A Core Stabilization Training Program for Tennis Athletes

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THE CORE INCLUDES the lumbopelvic-hip joint complex and its surrounding musculature, which function synergistically to produce force, reduce force, and provide dynamic stabilization throughout the kinetic chain.[1] The quality of these actions during functional movements requires optimal neuromuscular efficiency and control.[2] Mechanoreceptors provide the central nervous system with proprioceptive feedback necessary to maintain normal length-tension relationships in muscles (neuromuscular activation pattern), which create force couples that act through the osteoligamentous elements of the spine (inner core musculature activated prior to outer core musculature).[3] This facilitates maintenance of optimal arthrokinematics in the lumbopelvic-hip complex during functional kinetic chain movements, optimal neuromuscular efficiency throughout the entire kinetic chain, optimal acceleration and deceleration, dynamic stabilization of entire kinetic chain during functional movements, and proximal stability for efficient lower extremity movements.[1]

Core stabilization is an essential component of any athlete's total fitness, but it may be particularly important for tennis players. Tennis is not a one-dimensional game; players are constantly shifting their bodies from side to side or rotating their bodies toward the ball.[4] One aspect of tennis strategy requires the player to keep the opponent running and off-balance, hence making many directional changes during a match.[5] Core strengthening and stabilization training helps to increase functional strength and dynamic balance, thereby promoting tennis performance.[1,5,6] Core muscle activation has been documented during performance of specific tennis techniques, such as the forehand drive and volley and during serves and overhead shots.[5] The purpose of this report is to outline a core stabilization program that is specific to tennis.

Development of a Core Stabilization Program

Because there is no universally-accepted program for promotion of core stabilization, optimal exercises and training parameters that should be used are unknown.[7] According to McGill,[8] a justifiable approach to enhancement of lumbar stability involves abdominal co-contraction and muscular bracing in a functional manner. Brandon[9] adds that core stability training should be conducted in a manner that effectively recruits the trunk musculature, while maintaining control of the lumbar spine during dynamic movements. Gambetta[10] has suggested that the more the training environment replicates the functional demands of a particular sport, the more versatile the athlete will be in handling the stresses imposed by the actual sport activity. Exercises should be focused on motor control, with emphasis on neutral spine posture and contraction of the transverse abdominus, multifidus, and pelvic floor muscles. The exercises should be initially performed with low-level tonic contractions and gradually progressed to co-contraction of the entire core musculature during performance of functional tasks.

Traditional rehabilitation focuses on absolute strength gains in isolated muscles and in a single plane of motion. Because functional sports movements are multidirectional, athletes need to strengthen hip and trunk muscles to provide dynamic stability in all three planes of motion.[1,11] Clark et al.[1] proposes that all functional activities are triplanar, which require specific muscle activation patterns for acceleration, deceleration, and dynamic stability. A uniplanar movement also requires dynamic stabilization of the kinetic chain to retrain extraneous movements in the other planes for optimal neuromuscular efficiency. Pelvic positioning, rib cage positioning, and proper patterns of neuromuscular recruitment should be addressed by a core stabilization program.[12]

The body mechanics and performance strategies utilized in tennis are widely known.[13,14,15] The available research pertaining to optimal methods for core stabilization training of tennis players, however, is minimal. Only one study has supported the use of a specific core stabilization program for athletes. Swaney and Hess[16] reported beneficial effects on the posture of swimmers after completing a nine-week core stabilization training program, implemented two times per week using the National Academy of Sports Medicine's standard core stabilization exercises. Jeffreys[17] has suggested a systematic progressive approach to the introduction of core stabilization exercises in athletes. Based on the techniques of Swaney and Hess and those of Jeffreys, a core stabilization program for tennis players has been created by the authors. Although these exercises are believed to produce the desired effect of improved core stabilization, the degree of program effectiveness has not been systematically evaluated.

