

# THEORETICAL & PRACTICAL CONCEPTS RELATED TO WHEELCHAIR TENNIS

**THEORETICAL AND PRACTICAL CONCEPTS RELATED TO WHEELCHAIR TENNIS**

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**RFET**  
REAL FEDERACIÓN ESPAÑOLA DE TENIS

## SUMMARY

1. ADAPTED SPORT: WHEELCHAIR TENNIS
2. ADAPTATIONS
  1. EQUIPMENT
  2. TECHNICAL-TACTICAL
3. HIGH PERFORMANCE IN WHEELCHAIR TENNIS
  1. TECHNICAL ADAPTATIONS
  2. TACTICAL ADAPTATIONS
  3. TRAINING SYSTEMS
4. PATTERN ACTIVITY IN WHEELCHAIR TENNIS
5. CONCLUSIONS



## 1. ADAPTED SPORT



ges.



## PLAYERS WITH SPINAL CORD INJURY:



## PLAYERS WITH TETRAPLEGIA(QUAD)



# THEORETICAL & PRACTICAL CONCEPTS RELATED TO WHEELCHAIR TENNIS

## AMPUTEE PLAYERS




Simple amputee



Double amputee


## WHEELCHAIR TENNIS

- RULES:
  - DOUBLE BOUNCE
  - WHEELCHAIR AS BODY
  - WHEEL-FOULT
  - FUNCTIONAL CLASSIFICATION
- COMPETITION
  - MAIN DRAW
  - SECOND DRAW
  - QUAD
- NEC WHEELCHAIR TOUR
- WTC
- PARALYMPICS



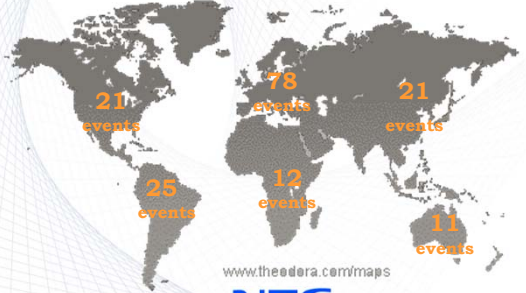
## NEC Wheelchair Tennis Tour

- Men, Women & Quad
- Grand Slams
- Super Series
- ITF 1 – Futures
- NEC Singles Masters
- Invacare Doubles Masters
- Prize Money – USD1.7m
- >170 tournaments in 46 countries



[www.itftennis.com/wheelchair](http://www.itftennis.com/wheelchair)



## NEC Wheelchair Tennis Tour (2011)



Region	Number of Events
North America	21
South America	25
Europe	78
Africa	12
Asia	21
Oceania	11

[www.theodora.com/maps](http://www.theodora.com/maps)  
[www.itftennis.com/wheelchair](http://www.itftennis.com/wheelchair)


