The Testing of a Tennis-Specific Fitness Program

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Abstract

Physical fitness is an important aspect in every person's daily life. For those who participate in sports, their personal fitness is crucial to their success in competition. A sports-specific fitness program is a fitness program that focuses on the needs of a particular sport. The creation and implementation of a tennis-specific fitness program for the women's tennis team at Bemidji State University will increase the participants' overall physical fitness, as well as their perceived ability to perform competitively. The results of the participants' overall physical fitness were found to be statistically significant. The results for the participant's perceived ability to perform competitively were found to increase as their fitness increased. The combined results establish that a tennis-specific fitness program enhances general and tennis-specific physical fitness which leads to higher levels of perceived competitive performance in tennis.

The Testing of a Tennis-Specific Fitness Program

> "I don't know anything about tennis, but it seems to me that, by the third step, you'd better be thinking about stopping. Otherwise, you're going to hit the ball and keep running, which means you'll be out of position for your next shot. The trick is to throttle down, then hit, then slam on the brakes, then hustle back. The way I see it, your sport isn't about running, it's about starting and stopping. You need to focus on building the muscles necessary for starting and stopping" according to Gil, personal athletic trainer of Andre Agassi (Agassi, 2009).

Physical fitness will always be interconnected with sports and tennis is no exception. The game of tennis uses both aerobic and anaerobic fitness. Anaerobic fitness means "without oxygen" (Roetert, & Ellenbecker, 2007). The anaerobic system uses two body systems to create adenosine triphosphate (ATP) which is what the human body uses as energy. The first of the two systems to be set in motion is the ATP-PC system. The ATP-PC system is able to create enough ATP to sustain a person for 6-10 seconds during a high-intensity workout. After that ATP is consumed, a second system, anaerobic glycolysis, begins to produce the ATP. The amount of ATP produced by anaerobic glycolysis will last a person for 2-3 continuous minutes during a high-intensity workout (Roetert, & Ellenbecker, 2007). Aerobic fitness means "with oxygen." Aerobic fitness refers to the aerobic energy system in the human body in which oxygen is taken through the lungs and carried out to the working tissues by the bloodstream where the body is able to produce ATP. ATP created through the aerobic energy system is able to maintain the body for several hours during workout sessions (Roetert, & Ellenbecker, 2007).

Both energy pathways, anaerobic and aerobic systems, are vital to tennis. Tennis matches can last anywhere from a half hour to several hours which requires a strong foundation in aerobic fitness. Tennis points, however, last between 3-7 seconds with breaks up to 25 seconds between points. The short burst of energy used for individual points requires a substantial base in anaerobic fitness. In order for an athlete to recover between points, games, sets, or matches, both of the energy pathways need to be well trained for optimal performance (Roetert, & Ellenbecker, 2007).

Tennis skill is obviously an essential component in becoming a better tennis player. The United States Tennis Association (USTA), in partnership with the National Tennis Rating Program (NTPR), established a rating system that distinguishes the skill level of tennis players. Those participating in this study are intermixed between the range of 4.0-5.0 (see Appendix A). The NTPR rating system starts at 1.0 (beginners) and ends at 7.0 (professional) ("About Ntrp," 2008).

Literature Review

According to research published in *Medicine and Science in Sports and Exercise*, "The main skills used in tennis are power, strength, agility, speed, explosiveness, some endurance components, mental health, and a highly developed neuromuscular coordinating ability (Konig, Hounker, Schmid, Halle, Berg, & Keul 2001)." The research also reveals elite tennis requires "additional off-court conditioning programs known to improve both aerobic and anaerobic performances such as sprint-interval training. This type of training results in an increase in both glyolytic and oxidative enzyme activity and maximum short power output gives the athlete

increased strength, power, speed, and explosiveness (Konig, Hounker, Schmid, Halle, Berg, & Keul 2001)."

A long term study of Austrian professional tennis players resulted in a test for measuring the most important tennis specific motor abilities which consisted of 10 different tests. These tests were issued twice annually to top Austrian tennis players in order to create individual training sessions. The test is defined by three factors:

- Factor 1 – Speed and Agility in Running
- Factor 2 – Special Power and Strength
- Factor 3 – Basic and Special Endurance

Factor 1 accounted for 49% of the total variance while Factor 2 and Factor 3 accounted for 27% and 17% respectively. From the results, it can be concluded that Factor 1 accounted for the majority of tennis specific abilities (Muller, Benko, Raschner, & Schwameder, 2000).

