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APPENDIX A

TENNIS RESEARCH PROJECT QUESTIONNAIRE

A Biokinetic Approach to the Prevention and Rehabilitation of Shoulder Injuries in Tennis Players

First Name

Surname

ID **Age** **Gender** Male Female

Tel

Medical History

1. Have you ever had any bone or muscle injuries before? **Yes** **No**

⇒ If yes, what kind of injury: _____

_____ Date: _____

2. Do you currently suffer from any kind of injury? **Yes** **No**

⇒ If yes, what kind of injury? _____

3. Have you ever had any operations done before? **Yes** **No**

⇒ If yes, what kind of operation? _____

⇒ Date of operation / /

4. Do you suffer from asthma? **Yes** **No**

5. Do you suffer from epilepsy? **Yes** **No**

Tennis History

1. At what age did you start playing tennis?
 2. At what age did you start playing serious competitive tennis?
 3. How long have you been at the Center of Excellence or ITF? _____
 4. In the last year, how many hours did you spend on the court a day?
 5. In the last year, how many days did you play tennis a week?
 6. Have you ever trained in a gym before? **Yes** **No**
 7. Have you ever followed fitness programmes on-court? **Yes** **No**
 8. What tension is your racquet strung? _____
-

Purpose of the research: This study is submitted in fulfillment of the degree DPhil (Biokinetics) (Doctoral degree). The results of this research will be used to develop conditioning programmes for tennis players that will help to minimize the occurrence of injuries during the year and therefore maximize performance of the tennis player. Also, the rehabilitation programme aims to get the injured player back on court as quickly as possible!

Conditions of the research:

- It will be expected of the participants to stay on the training programme for the duration of nine months;
- All participants will complete 3 Scientific Fitness Tests in 3-monthly intervals;
- It will be expected from the participants to co-operate with the Biokineticists in charge of the study;
- The training programmes will be incorporated into the normal training schedule at the Center of Excellence and the ITF. The experimental group will have 3 additional training sessions of 20 minutes a week for specific shoulder strengthening exercises.

I, _____, agree to take part in the research

project according to the above mentioned conditions.

Signature: _____

Date: _____

APPENDIX B

POSTURAL ANALYSIS for TENNIS PLAYERS

NAME _____ DOM TENNIS HAND: R L

1. Shoulder height:

Level Right high Left high

2. Hip height:

Level Right high Left high

3. Scapula:

Symmetric R- prominence L- prominence

4. Kifosis:

Normal Severe

5. Lordosis:

Normal Severe

6. Scoliosis:

• **Visual:**

Convecs to left Convecs to right

• **Thoracic spine motion: (Schrober)**

< 5cm 5cm >5cm

FLEXIBILITY

1. Shoulder Internal Rotation:

R _____ L _____

2. Shoulder External Rotation:

R _____ L _____

3. Shoulder flexion:

_____cm

4. Shoulder Extension:

_____cm

FUNCTIONAL STRENGTH

1. Maximum Push-ups in 1 minute: _____

2. Grip Strength:

R _____ L _____

ISOKINETIC STRENGTH

1. Shoulder flexion/extension:

2. Shoulder internal/external rotation

3. Shoulder abduction/ adduction

APPENDIX C

TESTING PROFORMA

- 1. Questionnaire**
- 2. Postural analysis**
- 3. Body Composition**
 - Height
 - Weight
 - Fat percentage
 - a. Skinfolds:**
 - *Biceps:*
 - *Triceps:*
 - *Subscapula:*
 - *Supra iliac:*
 - *Para umbilicus:*
 - *Medial thigh:*
 - *Calf :*
 - b. Girths:**
 - *Biceps relaxed:*
 - *Biceps flexed and tense:*
 - *Fore arm girth:*
 - *Wrist girth:*
 - *Chest girth:*
 - *Waist girth:*
 - *Hip girth (Gluteal):*
 - *Thigh girth*
 - *Calf girth:*
 - *Ankle girth:*
 - c. Obtaining Breadths:**
 - *Biacromial breadth:*

→ **Transverse chest width:** excursion (end tidal).

