more visible you are, the more respect you will gain. Be courteous to club players, mingle and socialize with them any opportunity you can get to create new relationships. You never know how these can help you in the future with potential volunteers, sponsors or programming needs.

MAKING YOUR PROGRAM GROW

Whether you are a 501 (c)(3) [recommended, see appendix for starting a 501 (c)(3)] or not, giving back to the community is important. It is best if the coach and/or player go into rehab hospitals, make a visit, talk to therapists, talk to current patients in rehab or in O.P> and visit schools. Begin to be creative with fundraising ideas even if you are not yet involved in a large organization. Have someone help you understand grant writing and write a couple of grants. There are several events in your community that you can leverage off of. You can't ever expect that money will be simply handed out. You MUST work hard for it, especially at the very beginning; you must be very committed. Explaining your goals, objectives, long-term plans, and creating your vision for the future is important at this level.

With some funding available, begin to have players competing at possibly one to three tournaments per year, even if you only have one to three to send. Seek out small sponsors at this time and begin to form relationships with them. Always ask yourself:

What can you do for them as well as well as how they can help you in return? Why would someone want to donate to your event or organization? What will they receive out of it? Remember, your organization has something has something to offer, and that is why they would like to support you.

ADVANCED PROGRAM DEVELOPMENT

At this stage, your program should definitely have the resources to become a 501 (C)(3). There should be several volunteers on board helping you with your program. Always recruit more help by continuously networking opportunities around you. You should have a person or persons who are experienced in grant writing for opportunities to come knocking on the door. If you read about a great idea in the news, magazines, or local paper, or hear about one from others, just do it and try it.

Players should be practicing at this level more than once a week, participating in additional tournaments and traveling as well. Funding should be secure enough at this time to help support some of the athletes traveling expenses.

Other key items of interest at this level of a program include: having a website; having brochures on your local program; promotional items to hand out at your events or give to potential new players or at any clinic or demo you might be at; calling the newspaper and TV stations about the events you are hosting; and getting media support from your events. Remember that if you want your name out there, just do it! Call the paper if you have a great back story; start with the smaller papers, your local magazines, etc. They love new and creative story ideas!

Set goals for your players and have a code of conduct. If you expect a lot from your players and they want to be treated as professional athletes, then expectations need to be set as well between the coaches and the players as to what is required from them. Have separate practices for recreational-level players and advanced-level players weekly as well as possibly one combined practice to build the team concept.

With ongoing limited funds to pay coaches at this level, recruit additional high-school level juniors, varsity-level players, college-level students and travel team players. You must also be giving back by possibly being part of the USTA or hosting a USTA sanctioned event/tournament.

COMMON CHARACTERISTICS OF A SUCCESSFUL LOCAL PROGRAM

1. At every point in program development, the people need to give back to the sport and your program in some aspect. This needs to happen annually at a minimum, by visiting rehab hospitals and newly injured individuals, educational talks at local schools, universities, or at local tennis clubs. Call your state TSR (Tennis Service Representative), introduce yourself, and create that awareness in your area and to leverage each other for future opportunities you might not be aware of within your own state.
2. Fundraising ideas: From creating a program book by selling ads, to setting up a booth at local sporting events, selling tickets to an event, hosting a charity adult doubles tournament at one of your local clubs, bringing in an experienced open-level player to put on a wheelchair tennis exhibition in front of a pre-existing event that will draw fans or hosting other fundraising events are all key points at this stage of the game. Be creative with your ideas; they are out there.
3. The large grants will not become available until you become a 501 (c)(3). Find people who are good at what they do and are passionate about it - be it a tournament director, a finance person, or a person who just likes to serve food. Do not force people who are busy and want to help to be part of monthly or weekly meetings. Usually, the good people are busy, so respect their schedule and be flexible. Remember that grant writing takes time. Find someone with good writing skills or a creative background who has experience to help you begin. It can be intimidating at first. Start with smaller grants and then work up to the larger ones. Don’t get discouraged if you put a lot of

time and energy into a grant you thought was worthwhile and you got denied. Be prepared for rejection letters as there are many wonderful non-profit organizations out there that all want the same things as you. You may get one out of five grants, but it's a start and it's worthwhile when you actually receive your first one.

4. Networking with the community: When you meet people who in passing offer to help, stay on them, hold them to it, and get their email address and phone number and follow up to call them, finding out what their area of expertise is and their availability. Maybe they are willing to come out one night a week for an hour, maybe they have a contact that would help you who is great at marketing; finding the business people in your community who have access to all areas to help you is critical (e.g., lawyers, business owners, marketing and PR, health-care professionals, grant writers). Use other people's skills to help grow your program.