Strength training is crucial in tennis just as it is in every other sport. Periodization is the recommended method to build a strength training program. Periodization means to separate strength training into different parts or cycles ("The Elite approach," 2009). Generally, there are four phases into which the program can be separated. Off-Season Period, Early Pre-Season Period, Late Pre-Season Period, and In-Season Period are the basic four periods. The Off-Season Period lasts 6-8 weeks and focuses on forming a solid base to balance out uneven muscles which lowers the possibility of injuries. The Early-Pre-Season Period lasts six weeks with the objective being to maximize strength by increasing weight and decreasing repetitions which will give the athlete greater power potential. The Late Pre-Season Period lasts 6 weeks; however, this period's objective is to develop explosiveness by incorporating plyometric training

into the program. The In-Season Period lasts the length of the given season with circuit training becomes the main focus of this period. Circuit training develops strength endurance. It should be done 1-2 times per week during the beginning of the season with the repetitions slowing down as the season continues ("The Elite approach," 2009).

Off-season training should consist of a transition/recovery phase and preparatory work. During the off-season the body begins to detrain which means reversing back to a pre-training level of fitness. In order to prevent detraining, it is suggested that athletes should maintain at least 50-60% of their in-season fitness levels. A good way to maintain fitness without burning out is to do cross-training. Resistance training and flexibility training are other ways to maintain fitness during the off-season ("Off season training," 2009).

Speed and agility drills are necessary for tennis fitness as proved by the Austrian study. When practicing speed and agility drills, it is critical to remember that these drills should not be done on endurance or strength training days. These drills should be done at least twice per week during the off season and once a week during the season. Generally, these workout sessions consist of five sets of drills with tens repetitions of each drill. Work to rest ratio is recommended to be 1:5 ("Sample speed and," 2009).

The USTA has a chart overview of the type of tennis learning and the type of fitness that should be used during the different phases spanning the lifetime of tennis players. The phases are split into childhood, pre to post puberty, and adulthood. The adulthood phase focuses on personal excellence and the age range is 15 years and older for females. Under the Physical Skills and Individualized Program section, the bulleted points are speed, strength, endurance, power, flexibility, core/shoulder stability, injury prevention, nutrition/hydration, rest/recovery,

and testing/tracking ("The Progressive development," 2009). This poster summarizes the basics of what college aged players should be focusing on in order to become better tennis players.

Complete Conditioning for Tennis is a book that overviews the physical spectrum of tennis. The authors researched the tennis-specific aspects of flexibility, strength and power, muscular endurance, agility and speed, body composition, stability and dynamic balance, aerobic and anaerobic fitness, testing, training, tracking, and program planning. The book contains the information for testing general and tennis-specific fitness. The tests include flexibility, strength, muscular endurance, power, agility and speed, body composition and aerobic endurance. The results are charted as excellent, good, average, and needs improvement (Roetert, & Ellenbecker, 2007). The book also contains different weight training lifts that are advantageous for tennis. There is a list of drills that help improve agility and speed (anaerobic) as well as different ways to improve aerobic fitness. The book contains sample fitness programs that use periodization that this new tennis-specific fitness program can use as a template (Roetert, & Ellenbecker, 2007).

The Ultimate Guide to Weight Training for Tennis contains tennis-specific periodization weight training program samples to maximize fitness potential. It gives a detailed procedure for designing a weight training program. This is a good resource for comparing this program and obtaining the most benefit out of weight training (Price, 2007).

From the creation and implementation of a tennis-specific fitness program, the women's tennis team at Bemidji State University will increase their overall physical fitness, as well as their perceived ability to perform competitively.

Methods

Participants

This study was conducted on the Bemidji State Women's Tennis team. The coach (at the time) was approached with this study and granted permission for his team to participate. The study was then presented to the women on the tennis team, where they were given the opportunity to not be included in the study. Seven team members agreed for their information to be recorded, anonymously, and used for this study. They are females, ranging in age from 19-22, and have all played tennis for more than four years.

Creation of the Tennis-Specific Fitness Program

A timeline was created to outline the periodization phases and to determine when the subjects would reach optimal fitness. Weight lifting, aerobic exercise, and anaerobic exercise (speed and agility) were used in the program (Roetert, & Ellenbecker, 2007). Pre and post tests measure four different sections of fitness: cognition, energy pathways, flexibility, and strength/muscular endurance (Roetert, & Ellenbecker, 2007).

The cognition section is tested by a pre and post survey given to the participants. The survey will deduce how the participants feel fitness relates to their competitive performance and how they view their personal fitness level (see Appendix B).

The energy pathways section was divided into two subsections, aerobic and anaerobic. The aerobic subsection was measured by a timed 1.5 mile run test (see Appendix F) (Roetert, & Ellenbecker, 2007). The anaerobic subsection was comprised of three tests that determine speed and agility. Speed is measured by the 20 yard dash test. To assess agility, the spider run and sideways shuffle test are used (see Appendix C & E for tables) (Roetert, & Ellenbecker, 2007).

