



ITF Coaches Education Programme

Coaching High Performance Players Course

Power and the Tennis Serve.

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A Powerful Serve – A Key Ingredient of Successful Tennis Performance



Preparation

OBSERVE

Relaxation of facial muscles → Relaxation throughout the body.

As tossing action begins weight more on the back foot.

Front toe pointed to the side or angled to the baseline**.



**Turning of the toe (normally pivoted about the heel of the foot)

← Adequate rotation

→ Reduce stress on the front knee

Ball Toss

“Straight forward and up”

Krajicek, Rusedski

“Rotary style”

Sampras, Agassi



Toss position in front and marginally to the left of the front foot at impact.

- ***Effective development of racket-speed near impact.***
- ***Individual player preference and type of serve will alter this location between marginally to the left, to marginally to the right of the front foot.***

(Chow, 1999; Elliott, 2002)





Full backswing (Henman)

VS.

Abbreviated take-back (Rafter)



- Individual characteristic
- Full backswing may provide better rhythm and reduced load on the shoulder

	Distance into court with 1st step (cm)	Height off ground at impact (cm)	Impact position relative to standing height
Foot-up technique	46.0	7.2	1.54
Foot-back technique	60.0	3.4	1.48

FOOT UP vs. FOOT BACK - A matter of style

Foot-up ➡ greater vertical force ➡ higher impact position ➡ better up-and-out trajectory

Foot-back ➡ larger horizontal force ➡ more rapid movement to the net.

(Elliott et al, 1986)



Backswing

COACHES CAN OBSERVE:

- Full extension of tossing arm with shoulders tilted.
- Drive of lead hip forward.
- Elbow position such that upper arm is aligned with the shoulders



Preparing to launch



Philippoussis v Ivanisevic



Philippoussis v Hsieh



Leg Drive

Effective leg drive and trunk rotations



Distance between racket and body



- Muscles on stretch
- Long acceleration path for racket



(Elliott et al, 1999; Bahamonde, 1997)





(Bahamonde, 1997)

Internal Rotators

Stop

External Rotation

JOINT POWER

	Near max. Ext. Rot.	Ext. Rot. to impact
Upper Arm Int (+) /Ext (-)	-220	1154
Hand Flex (+) / Ext (-)	-4	214



COACHES CAN OBSERVE:

- Body is driven off the ground for impact
- The racket is 'driven' away from, and behind the back

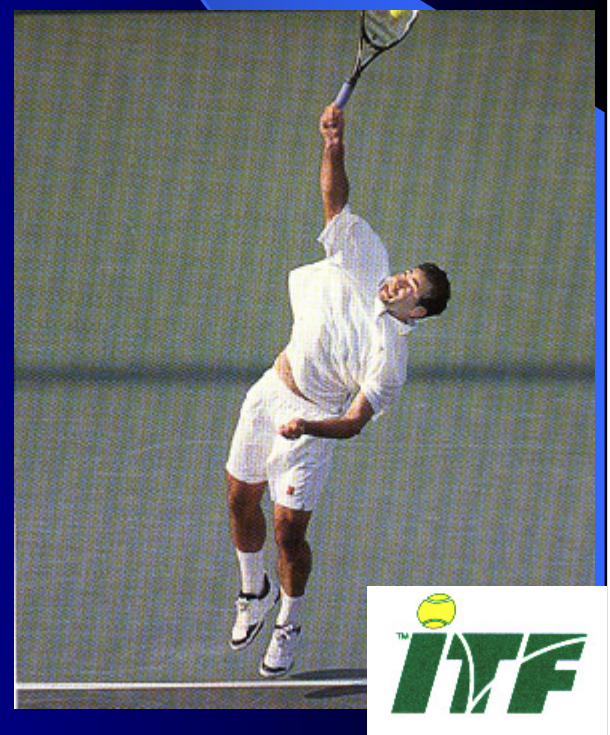
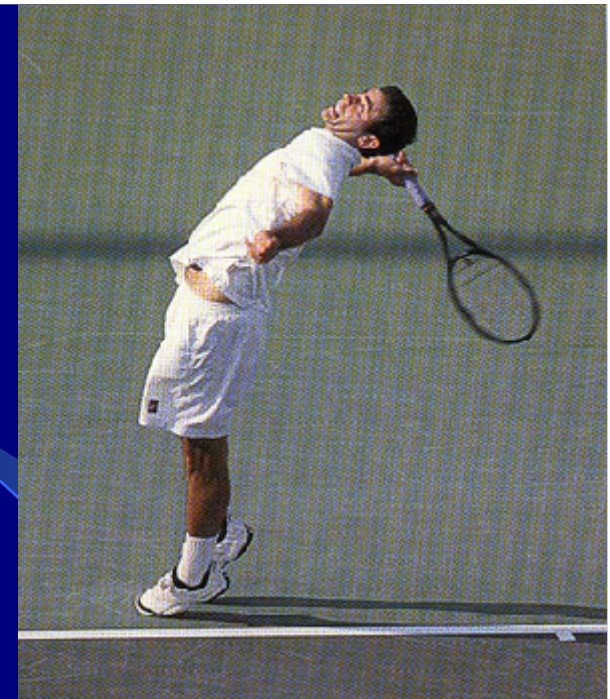
TRAINING TIP:

High shoulder and elbow joint loads



The need to train muscles about the shoulder girdle (latissimus dorsi, pectoralis major and subscapularis).

(World Class Tennis Technique, 2001)



Swing to Impact

The key to an effective serve



RHYTHM

Sequence of coordinated movements



RACKET-SPEED

IMPACT HEIGHT

RACKET TRAJECTORY

2 KEY DIFFERENCES between elite and lesser level players:

- Speed of rotation of the hitting arm
- Impact height



(Bartlett et al, 1995)

Optimal Racket Speed

(Kinetic or Kinematic Chain)

<u>Segment Rotation</u>		<u>Joint Moved</u>	<u>Contribution to Racket Speed at Impact</u>
Leg Drive and Trunk Rotation	→	Shoulder	10% - 20%
+			
Upper arm Horizontal Movement Forward and Away	→	Elbow	15% - 25%
+			
Forearm Pronation	→	Wrist	5% - 10%
+			
Forearm Extension	→	Wrist	≈ -10%
+			
Upper arm internal rotation	→	Wrist/Racket	≈ 40%
+			
Hand flexion	→	Racket	≈ 30%
+			
Hand flexion (side)	→	Racket	Negligible



(Elliott et al, 1995; Leganani, 1997; Van Gheluwe et al, 1997)



Trunk rotation to impact



TRUNK ROTATION IN 3 PLANES OF MOTION

TRANSVERSE

About long axis of body



Minor role, helps drive racket
backwards

FRONTAL

Shoulder-over-shoulder
(Cartwheel)



Produces momentum for and
prepares body for impact

SAGITTAL

Forward rotation (Somersault)



Allows player to produce momentum
that is shifted from trunk → racket → arm

(Bahamonde, 2000)



Trunk/Shoulder rotation related to impact location

Total Body Angular Momentum

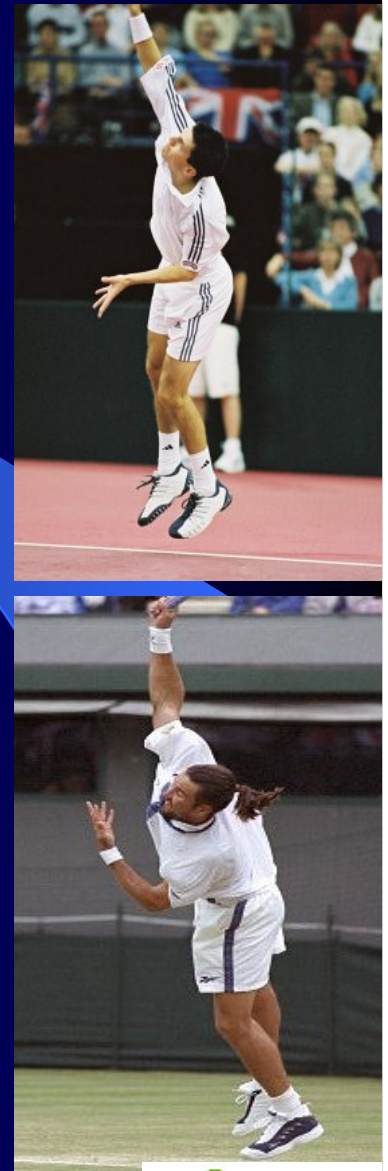
	RACKET AT LOWEST POSITION TO MAX EXT ROT	MAX EXTERNAL ROT TO IMPACT
Forward	28	30
Sh over Sh	4	0.5
Twist	0	-1.5

NOTE:

- Large Forward Rotation
- Contribution of shoulder-over-shoulder **

**** Differentiated FAST v SLOW Servers**

- Minimal Twist



(Bahamonde, 2000)