## TENNIS VS. WHEELCHAIR TENNIS

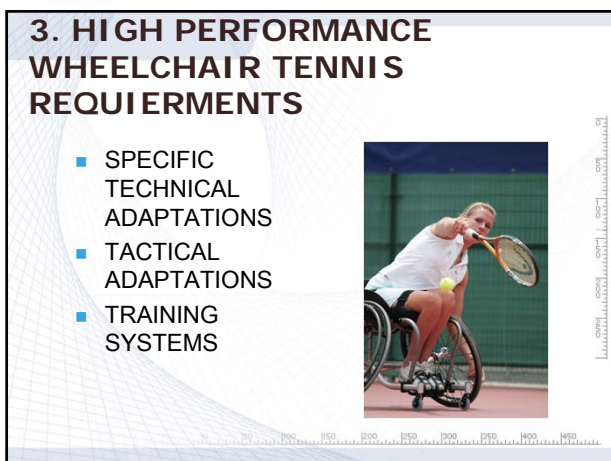
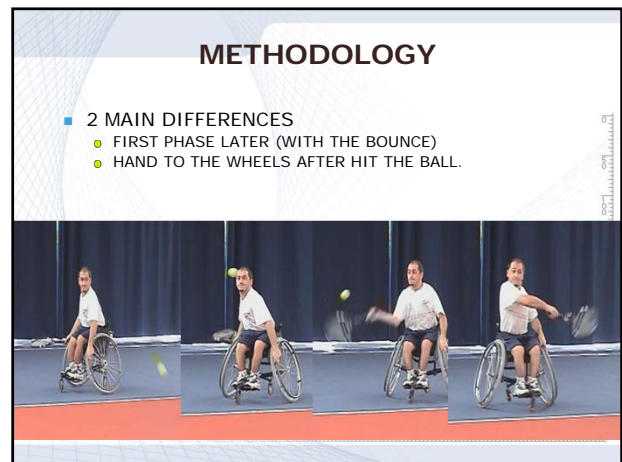
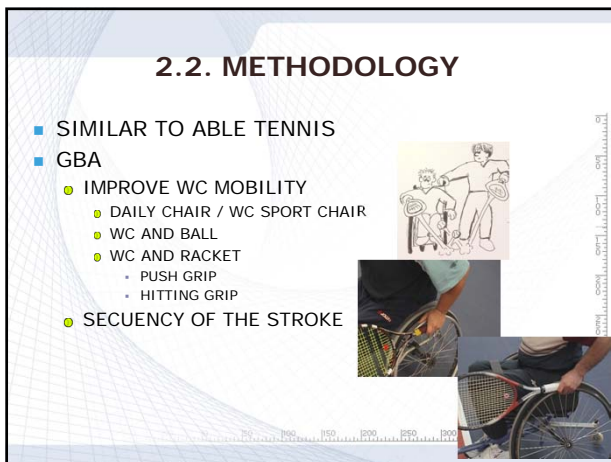
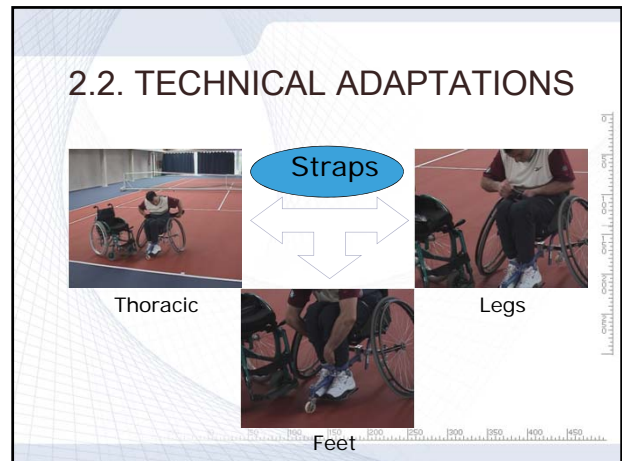
A lot of similarities, but WT has specific components T-T

## 2. ADAPTATIONS

- MATERIAL
  - SPORT WHEELCHAIR
- TECHNICAL
  - STRAPS
  - METHODOLOGY



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## CONVENTIONAL VS PRONATED

[www.ifftrns.com/wheelchair](http://www.ifftrns.com/wheelchair)

## 3.2. TACTICAL ADAPTATIONS

- KIND OF DISABILITY (LEVEL)
  - LEVEL OF MOBILITY
  - BALANCE
- TRAYECTORY PARAMETERS
  - DEEP
  - HIGHER
  - EFFECT
  - DIRECTION
- IINTERACTION WITH THE BALL
  - FIRST O SECOND BOUNCE

## 3.3. TRAINING SYSTEMS

- FEW DIFFERENCES RELATED ABLE TENNIS
- SPECIFIC TRAINING ABOUT WC MOBILITY
- SPECIFIC TRAINING FOR WC TENNIS STROKES
  - BALL INTO THE BODY
  - BH PRONATED
  - FH IN-OUT
  - ...
- TAKE CARE ABOUT THE OVERLOAD INTERNAL AND EXTERNAL