The flexibility subsection will be determined by the sit and reach test (see Appendix D for tables) (Roetert, & Ellenbecker, 2007).

The strength/muscular endurance subsection has four tests within it: strength, muscular endurance, power, and balance. The sit-up test measures abdominal power and endurance. The push-up test provides a general measure of upper body strength and muscular endurance. The one-leg stability test measures balance. Medicine ball (forehand and backhand), and medicine ball overhead and reverse overhead) tests are used to establish power potential (see Appendix E for tables) (Roetert, & Ellenbecker, 2007). Together, these tests ascertain the general and tennis-specific fitness of the participants.

Procedures

Before the fitness program could begin, the participants had to take the 10 physical fitness pre-tests along with the pre-survey. All the participants met together, with me as their administrator. After completing the pre-survey, the participants returned the surveys to me anonymously.

The participants then began with the speed and agility tests. The first test administered was the 20 yard dash test. The participants were tested one at a time. They were given three trials, resting between each trial, in which their best time was recorded. The second test administered was the spider run test, which was conducted similarly to the 20 yard dash test. The final speed and agility test was the sideways shuffle test which was also conducted the same as the previous two tests.

The flexibility test was measured by the use of the sit and reach test. A sit and reach box is a device used to measure the flexibility of each leg separately. Each participant started with

her leg of choice. They placed their first foot, flat against the box, and leaned towards the box with both arms extended, fingertips touching. The number of inches was recorded and the process was repeated for the other leg.

The remaining fitness tests measured the strength/muscular endurance section. This section was split into three subsections; strength, balance, and muscular endurance. The strength subsection included the sit-up and push-up tests. For the sit-up and push-up tests, the subjects paired up to helped keep count for their partners the number of completed repetitions during the specified timeframe of a minute. After the first group of partners completed their test, the second group did their testing. The balance subsection was determined by the one-leg stability test, which is either a pass or fail. The participants were examined individually as they lowered themselves into a single leg squat on their right leg and then their left leg. If their balance was lost, it was noted as such.

The muscular endurance subsection was measured by the various medicine ball tests. The participants were tested individually. They stood at a designated starting spot and performed the medicine ball tests in the order of forehand, backhand, overhead, and reverse overhead. Extra participants stood where the medicine ball landed until the distance was measured.

The results of these physical fitness tests were compared to the tables found in The Complete Conditioning for Tennis by Roetert and Ellenbecker (see Appendices B-F). The ratings for these tables are Needs Improvement, Average, Good, or Excellent.

After the completion of the eight-month-long tennis-specific fitness program, the participants were given a tennis-specific physical fitness post-test (same tests as the pre-test) to

see how their fitness level changed and a post-survey to see how they now perceive the relationship between physical fitness and their ability to perform competitively.

Implementation of the Tennis-Specific Fitness Program

The tennis-specific fitness program was split into four parts to balance the four periods of periodization. The lifting sessions were full body sessions, three days a week (Monday/Wednesday/Friday) with a day of rest in between. The Off-Season Period was performed first, to give tone to the subjects and to give them a base strength they would be able to build on. This period lasted two and a half weeks. The general lifts that were performed during this period were:

- Interior/Exterior Rotation
- Triceps Kickback
- Bicep Curl
- Bench Press
- Leg Press
- Seated Cable Row
- Lat Pull Down

The repetitions to sets ratio was 15/2. Weights were light so that the form would be worked on prior to adding heavy weight.

The Early-Pre Season Period lasted five weeks. These lifts became more intense and focused on building muscle. The main lifts that were performed during this period included lifts performed during the Off-Season Period as well as:

- Dumbbell Fly

- Dumbbell Press/Inclined Press
- Calf Raises
- Squats
- Military Press/Military Press on Balance Ball

This period's repetitions to sets ratio was 15-20/3. The number of repetitions depended on the type of lift being performed.

The Late-Pre Season Period lasted five weeks. This period's lifts focused on developing explosiveness. The lifts and other exercises that were added to this period are:

- Abdominal Exercises (bicycles, leg lifts, leg tucks, superman, etc)
- Lunges
- Dips
- Pull Ups
- Push Ups/Medicine Ball Push Ups
- Doubles Alley Single Leg Jumps
- Low to High Swing
- Bench Step Ups

The repetitions to sets ratio was 15-12-10/3. The repetitions would decrease as the amount of weight increased.