STAGING A WHEELCHAIR TENNIS EXHIBITION

Make an Introduction 105

Use the Best Athletes Available 105

Script the Exhibition 105

“Mic” All Participants if Possible… 106

Make Players Available 106

STAGING A WHEELCHAIR TENNIS EXHIBITION

Now more than ever wheelchair tennis is receiving opportunities to display its value at top-level professional events in the form of exhibitions. These exhibitions are bringing wheelchair tennis to audiences who have either never heard of wheelchair tennis or never even seen it. Making a positive impression in the limited time afforded is imperative to educating the public that we have a professional international sport with some of the best athletes in the world.

These exhibitions can take many different forms. Some of these forms include:

- Four wheelchair players playing doubles
- Two wheelchair players playing singles
- Two wheelchair players and two able-bodied players in an up/down match
- One coach and one to four players in an informative setting

Regardless of the format, there are a few simple steps you can take to make your wheelchair tennis exhibition both an informative and entertaining highlight of your event.

MAKE AN INTRODUCTION

People will always be amazed by what they see the first time they encounter wheelchair tennis. By making a brief introduction to wheelchair tennis, clarifying the mobility adjustment, rule differences, ITF Wheelchair Tour, and local programming, you will break down the barriers to truly understanding the game. It will highlight the athletic ability of the athletes they are seeing as well as give them a good idea of their travel, commitment and experience. The introduction also sets the environment of the exhibition. Put the crowd at ease with humor, giving them permission to applaud and have fun during the show. The introduction will set the tone for their entire experience.

USE THE BEST ATHLETES AVAILABLE

Hosting an exhibition of any kind implies that you are trying to highlight the sport. Utilizing the best athletes available will definitely increase the chances of having a lasting effect on the audience. You have a limited amount of time to leave an impression so each point should have the potential to look like it came from a highlight reel.

SCRIPT THE EXHIBITION

Exhibitions are inherently entertaining. The people involved on court should understand that this is not a competition, where the focus is to destroy the opponent. Rather, it is an attempt to make all players on the court look like stars. If there is a clear ability difference between the participants, the best players need to understand that making the others look good will only benefit the sport as well as making the exhibition far more entertaining. It is a good idea to plan for competitive outcomes. This means that if you are playing a set number of games (i.e., four games with a tie-break at two all) it is essential that the mini-set reaches the tie-break. When two standing players are involved, it is a good idea to put them in chairs at some predetermined point during the exhibition. The crowd loves to see this it and it emphasizes how difficult it is to play from a chair. Knowing the “script” of the exhibition will make the event more professional and put all on the court at ease.

"MIC" ALL PARTICIPANTS IF POSSIBLE...

The verbal banter of a good exhibition can be informative and humorous. It adds personality to the event and brings the personality of each participant to the audience. When in a stadium setting, it is a good idea to place a microphone on each player. In a smaller setting this may not be necessary, but make sure that the acoustics of the venue allow everyone in attendance to hear.

MAKE PLAYERS AVAILABLE

Audience members will have questions after the event. Upon completion, announce a place and time the athletes will make themselves available for a question and answer period. This should include any and all media opportunities. One never knows who may be sitting in the crowd waiting to jump on board.

Many of our exhibitions at major professional events have led to tournament opportunities for our athletes. In fact, these exhibitions opened the door to prize money events at each of the Grand Slams. Effective presentations can change the attitude, interest and development of wheelchair tennis. It is simply not enough to put four wheelchair tennis players on the court and consider that a quality exhibition. You must be informative, entertaining, funny and creative to create a lasting effect. A good exhibition will lead to future opportunities for wheelchair tennis and its players.

CLOSING

CLOSING

Wheelchair tennis is simply another aspect of tennis. We say it all the time but we hope the information in this manual will make it true. Make sure to read the appendices as they contain places where you can find further information on wheelchair tennis.

We would like to thank all of our contributors in this manual in helping put together what we hope will be a tremendous resource for all coaches and players wanting to learn more about wheelchair tennis. Education and awareness is what is critical for this aspect of the tennis storyline to continue to grow and thrive.

So read on! The rest of this manual contains drills you can use to practice the skills necessary to play wheelchair tennis. They come from some of the greatest players and coaches in the history of wheelchair tennis! Let's grow the game!!!