## 4. ACTIVITY PATTERN

- TENNIS IS A COMPLEX SPORT
  - TIME OF PLAY
  - SURFACES
  - WHEATER
  - PHASES WITH ALTERNACE BETWEEN HIGH/LOW NEUROMUSCULAR ACTIVITY, WITH DIFFERENT INVOLVEMENT OF LOWER AND HIGHER LIMBS
- ANALYSIS OF PATTERN ACTIVITY AND SPECIFIC WORK TO ADJUST LOAD TRAINING

## TENNIS COMPETITION RESEARCH

Knowledge about physiological profile of tennis seems to be to reasonable to design effective training programs.

↓

Previous research have describe the physiological demands of tennis trough HR, LA y VO<sub>2</sub>

↓

Needs to compare tennis vs wheelchair tennis

(Smekal et al., 2001;2003; Ferrauti et al., 2001; Elliot et al., 1985; Bergeron et al., 1991; Christmass et al., 1998)

## TOOLS TO CONTROL THE INTENSITY

- HR
- BLOOD LACTATE
  - RPE
  - VO2 MAX

# THEORETICAL & PRACTICAL CONCEPTS RELATED TO WHEELCHAIR TENNIS

## COMPARATIVE ANALYSIS TENNIS VS WHEELCHAIR TENNIS

## HR COMPARATION

FC Media	FC Máx	FC Media	FC Máx
140/160 lpm	190/200 lpm	125/135 lpm	160/170 lpm

Fernández et al (2006)  
Sanz et al (2003), (2006)  
Roy et al (2006)

## BLOOD LACTATE ANALYSIS ON COMPETITION

Intensity during a match  
*(Bergerson, 1991; Ferrauti et al., 2001; Smekal et al. 2001, 2003)*

↓

Singles =  $\approx 3$  mmol.L<sup>-1</sup>

Longer and faster rallies  $\approx > 6$  mmol.L<sup>-1</sup>  
*(Smekal et al., 2001; König et al., 2001)*

↓

> High influence of glucolytic anaerobic process.  
*(Smekal et al., 2001; Christmass et al., 1998)*

## BLOOD LACTATE ANALYSIS ON COMPETITION

Singles =  $\approx 2$  mmol.L<sup>-1</sup>

Longer and faster rallies =  $> 4$  mmol.L<sup>-1</sup>  
*(Sanz et al., 2005; Sanz et al., 2007)*

↓

> High influence of glucolytic anaerobic process.  
*(Smekal et al., 2001; Christmass et al., 1998)*

## PATTERN ACTIVITY IN THE COMPETITION

Variables which can modify the physiological response

↓

Activity Pattern  
*(WT, RT, ET)*  
Tactical  
*(defens vs ofens)*  
Game situation  
*(serve vs return)*

↓

Influence of (HR, LA, VO<sub>2</sub>)  
*(Smekal et al., 2001; Reilly & Palmer, 1983)*

## PHYSIOLOGICAL-PERCEPTUALS. DATA (RPE)

### TENNIS RPE

Average RPE  $13.0 \pm 2.1$   
 $11.0$  a  $14.7$  per match

### WC TENNIS RPE

Average RPE  $11.3 \pm 2.2$   
 $10.0$  a  $13.0$  per match

How was the exercise?

6
7 very very lighth
8
9 very lighth
10
11 lighth
12
13 some hard
14
15 hard
16
17 very hard
18
19 very very hard
20

# THEORETICAL & PRACTICAL CONCEPTS RELATED TO WHEELCHAIR TENNIS

## VO<sub>2</sub>MAX DURING A MATCH

VO <sub>2</sub> max	VO <sub>2</sub> max
23-29 ml/Kg	17-20 ml/Kg

Fernández et al (2006)  
Sanz et al (2003), (2006)  
Roy et al (2006)