The final In-Season Period lasted 10 weeks. The lifts within this period were developed by Joe Ferraro, the strength and conditioning coach at Bemidji State University. He granted this study permission to use his In-Season program. In this period, the participants lifted two, full-body, days a week instead of three days a week. These lifts pertained more to sustaining

muscular endurance and maintaining strength rather than building muscle. The lifts and exercises added to this period are:

- Overhead Squat
- Jerk Split
- Dumbbell Pullover
- Alternating Chess Press
- Deadlift
- Knee Drives
- Burpees
- Side Shuffles

The repetitions to sets ratio was 6-10-15/3. Depending on the kind of lift, the number of repetitions changed.

After the program was completed, the post-physical fitness tests took place by the same means as the pre-physical fitness testing. The subjects then took the post-survey and returned it to me anonymously.

Results

Analyses focus on the individual tennis-specific physical fitness tests, looking for their reliability to increase performance within the whole program. The results of the 10 physical fitness pre and post-tests were input into SPSS by creating my own variables. Paired samples t-tests were created that compared the average of the participant's pre and post-physical fitness test's scores. The paired samples t-test's results provided results to show if the physical fitness

test's results were statistically significant or not. For this study, tests are proven to have statistically significant results at the p<.050 level.

The means in each of the post-tests were compared against the means in each of the pre-tests. For the 20 yard dash pre-test, M=3.7343 (*.29240*), which revealed that has a whole, the participants were rated as Needs Improvement. The 20 yard dash post-test showed different results; M=3.3400 (*.12315*), that placed the participant's as Good. After comparing the two test's directly in a paired sample's t-test, M=.39429 (*.24316*) and a significance level of p<.005.

For the spider run pre-test M= 18.7929 (*.77390*), meaning the participants were rated as Needs Improvement. The spider run post-test results showed, M= 17.8214 (*.93841*), that placed the participant's rating as Good. In comparing the two test's directly in a paired sample's t-test, M= .97143 (*.55921*) and a significance level of p<.004.

The sideways shuffle pre-test resulted in M=8.3000 (*1.33418*) which placed the participants in the Needs Improvement rating. The sideways shuffle post-test showed M=7.1200 (.63066), rating the participants as Average. The significance level after comparing the two means was p<.040.

The sit and reach tests were split into right and left leg to distinguish the results of each leg. The pre-test for the right leg showed results of M=4.3929 (*3.58102*) and a rating of Good. The pre-test for the left leg resulted in M=4.9643 (*3.8543*) with a rating of Good. The post-tests for the right leg and left leg showed, M=5.9186 (*2.91631*) and M=5.9343 (*3.15160*). The new means kept the ratings as Good. The significance levels for the paired samples t-tests were p<.030 and p<.050 respectively.

For the sit up pre-test M= 38.29 (*8.770*), meaning the participants were rated as Needs Improvement. The sit up post-test results showed, M= 52.29 (*10.641*), that placed the participant's rating as Excellent. After comparing the two test's directly in a paired sample's t-test, M= -14.000 (*5.888*) and a significance level of p<.001.

The push up pre-test resulted in M= 28.86 (*8.840*) which placed the participants in the Average rating. The push up post-test showed M=37.57 (*10.876*), rating the participants as Good. The significance level after comparing the two means was p<.000.

The pre-test for the medicine ball (forehand) showed results of M=23.1614 (*4.21690*) with a rating of Average. The pre-test for the medicine ball (backhand) resulted in M=21.4764 (*2.94144*) with an Average rating. The post-tests for the medicine ball (forehand and backhand) were, M=25.0364 (*4.67965*) and M=24.8171 (*3.02967*). The post-test means put the ratings as Good. The significance levels for the paired samples t-tests were p<.095 and p<.000, correspondingly.

For the pre-test for the medicine ball (overhead) showed results of M=14.4406 (*2.67179*) with a rating of Needs Improvement. The pre-test for the medicine ball (reverse overhead) resulted in M=18.7207 (*2.00050*) with a Needs Improvement rating. The post-tests for the medicine ball (overhead and reverse overhead) were, M=17.1264 (*1.71979*) and M= 22.2671 (*2.61804*). The post-test means put the ratings as Average. The significance levels for the paired samples t-tests were p<.002 and p<.001, in the listed order.

For the 1.5 mile run pre-test, M= 11.6033 (*2.04022*) which gave it a rating of Excellent. The post-test showed M=10.8500 (*2.03914*) with a rating of Excellent. After comparing the two means, the significance level is p<.002 (see Appendix G for tables).