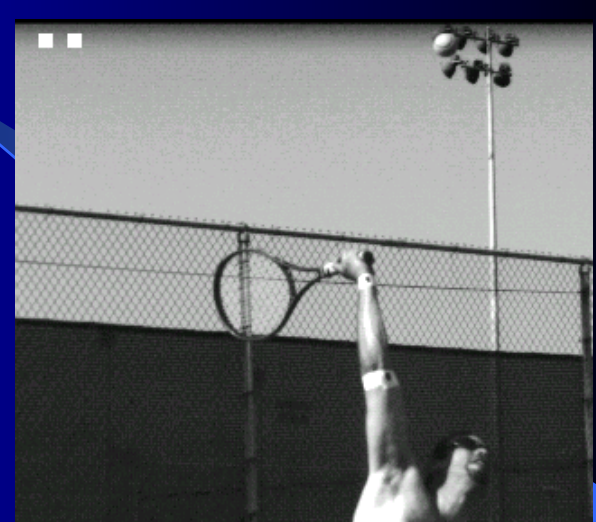
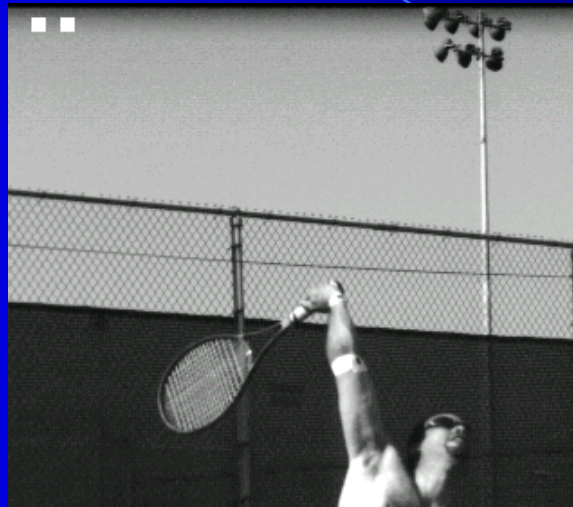
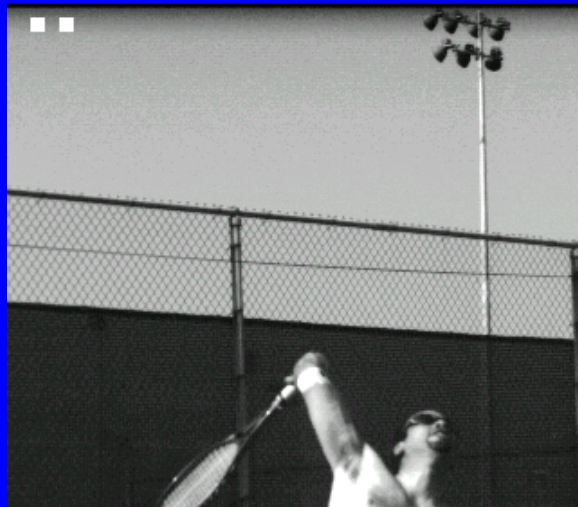
Shoulder-Over-Shoulder Rotation