## PATTERN ACTIVITY IN TENNIS

**Table 1** Notational analysis in tennis

Reference	Level (sex)	Rally time (s)	Effective playing time (%)	Work to rest ratio	Surface
O'Donoghue & Ingram*	International (M and F)	6.3 (1.8)	-	-	Hard
		7.7 (1.7)			
		4.3 (1.6)			
		5.8 (1.9)			
Smekal et al <sup>2</sup>	National (M)	6.4 (4.1)	16.3 (6.6)	1:3.4	Hard
Reilly & Palmer <sup>10</sup>	Top club-standard (M)	5.3 (1.0)	27.9 (3.9)	1:2.5	Hard
Christmas et al <sup>11</sup>	State (M)	10.2	23.3 (1.4)	1:1.7	Hard
Elliott et al <sup>2</sup>	College (M)	4.0-4.3	26.5 (3.5)	1:3.1	Hard
Girard & Miller*	Regional (M)	7.2 (1.7)	-	-	Clay
		5.9 (1.2)			
Docherty <sup>13</sup>	Range of abilities (M)	10.0	-	1:1.8	Hard
Fernandez et al <sup>14</sup>	International (M)	7.5 (7.3)	18.2 (5.8)	1:2.2	Clay
Weber et al <sup>2</sup>	National (M)	5.08	16.4	-	Hard
Kovacs <sup>16</sup>	International (M)	5.99	-	1:2.6	Hard

Values are mean or mean (SD).  
-, No study variable; \*young tennis players.

Fernandez, Mendez-Villanueva y Plum. *Br J Sports Med* 2006

## PATTERN ACTIVITY IN WHEELCHAIR TENNIS

**PATRÓN DE ACTIVIDAD**

	1	2	3
CHICOS	4,653333333	12,26666667	13,30333333
CHICAS	3,56	10,585	13,8

1 Nº GOLPES  
2 TIEMPO POR PUNTO  
3 TIEMPO DESCANSO ENTRE PUNTOS

Sanz, D. et al (2009)

## ACTIVITY PROFILE

Work (s)	Rest (s)	Ratio. W:R	SP (n)
7-5 (C) / 6,3 (H)	16,2	1:2,2 (C) / 1:2,6 (H)	2-3

Work (s)	Rest (s)	Ratio. W:R	SP (n)
± 10	± 13	1:1,2	3-4

Fernández et al (2006)  
Kovacs (2004)  
Sanz et al (2003), (2006)  
Roy et al (2006)

## ACTIVITY PROFILE

Filipic, T; Filipic, A. (2006) (2007)

Work (s)	Rest (s)	Parte Activa	SP (n)	Rallies	Nº Golpes
4,16	15	10,32 (19,68)	2,23	150	336

**Filipic Research**


## ACTIVITY PROFILE

Sanz et al., (2009, 2010)

Nº STROKES	POINTS	TIME PLAY (%)	SB (%)
2231	535	19,83	51,25


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## MORE NOTATIONAL RESEARCH



A person dressed as a green mascot is sitting on a tennis court, using a laptop to analyze data. This illustrates the application of notational research in wheelchair tennis.

SAMPLE	CATEGORY	EVENT	YEAR
27 MATCHES 14=TIERRA BATIDA 13=GREEN SET	SINGLE MEN	ROLAND GARROS & OPEN USA	2010 & 2011



US OPEN  
A USTA EVENT

ROLAND GARROS  
PARIS


Sanchez, A. et al. (2013)

## CONCLUSION OF THIS STUDY

- HIGHER TIME OF PLAY IN SLOW SURFACES
- FIRST SERVE MORE POWERFUL IN HARD SURFACES
- MORE NUMBER OF POINTS WON TO THE RETURN GAME SITUATION IN SLOW SURFACES

## GAME SITUATIONS ANALYSIS IN WHEELCHAIR TENNIS

- WC TENNIS EVOLUTION:
  - LOWER NUMBER OF STROKES PER RALLY (3-4)
  - HIGHER NUMBER OF FIRST BOUNCE INTERVENTION
    - 2<sup>o</sup> BOUNCE ??
  - HIGHER SPEED IN SERVICE PRODUCTION
  - FUNCTIONAL CLASSIFICATION ??