The pre and post-survey results corresponded positively as the participants' physical fitness was increased. The pre-survey results were determined by a means analysis to see how the subjects felt about fitness and the program as a single population. The mean year in school for the subjects was a junior level. On average, the subjects had played tennis for 8.7 years prior to the beginning of this program. The current fitness level showed M= 2.5, out of a 5 point scale. The "does physical fitness enhancing their ability to perform competitively in tennis?" had M= 4.5 out of a 5 point scale. The "do you think fitness is important to tennis?" had M= 4.7 out of a 5 point scale (see Appendix H for tables).

Discussion and Conclusion

As previously stated, this study looked at the effects of applying a tennis-specific physical fitness program to tennis athletes and obtaining results that would determine their physical fitness growth, as well as their perceived ability to complete. The literature on the subject, have concluded that a tennis-specific physical fitness program enhances tennis-specific skills which enables the athlete to compete more effectively.

The results from this study, work with the results from previous study's to conclude that a fitness program enhances physical fitness levels. As individual assessments, each physical fitness test affirmed if, within this study, the fitness area that directly related to the physical fitness test was met. The four areas of fitness tested in this study were; cognitive, energy pathways, flexibility, and strength/muscular endurance. As a whole group, the participants improved their scores for the all the tennis-specific physical fitness tests. Due to the responses from the surveys, the cognitive reaction to the tennis-specific fitness program results show the athletes' have a heighten sense perceived ability of performing better in competition.

When looking at each test individually, the medicine ball (forehand) test was proven to not have statistical significance; meaning that any improvements in individual participant scores were coincidental and not a result of having participated in this tennis-specific program. The one-leg stability test was not included on a paired samples t-test since it is a pass/fail test. There aren't different variances of pass or fail to compare the results to. As all participants passed in both the pre and post-tests, there wasn't a need to see if the results were statistically significant.

This study came with a number of limitations. The main, and most obvious limitation, is that there was no control group within the study to compare the results of those who completed the study. Due to previous literature, it was well proven that participating in a fitness program would increase physical fitness, as such; the results from this study can read as a positive relationship to previous studies that have had positive results while using similar standards in their tennis-specific physical fitness programs. Another limitation in this study was the participation within the fitness program. On account of lack of available time, the participants in the study weren't always supervised when performing the fitness program. This gave leeway for the fitness program to not have been completed to the participants' fullest potential. School breaks, and the various degrees of participant prior experience, gave this study additional limitations, as there was no possibility of controlling the extent of detraining and starting the study with all participants on the same base strength level.

There are two aspects in every sport, the cognitive aspect and the physical aspect. This study provided a positive relationship stating that tennis players are able to perform more competitively due to participating within a tennis-specific fitness program. These results were founded on a physical and a cognitive level. Overall, the tennis-specific fitness program has

some flaws that need to be remedied in order to be used again, but due to previous literature and the results of this study, competitive tennis athletes should invest time into a tennis-specific fitness program.