→ **Biiliocrystal breadth:**

→ **Anterior/posterior chest depth:**

→ **Humerus width:**

→ **Femur width:**

4. Flexibility

a. Shoulder internal and external rotation:

b. Shoulder flexion and extension:

5. Functional strength

→ **Maximum push-ups in 1 minute:**

6. Isokinetic strength

→ **Shoulder flexion & extension:**

60°: 3 Warm-ups @ 50%, 75% and 100% respectively;
5 maximal efforts recorded.

180°: 3 Warm-ups @ 50%, 75% and 100% respectively;
20 maximal efforts recorded

→ **Shoulder abduction & adduction:**

60°: 3 Warm-ups @ 50%, 75% and 100% respectively;
5 maximal efforts recorded.

180°: 3 Warm-ups @ 50%, 75% and 100% respectively;
20 maximal efforts recorded

→ **Shoulder internal & external rotation:**

60°: 3 Warm-ups @ 50%, 75% and 100% respectively;
5 maximal efforts recorded.

180°: 3 Warm-ups @ 50%, 75% and 100% respectively;
20 maximal efforts recorded

APPENDIX D**SHOULDER STRENGTHENING PROGRAMME**

EXERCISE	Reps	Sets	Weight
1)Bench Press / Dumbell Bench Press	10-12	3	
2)Dumbell side raises (fast up & slowly down)	10	3	
3)Dumbell / barbell biceps curls (slowly down)	10	3	
4)Lie on back on bench: Straight arm flexion & extension with dumbell	10	2	
5)Wrist deviation (thumb up – flex hand up & down	12	2	
6)Arm 90° horizontal in front: rotate arm in and out	12	2	
7)Wrist Curls	12	2	
8)Reverse wrist curls	12	2	
9)Triceps push down / Dips	10-15	3	

ELASTIC BAND PROGRAMME

EXERCISE	Reps	Sets	Weight
Protraction: Straight arm in front-push shoulder forward (elastic behind you)	15	2	
Retraction: Straight arm in front-pull shoulder back (elastic in front of you)	15	2	
90° shoulder rotation: (work in both directions)			
• elbow against side: rotate hand in & out	10/1	2	
• elbow beside shoulder – rotate hand up & down	0	2	
• elbow in front of shoulder – hand up & down	10/1	2	
	0		
	10/1		
	0		
Biceps curls (slowly down)	12	2	
Triceps extension	12	2	
Front raises	12	2	
Face the elastic-palm back – push straight arm back	12	2	

APPENDIX E ADDITIONAL FLEXIBILITY EXERCISES

b. Hip and leg stretches:

i) **Figure 4 hamstrings stretch:** (Figure 62)

Focus: Hamstrings:

Start: Sit with one leg stretched out in front with the knee straight and the toes pointing upwards. Bend the other knee and place the sole of the foot against the knee of the straight leg.

Action: Keep the back erect and the knee as straight as possible while you reach forward with both hands trying to touch the toes (Burnham *et al.*, 1993; Roetert & Ellenbecker, 1998).

ii) **Hamstring stretch:** (Figure 63)

Focus: Hamstrings and gluteal muscles

Start: While lying on your back, bend the leg that you want to stretch to 90° at the hip. Support the bent leg by grasping both hands behind the knee, keeping the opposite leg straight.

Action: Straighten the lifted leg and raise it towards the trunk. The hands can be used to gently increase the stretch. Also, to increase the stretch, point the toes towards the face (Roetert & Ellenbecker, 1998).

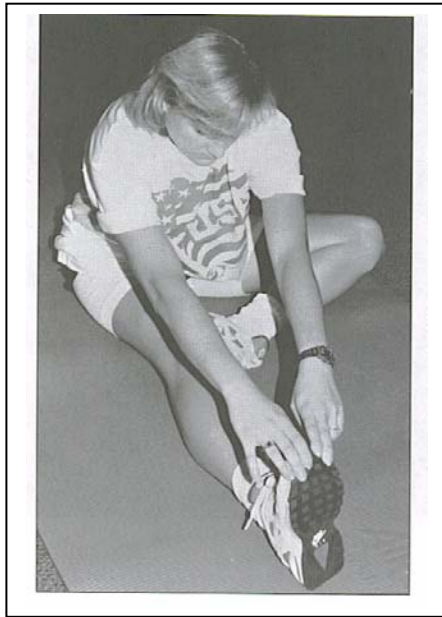


Figure 62: Figure 4 hamstrings stretch.