## PRACTICAL TRAINING PROPOSAL



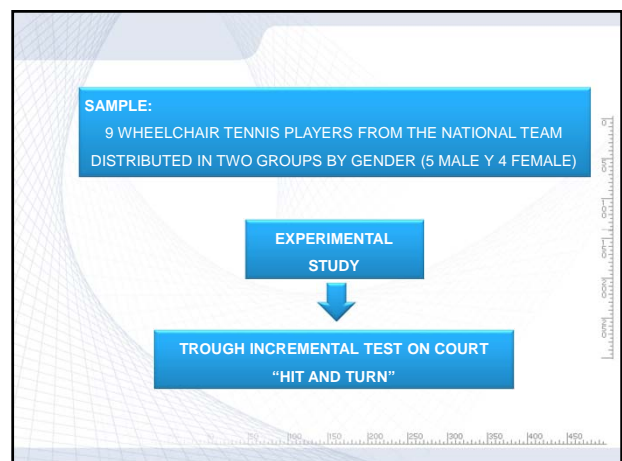
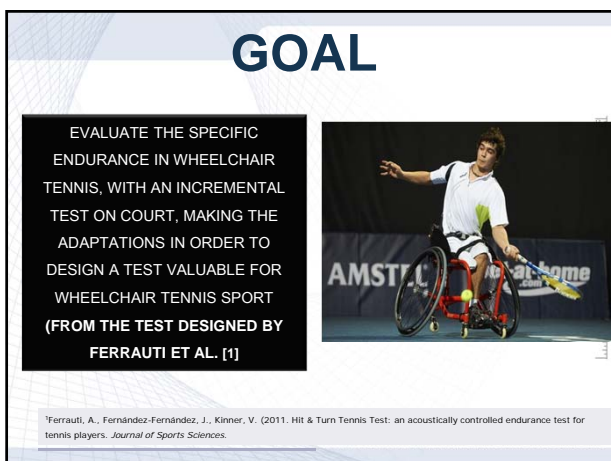
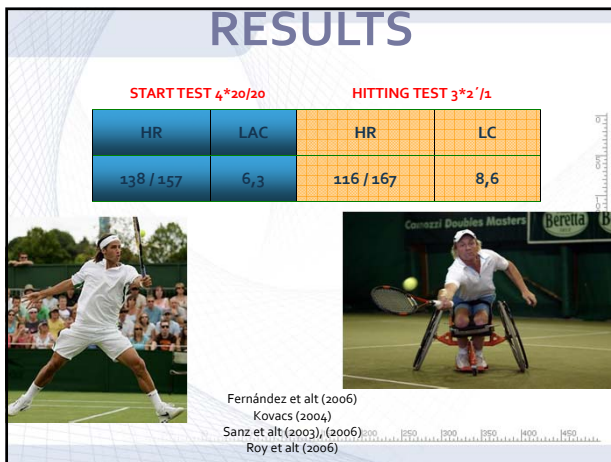
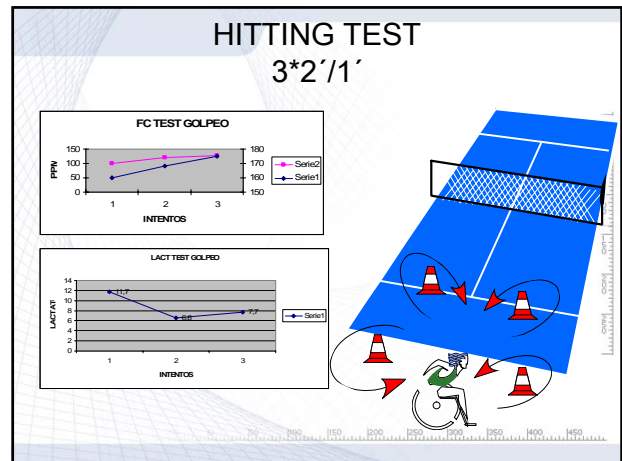
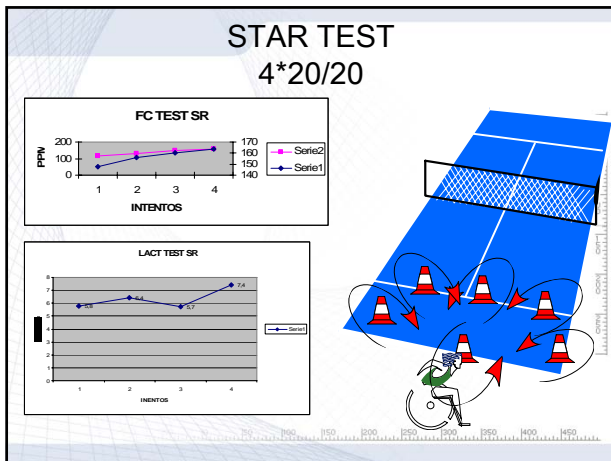
Two images of wheelchair tennis players in action on a clay court. One image shows a player in a blue shirt, and the other shows a player in a black shirt.