Philippoussis v Sampras



APPRECIATING THE IMPORTANCE OF INTERNAL ROTATION



WRIST ACTION FOLLOWING INTERNAL ROTATION

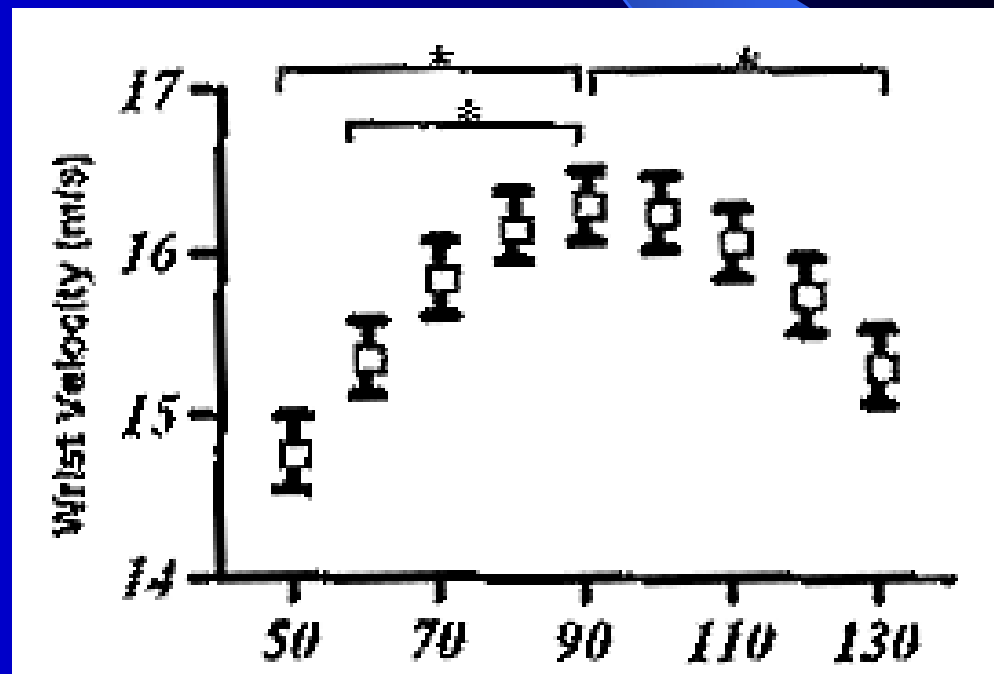
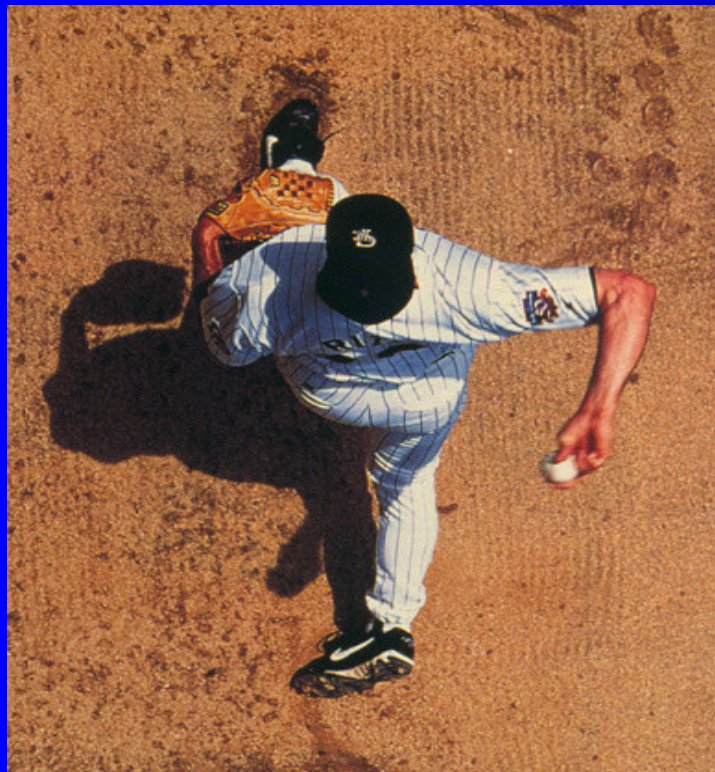


Throwing

Shoulder Angle and Performance

Professional Japanese Pitchers

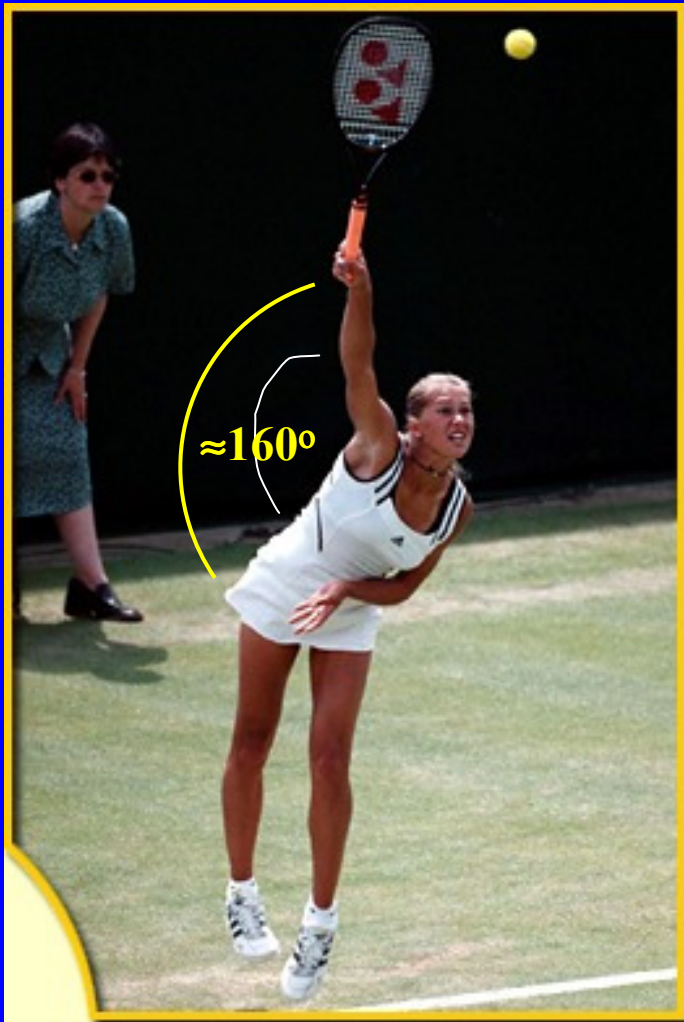
***Optimal Shoulder Angle for
Maximal Ball Velocity + Minimal
Stress $\approx 100^\circ$***