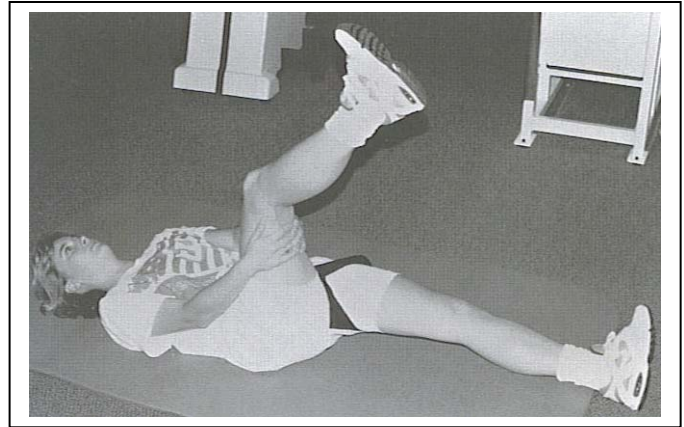


Figure 63: Hamstring stretch.

iii) Hamstring super stretch: (Figure 64)

Focus: Hamstrings and calf muscles.

Start: Place the one leg on an object approximately waist height.

Action: In a slow and smooth motion bend forward at the waist, bringing your trunk toward your thigh. Bending the toes toward your face will increase the stretch (Burnham *et al.*, 1993; Roetert & Ellenbecker, 1998).

iv) Stork quadriceps stretch: (Figure 65)

Focus: Quadriceps and the hip flexors

Start: Stand on one leg. Bend the opposite knee and grasp the foot or ankle.

Action: Keep the back straight and buttocks tucked in. Bend the knee and bring the foot toward the buttocks until the knee points toward the floor. Take care not to twist the knee (Roetert & Ellenbecker, 1998).

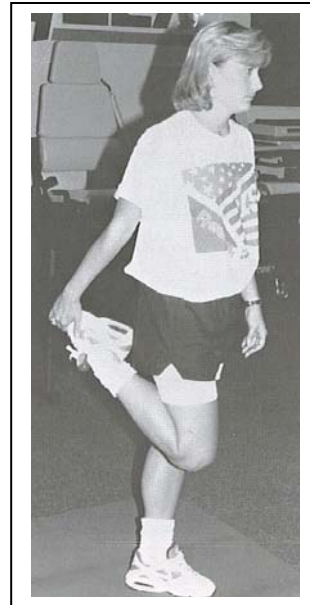
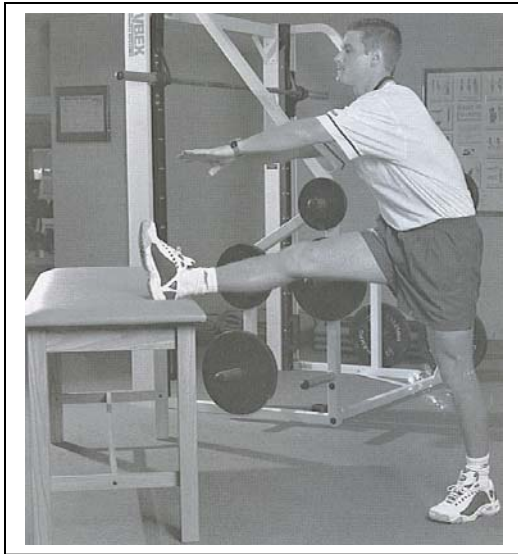


Figure 64: Hamstring super stretch.

Figure 65: Stork quadriceps stretch.

v) ***Prone quadriceps stretch:*** (Figure 66)

Focus: Quadriceps and hip flexors.

Start: Lie flat on your stomach.

Action: Bend one knee to bring the foot toward the buttock and grasp the foot or ankle with the hand on the same side of the body. Pull the foot directly toward the buttock without twisting the knee (Roetert & Ellenbecker, 1998).

vi) ***Groin stretch:*** (Figure 67)

Focus: Groin and the inner thigh muscles.

Start: Stand with your feet shoulder width apart and with your hands on your hips.

Action: With the toes pointing slightly outwards, slowly bend the one knee until you feel a stretch in the groin. Roll your weight slowly to the inside of the opposite foot (Burnham *et al.*, 1993; Roetert & Ellenbecker, 1998).