## TEST

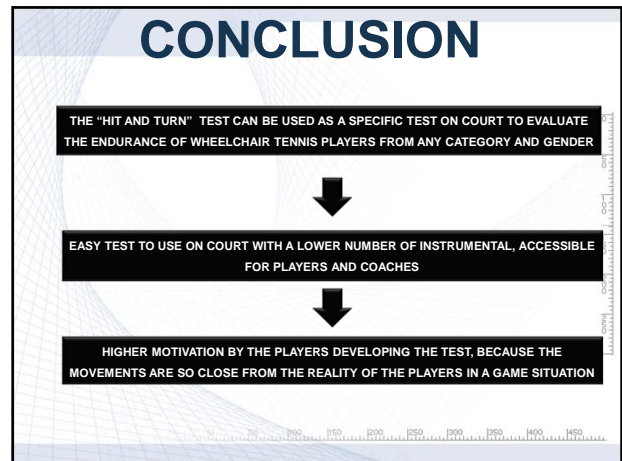
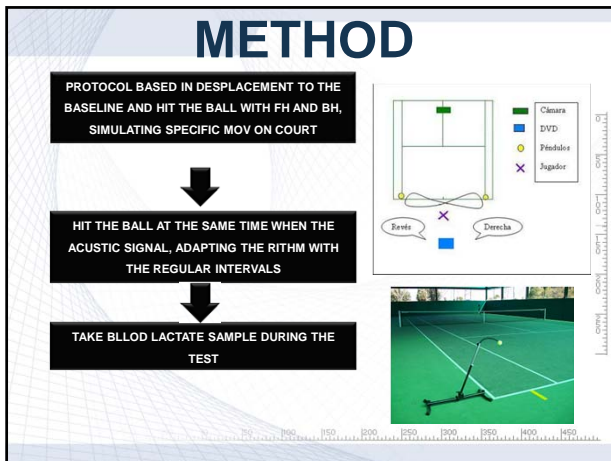
- INTERVALIC INTERMITENT
  - START TEST
    - WITHOUT BALL
  - HITTING TEST
    - WITH BALL




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## 5. CONCLUSIONS

- Wheelchair tennis sport is an **intermittent anaerobic sport** with aerobic recovery phases
- Very close** with able tennis
- We need to **adapt the training systems** to the real play time in wheelchair tennis competition.
- We have to **control the pattern activity** and register the intensity of the game play.
- The **main sources** system to provide energy are the **aerobic and alactic anaerobic pathway**.
- Pay attention to the prevention with the core stability and cuff rotators in shoulders.
- We need much more **research!!**

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THANKS FOR YOUR ATTENTION

RFET REAL FEDERACIÓN ESPAÑOLA DE TENIS