Appendices

Appendix A

United States Tennis Association National Tennis Rating Program

ITN	NTRP	NATIONAL TENNIS RATING PROGRAM					
		FOREHAND	BACKHAND	SERVE OR RETURN OF SERVE	VOLLEY	SPECIAL SHOTS	PLAYING STYLE
10.1 10.3	1.0	This player is just starting to play tennis.					
10	1.5	This player has limited experience and is still working primarily on getting the ball into play.					
9	2.0	Incomplete swing; lacks directional intent	Avoids backhands; erratic contact; grip problems; incomplete swing	Incomplete service motion; double faults common; toss is inconsistent; return of serve erratic	Reluctant to play net; avoids backhand; lacks footwork		Familiar with basic positions for singles and doubles play; frequently out of position
8	2.5	Form developing; prepared for moderately paced shots	Grip and preparation problems; often chooses to hit forehand instead of backhand	Attempting a full swing; can get the ball in play at slow pace; inconsistent toss; can return slow-paced serve	Uncomfortable at net, especially on the backhand side; frequently uses forehand racquet face on backhand volleys	Can lob intentionally but with little control; can make contact on overheads	Can sustain a short rally of slow pace; modest consistency; weak court coverage; usually remains in the initial doubles position
7	3.0	Fairly consistent with some directional intent; lacks depth control	Frequently prepared; starting to hit with fair consistency on moderate shots	Developing rhythm; little consistency when trying for power; second serve is often considerably slower than first serve; can return serve with fair consistency	Consistent forehand volley; inconsistent backhand volley; has trouble with low and wide shots	Can lob fairly consistently on moderate shots	Fairly consistent on medium-paced shots; most common doubles formation is still one up, one back; approaches net when play dictates but weak in execution
6	3.5	Improved consistency and variety on moderate shots with directional control; developing spin	Hits with directional control on moderate shots; has difficulty on high or hard shots; returns difficult shots defensively	Starting to serve with control and some power; developing spin; can return serve consistently with directional control on moderate shots	More aggressive net play; some ability to cover side shots; uses proper footwork; can direct forehand volleys; controls backhand volley but with little offense; difficulty in putting volleys away	Consistent overhead on shots within reach; developing approach shots, drop shots, and half volleys	Improved consistency on moderate shots with directional control; improved court coverage; starting to look for the opportunity to come to the net; developing teamwork in doubles
5	4.0	Good consistency; hits with depth and control on moderate shots; may try to hit too good a placement on a difficult shot	Directs the ball with consistency and depth on moderate shots; developing spin	Places both first and second serves, often with power on first serve; uses spin; dependable return of serve; can return with depth in singles and mix returns in doubles	Depth and control on forehand volley; can direct backhand volleys but usually lacks depth; developing wide and low volleys on both sides of the body	Can put away easy overheads; can poach in doubles; follows aggressive shots to the net; beginning to finish point off; can hit to opponent's weaknesses; able to lob defensively on difficult shots and offensively on set-ups	Good consistency on ground strokes with directional control and depth demonstrated on moderate shots; not yet playing good percentage tennis; teamwork in doubles is evident; rallies may still be lost due to impatience
4	4.5	Very good consistency; uses speed and spin effectively; controls depth well; tends to over-hit on difficult shots; offensive on moderate shots	Can control direction and depth but may break down under pressure; offensive on moderate shots	Aggressive serving with limited double faults; uses power and spin; developing offense; on second serve frequently hits with good depth and placement; frequently hits aggressive service returns; can take pace off with moderate success in doubles	Can handle a mixed sequence of volleys; good footwork; has depth and directional control on backhand; developing touch; most common error is still overhitting	Hits approach shots with good depth and control; can consistently hit volleys and overheads to end the point	Very good consistency; more intentional variety in game; is hitting with more pace; covers up weaknesses well; beginning to vary game plan according to opponent; aggressive net play is common in doubles; good anticipation; beginning to handle pace

3	5.0	Strong shots with control, depth, and spin; uses forehand to set up offensive situations; has developed good touch; consistent on passing shots	Can use backhand as an aggressive shot with good consistency; has good direction and depth on most shots; varies spin	Serve is placed effectively with intent of hitting to a weakness or developing an offensive situation; has a variety of serves to rely on; good depth, spin, and placement on most second serves to force weak return or set up next shot; can mix aggressive and off-paced service returns with control, depth, and spin	Can hit most volleys with depth, pace and direction; plays difficult volleys with depth; given an opportunity volley is often hit for a winner	Approach shots and passing shots are hit with pace and high degree of effectiveness; can lob offensively; overhead can be hit from any position; hits mid-court volleys with consistency	Frequently has an outstanding shot, consistency or attribute around which game is built; can vary game plan according to opponent; this player is "match wise," plays percentage tennis and "beats himself or herself" less than the 4.5 player; solid teamwork in doubles is evident; game breaks down mentally and physically more often than the 5.5 player
2	5.5	This player is capable of hitting dependable shots in stress situations; has developed good anticipation; can pick up cues from such things as opponent's toss, body position, backswing, preparation; first and second serves can be depended on in stress situations and can be hit offensively at any time; can analyze and exploit opponent's weaknesses; can vary strategies and style of play in a competitive situation.			Players in Wheelchairs: Players in wheelchairs should use these general characteristics to determine their NTRP skill level. The only differences are as follows: **Mobility:** While players in wheelchairs may have skills that would normally provide them a certain rating, the mobility factor suggests that when competing against able-bodied players, they should participate at an NTRP skill level that provides for competitive rather than compatible play. **Serving ability:** Due to the nature of the player's injury or disability, a powerful serve may not be possible. In this case, it may be more realistic to self-rate below 4.0, as service strength becomes key beyond this level. Many tournament players in wheelchairs have already received an NTRP rating. Wheelchair players should check with players whose skills match their own before determining their rating. The very best world-class players in wheelchairs have an NTRP rating in the low 4.5s.		
1	6.0 to 7.0	These players will generally not need NTRP ratings. Rankings or past rankings will speak for themselves. The 6.0 player typically has had intensive training for national tournament competition at the junior level and collegiate levels and has obtained a sectional and/or national ranking. The 6.5 player has a reasonable chance of succeeding at the 7.0 level and has extensive satellite tournament experience. The 7.0 is a world-class player who is committed to tournament competition on the International level and whose major source of income is tournament prize winnings.					