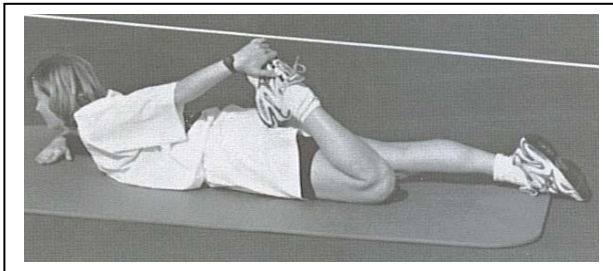


Figure 66: Prone quadriceps stretch.

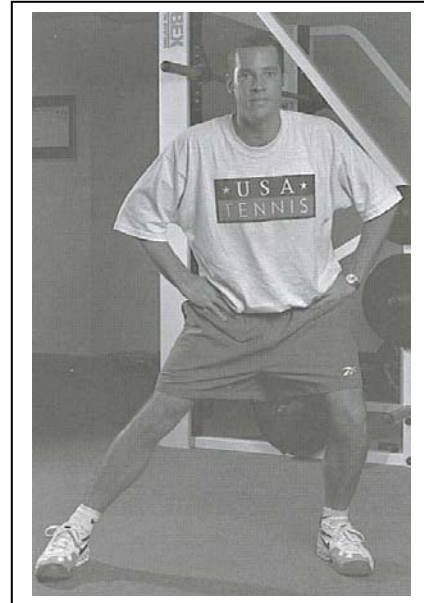


Figure 67: Groin stretch.

v) **Seated groin stretch:** (Figure 68)

Focus: Groin and the inner thigh muscles

Start: Sit with the soles of your feet touching each other, knees pushed outwards with your hands holding your toes.

Action: Bending from the hips, pull yourself forward, bringing the chest to the feet. Keep the back straight and gently push the knees toward the ground with your elbows (Roetert & Ellenbecker, 1998).

vi) **Hip twist:** (Figure 69)

Focus: Lateral hip muscles and the lower back.

Start: Lie on your back with knees bent and feet flat on the floor. Place the arms outwards at the side in order to stabilize the upper back.

Lift the left leg and place the left ankle on the outside of the right knee.

Action: Use the left leg to pull the right leg toward the floor until you can feel a stretch along the outside of the hip or lower back. The upper back and shoulders must remain flat on the floor at all times. The right leg should not touch the floor, but be stretched within your limits (Burnham *et al.*, 1993; Roetert & Ellenbecker, 1998).

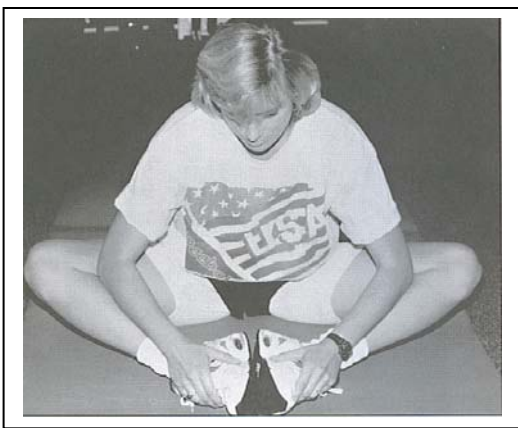


Figure 68: Seated groin stretch.

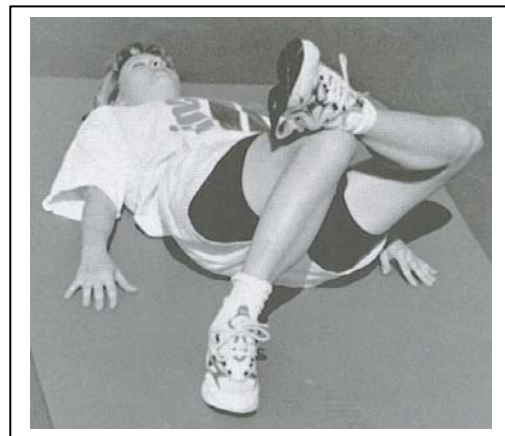


Figure 69: Hip twist.

vii) Piriformis stretch: (Figure 70)

Focus: Piriformis muscle

Start: Lie on your back with the left leg bent and the right ankle resting just above the left knee.