Exercise Selection

A systematic literature review was performed for exercise selection, with the inclusion criteria specified as any type of study that used the key words of core, stabilization, and/or strengthening. A general protocol was derived from consistent findings of the reviewed studies,[7-10,15-19] while using Jeffreys[17] categorization of progressive core exercises as a guide in exercise selection. Five exercise program levels consist of (a) mastery of core contraction, (b) static holds and slow movements in a stable environment, (c) static holds in an unstable environment and dynamic movement in a stable environment, (d) dynamic movements in an unstable environment, and (e) resisted dynamic movement in an unstable environment (Table 1).

The exercises were carefully selected to incorporate skill components necessary for effective tennis performance; however, all of the exercises could be used to improve core stabilization of any athletic population. The exercises were specifically arranged in the training program sequence to follow the guidelines proposed by Jeffreys.[17] Thus, they incorporate center of gravity control (i.e., multi-planar lunges), eccentric control (i.e., med ball twists on Swiss ball) and isometric control (i.e., abdominal hollowing) to enhance dynamic balance. The exercises are progressed through three levels of progressive difficulty (Table 2). The level-one exercises are performed in a stationary position with static contractions and are progressed to slow movements in an unstable environment (Figures 1 and 2). Level-two exercises involve static contractions in an unstable environment, which are progressed to dynamic movements in a more stable environment (Figure 3). Level three exercises involve dynamic movements in an unstable environment, followed by the addition of resistance to the dynamic movements (Figures 4 and 5). The exercises involve the use of body weight, Swiss Balls, tennis racquets, medicine balls, and therapeutic resistance bands.

Table 1. Jeffreys Progressive Core Stability Program[17]

Classification	Characteristic	Example
Mastery of core contraction	Static isometric contraction	Side bridge
Static holds and slow movements in stable environment	Static isometric contraction with controlled simultaneous limb movement	Dead bug
Static holds in unstable environment and dynamic movement in a stable environment	Static isometric contraction on an unbalanced surface/body movement on a static surface	Abdominal isometric contraction on a Swiss ball
Dynamic movements in an unstable environment	Body movement on an unbalanced surface	Trunk twists on a Swiss ball
Resisted dynamic movement in unstable environment	Resisted body movement on an unbalanced surface	Trunk twists with Theraband on Swiss ball

Table 2. Core Stabilization Training Program Exercises

Level	Exercises	Sets/reps
Level 1: Week 1	Abdominal muscle contraction – supine	3x20
Day 1-3	Abdominal muscle contraction – quadruped	2x15
(Figure 1)	Abdominal muscle contraction – side bridge (R & L)	1x6/each side
		(10 sec holds)
Level 1: Week 2	Dead bug – supine	3x20
Day 4-6	Bridging – quadruped	3x15
(Figure 2)	Seated medicine ball rotation	3x15
Level 2: Week 3	Abdominal muscle contractions	1x20
Day 1-3	Seated on Swiss ball	3x20
(Figure 3)	Squat with Swiss ball	3x15
	Superman - supine	3x15
Level 2: Week 4	Abdominal muscle contraction	1x20
Day 4-6	Multidirectional lunge (R & L)	3x15
(Figure 4)	Oblique pulley with side shuffles	3x15
	Standing wall cross toss (R & L)	3x20
Level 3: Week 5	Abdominal muscle contractions	1x20
Day 1-3	Diagonal curls on Swiss ball (R & L)	3x10
(Figure 5)	Twists on Swiss ball while holding medicine ball (R & L)	3x15
	Standing with tennis racquet on unstable surface (R & L)	4x10

Figure 1 Level 1: Week 1 (Abdominal muscle contraction)