Appendix B

Pre Survey

1. What year in school are you?
   Freshman Sophomore Junior Senior

2. How many years have you played tennis?
   _____

3. What would you rate your current fitness level?

0	1	2	3	4	5
Not Fit			Average		Completely Fit

4. Do you think fitness enhances competitive performance in tennis?

0	1	2	3	4	5
Don't Agree			Neutral		Completely Agree

5. Do you think fitness is important in tennis?

0	1	2	3	4	5
Don't Agree			Neutral		Completely Agree

Post Survey

1. What year in school are you?
   Freshman Sophomore Junior Senior

2. How many years have you played tennis?
   _____

3. What would you rate your current fitness level?

0	1	2	3	4	5
Not Fit			Average		Completely Fit

4. Do you think fitness enhances competitive performance in tennis?

0	1	2	3	4	5
Don't Agree			Neutral		Completely Agree

5. Do you think fitness is important in tennis?

0	1	2	3	4	5
Don't Agree			Neutral		Completely Agree

6. Did you find the fitness program beneficial?

0	1	2	3	4	5
Don't Agree			Neutral		Completely Agree

7. Do you think the fitness program enhanced your performance in competition?

0	1	2	3	4	5
Don't Agree			Neutral		Completely Agree

8. Would you repeat the fitness program?

0	1	2	3	4	5
Don't Agree			Neutral		Completely Agree

Appendix C

Speed and Agility Tests

20 Yard Dash

Procedure:

1. Mark off 20 yards on a tennis court. The distance from the baseline to the opposite side service line.
2. Have a partner stand at the finish line with an arm in the air and a stopwatch in hand.
3. At the drop of the arm and the command "ready, go" sprint toward the finish line.
4. Complete three trials. Record the best time.
5. Compare scores with the ranges in the table

	Adult Female Times (in seconds)
Excellent	<3.30
Good	3.30-3.40
Average	3.40-3.60
Needs Improvement	>3.60

Spider Run Test

Procedure:

1. Position 5 tennis ball on the court – one on each corner where the baseline and singles sideline meet, one on each side where the singles sideline and service line meet, and one ball on the T where the center line and service line meet.
2. Start with one foot on the hash line at the baseline. Retrieve each ball and place it on the hash line, one at a time, moving in a counterclockwise direction.
3. Have a partner record the time with a stopwatch. As soon as the last ball is placed on the hash line, stop the stopwatch.
4. Compare the score with the ranges in the table

	Adult Female Times (in seconds)
Excellent	<17.30
Good	17.30-18.00
Average	18.00-18.30
Needs Improvement	>18.30

Sideways Shuffle Test

Procedure:

1. Start on the center service line at the T with one foot on either side of the line, facing the net.
2. While facing the net, shuffle along the service line and touch the doubles sideline with your foot. Then shuffle to the opposite doubles sideline and continue back to the center. Crossover steps are not allowed.
3. Have a partner record the time with a stopwatch. After you touch doubles sidelines and return to the center, stop the stopwatch.

	Adult Female Times (in seconds)
Excellent	<6.0
Good	6.0-7.0
Average	7.0-7.3
Needs Improvement	>7.3

Appendix D

Flexibility Tests

Sit and Reach Test

Procedure:

1. Sit with your knees extended and legs flat on the floor. Have a partner hold your knees so they do not come off the floor.
2. Lean forward with arms extended and have the partner measure the distance between the fingertips and toes. Hands should be placed next to each other with fingertips touching.
3. Record the score.
4. Compare the score to the table.

	Adult Female (in inches)
Excellent	>6
Good	4-6
Average	2-4
Needs Improvement	<2

Appendix E

Strength and Balance Tests

Sit-Up Test

Procedure:

1. Lie on your back with your knees bent and feet flat on the floor.
2. Have a partner hold the feet so they don't move while performing the exercise.
3. Cross the arms over the chest and place the hands on opposite shoulders.
4. Perform as many repetitions as possible in 60 seconds.
5. To count a sit-up as complete, the elbows must touch the knees in the up position (while keeping the arms against the body). And the shoulder blades must touch the floor in the down position (hips must stay in contact with the floor).
6. Compare scores with the table.

	Adult Female (in one minute)
Excellent	>53
Good	46-53
Average	42-46
Needs Improvement	<42

Push-Up Test

Procedure:

1. Lie face down with hands shoulder-width apart.
2. Extend the arms, but keep the head, shoulders, back, hips, knees, and feet in a straight line. Support the weight of the lower body on the toes.
3. Have a partner record the number of pushups completed in 60 seconds or until muscle failure.
4. To count as a complete pushup, the upper arm must reach parallel to the floor or below in the down position, the arms must be completely extended in the up position, and straight body alignment must be maintained.
5. Compare the scores with the ranges below.