Action: Keeping the right knee pointing outwards, slowly bring the left knee toward the chest. You should feel the right buttock stretching (Roetert & Ellenbecker, 1998).

viii) Iliotibial band stretch: (Figure 71)

Focus: Iliotibial band

Start: Stand with your right hand against the wall, the right leg approximately 1 meter from the wall and the left leg crossed over the right leg.

Action: Gently start pushing the right hip toward the wall. In order to intensify the stretch, you could stand further away from the wall (Burnham *et al.*, 1993; Roetert & Ellenbecker, 1998).



Figure 70: Piriformis stretch.

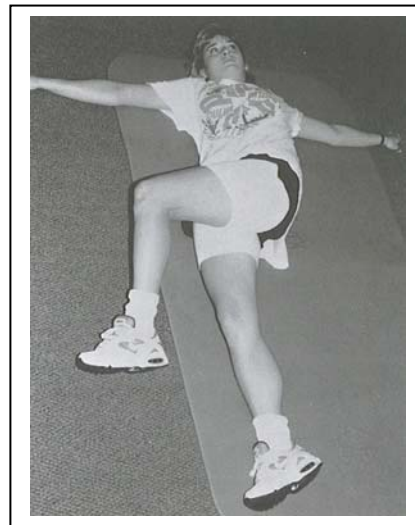


Figure 71: Iliotibial band stretch.

ix) Calf stretch: (Figure 72)

Focus: Gastrocnemius and soleus.

Start: Stand facing a wall or fence with one leg 0.5 to 0.75m behind the other with all the toes pointing forward.

Action:

- Bend the front knee and lean forward with the trunk and hips, keeping the back leg straight, the heel on the floor and the back erect.
- Repeat the stretch as for (a) but bend the back knee slightly, keeping the heel on the floor (Roetert & Ellenbecker, 1998).

c. Trunk stretches:

i) *Knee to chest flex:* (Figure 73)

Focus: Lower back and gluteal muscles

Start: Stand upright with your feet shoulder width apart.

Action: Bend the one leg and grasp the lower leg below the knee. Keeping the back straight, slowly pull the knee to the chest (Roetert & Ellenbecker, 1998).

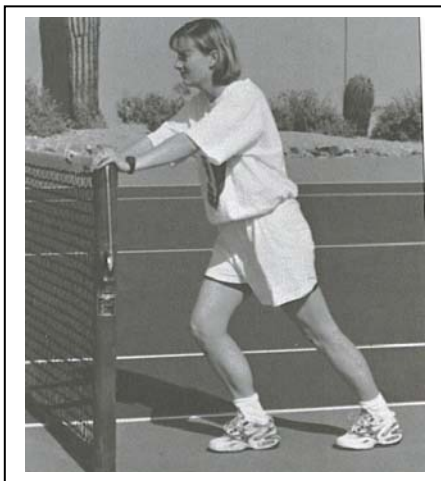


Figure 72: Calf stretch.

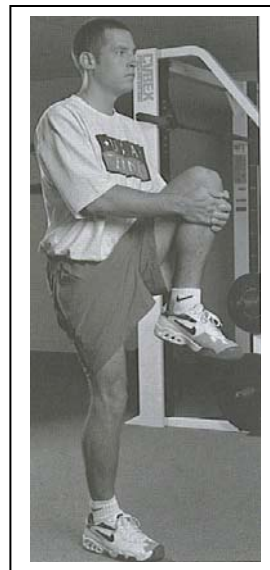


Figure 73: Knee to chest flex.

ii) *Double knee to chest flex:* (Figure 74)

Focus: Lower back and gluteal muscles.

Start: Lie on your back with both knees bent.

Action: Grasp the lower legs just below the knees and bring the knees toward the chest (Burnham *et al.*, 1993; Roetert & Ellenbecker, 1998).

iii) Spinal twist (Figure 75):

Focus: Lower back and hip rotators.

Start: Sit with the left leg slightly bent in front of you. Place the right ankle on the outside of the left knee.

Action: Place the left arm around the right knee and then slowly turn the shoulders and the trunk to the right. Look over the right shoulder (Roeter & Ellenbecker, 1998).



Figure 74: Double knee to chest flex.



Figure 75: Spinal twist.