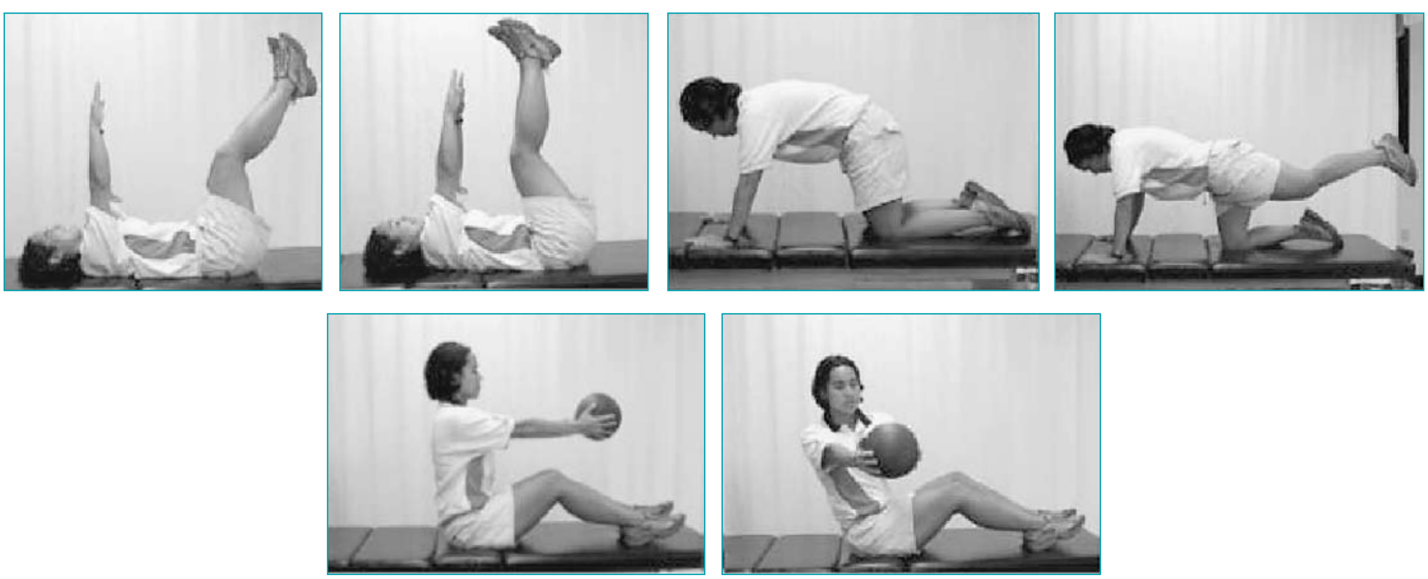

Figure 2 Level 1: Week 2

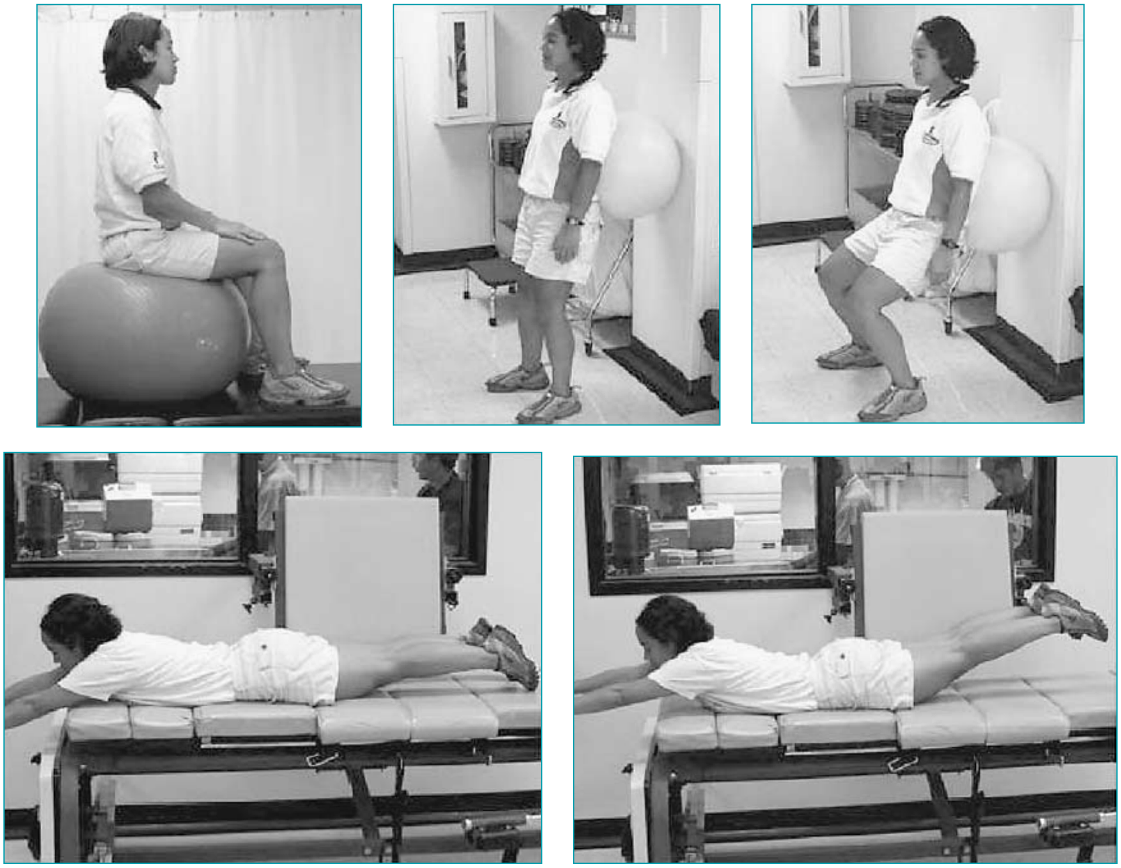

Figure 3 Level 2: Week 3

Figure 4 Level 2: Week 4

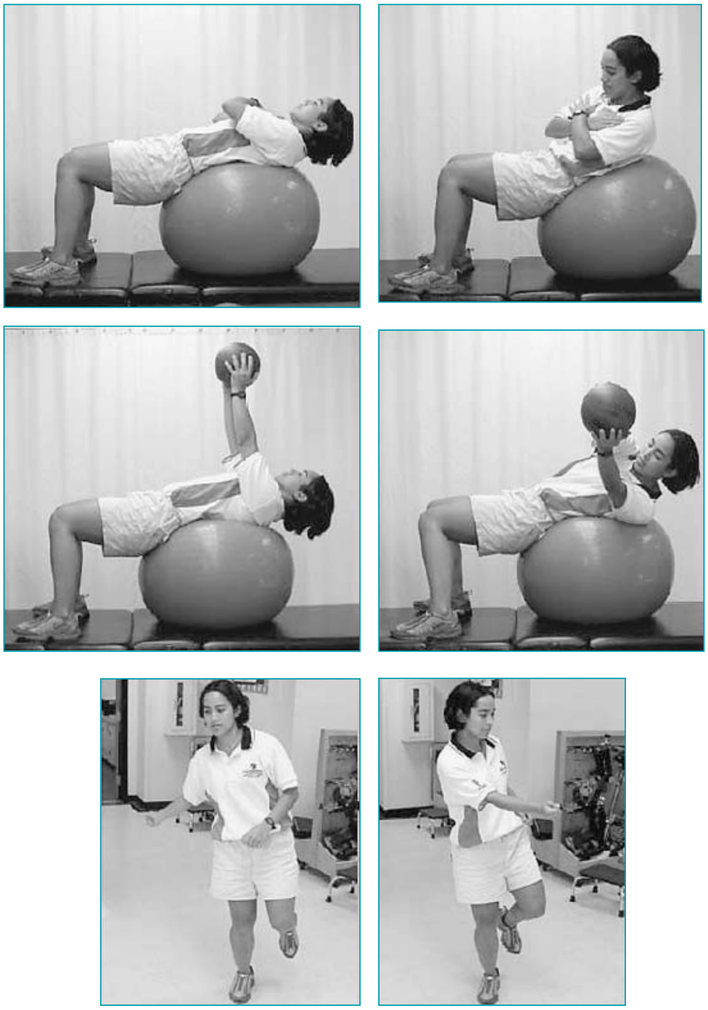

Figure 5 Level 3: Week 5

Core Stabilization Training Program in a Clinical Study

This core stabilization training program was used in a five-week training study involving tennis players (3 times per week on alternating days). Dynamic postural control was assessed by the Star Excursion Balance Test, which was administered before and after the five-week training program. The Star Excursion Balance Test utilizes an eight-point star floor pattern to assess the length of 8 excursions in the anterior, posterior, medial, lateral, anteromedial, anterolateral, posterolateral, and posteromedial directions. The athletes maintained a unilateral stance on the center of the star pattern, while performing a maximal excursion with the nonstance limb. To normalize the data, excursion distance was expressed in terms of leg length. Our assessment compared the performance of an aged-matched control group with that of tennis athletes from a Division III institution. Although no difference was found between groups, there were significant differences between pre-training and post-training excursion distances in all directions ($p < .05$). We feel confident that the training program improves dynamic postural control in tennis players.

Summary