HOME

APPENDIX

Rules of Play: Wheelchair Tennis 110

Integration Rule 111

Wheelchair Tennis Resource References 111

Medical/Safety References 113

APPENDIX

RULES OF PLAY: WHEELCHAIR TENNIS

The game of wheelchair tennis follows the ITF Rules of Tennis and USTA "Friend at Court" with the following exceptions:

1. **The Two-Bounce Rule**
   The wheelchair tennis player is allowed two bounces of the ball. The player must return the ball before it hits the ground a third time. The second bounce can be either in or out of the court boundaries.

2. **The Wheelchair**
   The wheelchair is considered part of the body and all applicable Rules which apply to a player's body, shall apply to the wheelchair.

3. **The Service**
   The service shall be delivered in the following manner:

   i. Immediately before commencing the serve, the server shall be in a stationary position. The server shall then be allowed one push before striking the ball.

   ii. The server shall throughout the delivery of the service not touch with any wheel, any area other than that behind the baseline within the imaginary extension of the centre mark and Sideline.

   iii. If conventional methods for the service are physically impossible for a quadriplegic player, then the player or an individual may drop the ball for such a player. However, the same method of serving must be used each time.

4. **Player Loses Point**
   A player loses a point if:

   i. He/She fails to return the ball before it has touched the ground three times.

   ii. Subject to rule e) below. He/She uses any part of his feet or

lower extremities as brakes or as stabilizers while delivering service, stroking a ball, turning or stopping against the ground or against any wheel while the ball is in play.

iii. He/She fails to keep one buttock in contact with his wheelchair seat when contacting the ball.

5. **Propelling the Chair with the Foot**

i. If due to lack of capacity a player is unable to propel the wheelchair via the wheel, then he/she may propel the wheelchair using one foot.

ii. Even if in accordance with rule "e", subset i., above, a player is permitted to propel the chair using one foot, no part of the player's foot may be in contact with the ground:

- During the forward motion of the swing, including when the racquet strikes the ball;
- From the initiation of the service motion until the racquet strikes the ball.

iii. A player in breach of this Rule shall lose a point.

INTEGRATION RULE

Where a wheelchair tennis player is playing with or against an able-bodied person in singles or doubles, the Rules of Wheelchair Tennis shall apply for the wheelchair player, while the Rules of Tennis for able-bodied tennis shall apply for the able-bodied player. In this instance, the wheelchair player is allowed two bounces while the able-bodied player is allowed only one bounce.

Note: The definition of lower extremities is: the lower limb, including the buttocks, hip, thigh, leg, ankle and foot.

WHEELCHAIR TENNIS RESOURCE REFERENCES

usta.com/en/home/play.html

- Information on programming: National and Sectional, Tournament Play, All-Comers Camps, Junior Camps and Train the Trainer Workshop opportunities.

- High Performance
- Current rankings

www.itftennis.com/en/itf-tours/uniqlo-wheelchair-tennis-tour/

- Wheelchair Tennis Manual
- Wheelchair Tennis Videos
- Coaches Review (articles by world's foremost coaches)
- Up to date ITF Tour schedule, results and rankings
- News/Stories about wheelchair programming throughout the world

www.uspta.com

- Course and Certification for coaches
- Videos and Webinars

www.ptrtennis.org

- Specialty course with exam
- USTA/ITF wheelchair tennis tournament on Hilton Head Island
- Course outline for members

www.teamusa.org/US-Paralympics

- Information on the Paralympic movement and necessary qualifications for athletes to compete at Paralympic Games and/or Parapan American Games
- Standards for International Paralympic Committee (IPC)
- USADA standards and regulations

www.usopc.org

- All information involving Olympic/Paralympic activities, International Games
- Information in regards to USOC Olympic and Paralympic Training Centers - Colorado Springs and Lake Placid (Chula Vista)

MEDICAL/SAFETY REFERENCES

1. **ITF Wheelchair Tennis Regulations.** 2015 [cited 2015 November 13, 2015]; Available from: https://www.itftennis.com/en/about-us/governance/rules-and-regulations/?type=tour-regulations

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4. Cucurello, S.J., **"Spinal Cord Injuries." Physical Medicine and Rehabilitation Board Review, 3rd Ed.** 2015: Demons Medical Publishing, LLC.

5. **Instructing Wheelchair Tennis.** 2011 [cited 2015 November 13, 2015]; PTR.