(Matsuo et al., 2000)

Impact Alignment of Upper Limb-Trunk

INCORRECT



CORRECT



The Serve: Impact Ball Locations – First Serve

(4 Females; 5 Males: Atlanta Olympics – Centre and Wide Serves (m))

	Females		Males	
	1st	2nd	1st	2nd
In-Front	0.8/0.8	0.5	0.8/0.8	0.6
Vertical	2.6/2.6	2.7	2.8/2.7	2.7
Side-to-side	-0.2/-0.2	-0.1	-0.2/-0.2	-0.6

Ball traveled FORWARD and LEFT
Related to LEFT TOE



(Chow et al, 1999)

The importance of an up-and-out hitting action

Height	108 km/h	145 km/h	180 km/h
2.03m	1.9°	0.6°	0.0°
2.54m	2.6°	1.4°	0.8°
3.05m	3.5°	2.1°	1.6°



Elite players impact the ball after it has begun to drop (2.5-20.0 cm).



Forward Rotation (topspin)

(Brody, 1987)



The weight of a serve!

Rusedski vs Sampras

- *Similar serve speed $\approx 117/118$ mph*
- *Same initial spin rates ≈ 2500 rpm*
- *Different initial angle of rotation*



(Yandell et al., 2002)



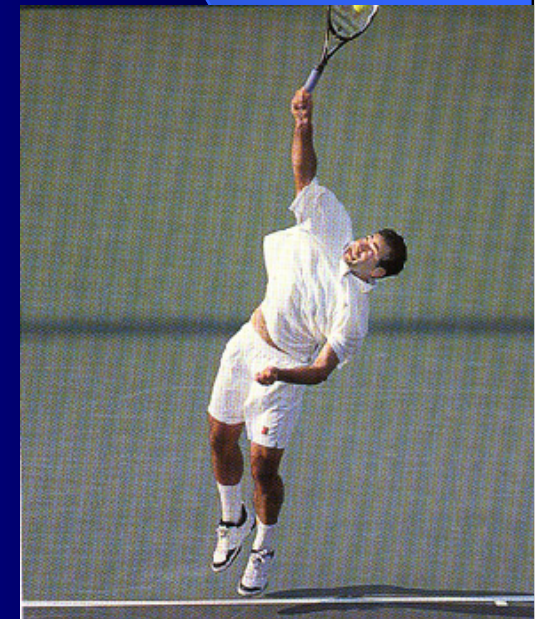
Ball flight (cm)

PLAYER	Average Contact Height	Range of Net Clearance	Average Net Clearance	Height Range at Ret/BL	Average Height at Ret/BL
SAMPRAS	282.5	12.5 – 27.5	17.5	125 - 145	135
RUSEDSKI	282.5	12.5 – 22.5	17.5	117.5 – 132.5	125

- Sampras higher topspin component
- At return – Sampras serve 500 rpm more & 10-30cm higher



(Yandell et al., 2002)



First v Second Serve (4M & 4F Professionals)

Racket Velocities (m/s)



	1st		2nd	
	M	F	M	F
Forward	34	28	32	25
Up	17	13	19*	13
Side-to-side	-3	0	2	7
Resultant	39	31	38	29
Post-impact	27	22 ($\approx 70\%$)	27	21

(Brody, 1987)



Initial continued internal rotation of the upper arm and forearm pronation.



Minimize stress

*Follow
through*

Left foot landing

- Leg drive, shoulder-over-shoulder and forward trunk action + impact location
- 95 % of professionals land on front foot

“Kick-back” → reaction force

“Kick out” (Williams example)



(World Class Tennis Technique, 2001)



Thank you
Any questions?