Tennis is a sport that involves multidirectional movement patterns that challenge the ability to maintain dynamic stability. Tennis players need a stable core to effectively perform upper and lower extremity movements. The core stabilization program presented in this report incorporates the skill components necessary for effective tennis performance. The exercises emphasize eccentric and isometric muscle actions that are believed to enhance dynamic postural control. We feel that the five-week training study program produced positive effects on dynamic postural control, and that continuation of the program for a longer period of time will provide further benefit. ▮

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Core training has become a staple of almost all conditioning programs. Whether it is for high-level athletes, the weekend warrior, or your average fitness enthusiast, â€œworking the coreâ€ tends to get a lot of attention by fitness professionals, their clients, and the general public alike. Unfortunately, still to this day, there are many misconceptions on what the core truly is, how it functions, as well as how to properly design a progressive core training program. Far too often fitness professionals are asked by their clients or prospective clients, â€œHow do I get rid of this?â€ as they grab the...Â Local stabilization muscles of the core. Provide support from vertebra to vertebra. Transverse abdominis. We designed a tennis-specific training program based on prior work in other sports in which neuromuscular retraining techniques were incorporated along with athletic performance enhancement drills in a program known as Sportsmetrics.Â None of the athletes played other sports or were involved in other training programs while participating in our program. Over the course of the study collection period, 15 athletes voluntarily participated in more than one training program.Â Our program incorporated many exercises for core stabilization and strengthening and all but 4 players improved in the posttrain abdominal endurance test. Context: Core training specifically for track and field athletes is vague, and it is not clear how it affects dynamic balance and core-endurance measures. Objective: To determine the effects of a 6-week core-stabilization-training program for high school track and field athletes on dynamic balance and core endurance. Design: Test-retest. Setting: High school in north central West Virginia. Participants: Thirteen healthy high school student athletes from 1 track and field team volunteered for the study. Interventions: Subjects completed pretesting 1 wk before data collection. They completed a 6

Conclusion: Core stabilization training program may improve the static and dynamic balance and can be used with other training programs.Â Kimberli SM, Sandrey MA. A core stabilization trainingprogram for tennis athletes. J Athl Ther Today 2005; 12: 41-6. Ð¯Ð·Ñ‹Ðº: b/d. Hi Everyone! Thanks for visiting this page! Redline is still my favorite place to train! I've moved, I am now the owner at Renew Cryo Center in Aliso Viejo. You can check us out at renewcryocenter.com Swing by for a cryotherapy treatment! :) See All. See More.