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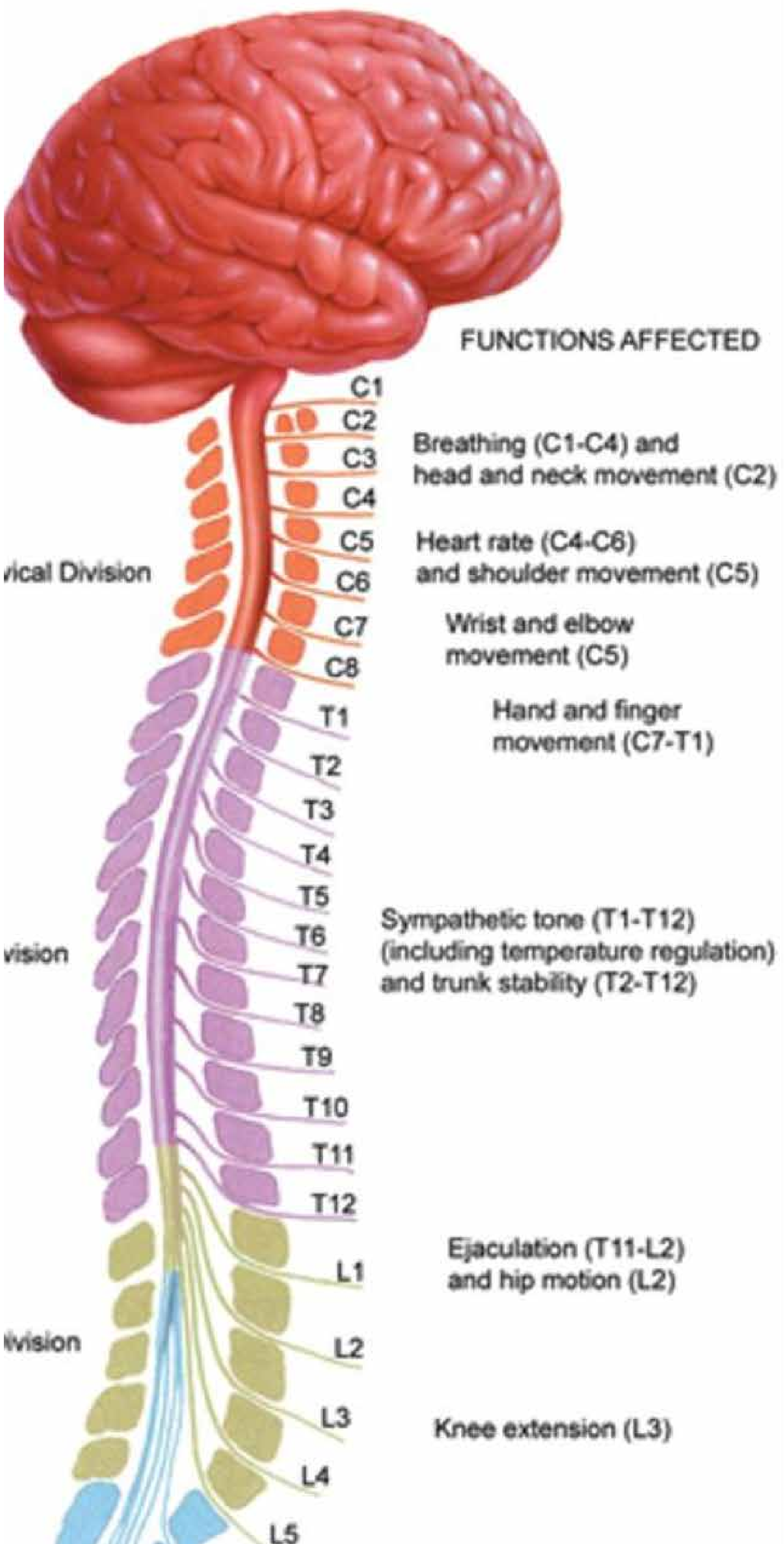
FUNCTIONS AFFECTED
C1
C2
C3
C4
C5
C6
C7
C8
T1
T2
T3
T4
T5
T6
T7
T8
T9
T10
T11
T12
L1
L2
L3
L4
L5
S1
vical Division
vision
ivision
h
Breathing (C1-C4) and head and neck movement (C2)
Heart rate (C4-C6) and shoulder movement (C5)
Wrist and elbow movement (C5)
Hand and finger movement (C7-T1)
Sympathetic tone (T1-T12) (including temperature regulation) and trunk stability (T2-T12)
Ejaculation (T11-L2) and hip motion (L2)
Knee extension (L3)
Foot motion (L4-S1) and knee flexion (L5)