	Adult Female (in one minute)
Excellent	>44
Good	36-44
Average	24-36
Needs Improvement	<24

One-Leg Stability Test

Procedure:

1. Stand with your arms at your sides. You can bend your non-weight-bearing knee to as much as 90 degrees.
2. Look forward and bend the weight-bearing knee approximately 30 degrees (partial squat).
3. Repeat several times on both legs.
4. Look for several compensations during the test, including an inability to control the pelvis, corkscrewing, the use of excessive trunk flexion during the descent, and the inability to maintain proper balance throughout the test.

Medicine Ball (Forehand and Backhand) Test

Procedure:

1. Stand at a designated spot facing forward and hold a 6-pound medicine ball.
2. Take one step and toss the ball, simulating a forehand stroke, whole staying behind the starting line.
3. Measure the distance from the spot to where the ball lands.
4. Repeat for the backhand side.
5. Compare the scores with the ranges in the tables.

	Forehand Adult Female (in feet)
Excellent	>30.5
Good	25-30.5
Average	19.5-25
Needs Improvement	<19.5

	Backhand Adult Female (in feet)
Excellent	>30
Good	24-30
Average	17.5-24
Needs Improvement	<17.5

Medicine Ball (Overhead and Reverse Overhead) Test

Procedure:

1. Stand face forward behind a line and hold a 6-pound medicine ball.
2. Toss the ball from an overhead position as far as possible using only one step. Do not cross the line.
3. Measure the distance from the line to the point where the ball lands.
4. Repeat the procedure for a reverse overhead toss (behind the back). Take no steps on this toss.
5. Compare the scores with the ranges in the tables.

	Overhead Adult Female (in feet)
Excellent	>22.5
Good	18.5-22.5
Average	14.5-18.5
Needs Improvement	<14.5

	Reverse Overhead Adult Female (in feet)
Excellent	>32.5
Good	26.5-32.5
Average	20.5-26.5
Needs Improvement	<20.5

Appendix F

Endurance Tests

1.5 Mile Run Test

Procedure:

1. Stand on a level track
2. A partner gives the command "ready, go" and starts a stopwatch
3. Complete 1.5 miles and record time
4. Compare score with the times in the table

	Adult Female Times (in seconds)
Excellent	<11:49
Good	11:49-13:43
Average	13:43-15:08
Needs Improvement	>15:08

Appendix G

Physical Fitness Paired Sample Test Tables

1.5 Mile Run

Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
mile1.5pre	11.6033	7	2.04022	.83292
mile1.5	10.9500	7	2.03912	.83247

Paired Samples Correlations

	N	Std. Deviation	Sig
mile1.5pre & mile1.5	7	.992	.000

Paired Samples Test

	Paired Differences		
	Mean	Std. Deviation	Std. Mean Error
mile1.5pre & mile1.5	.65333	.25657	.10474

	Paired Differences				
	95% Confidence Interval of the Difference				
	Lower	Upper	t	dt	Sig. (2-tailed)
mile1.5pre & mile1.5	.38408	.92258	6.237	6	.002

20 Yard Dash

Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
dash20pre	3.7343	7	.29240	.11052
dash20	3.3400	7	.12315	.04655

Paired Samples Correlations

	N	Std. Deviation	Sig
dash20pre & dash20	7	.577	.175

Paired Samples Test

	Paired Differences		
	Mean	Std. Deviation	Std. Mean Error
dash20pre & dash20	.39429	.24316	.09191

	Paired Differences				
	95% Confidence Interval of the Difference				
	Lower	Upper	t	dt	Sig. (2-tailed)
dash20pre & dash20	.16940	.61917	4.290	6	.005

Spider Run

Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
spiderrunpre	18.7929	7	.77390	.29251
spiderrun	17.8214	7	.93841	.35469

Paired Samples Correlations

	N	Std. Deviation	Sig
spiderrunpre & spiderrun	7	.803	.030

Paired Samples Test

	Paired Differences		
	Mean	Std. Deviation	Std. Mean Error
spiderrunpre & spiderrun	.97143	.55921	.21136

	Paired Differences				
	95% Confidence Interval of the Difference				
	Lower	Upper	t	dt	Sig. (2-tailed)
spiderrunpre & spiderrun	.45425	1.48861	4.596	6	.004

Sideways Shuffle

Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
sideshufpre	8.3000	7	1.33418	.50427
sideshuf	7.1200	7	.63066	.23837

Paired Samples Correlations

	N	Std. Deviation	Sig
sideshufpre & sideshuf	7	.442	.321

Paired Samples Test

	Paired Differences		
	Mean	Std. Deviation	Std. Mean Error
sideshufpre & sideshuf	1.18000	1.19746	.45260

	Paired Differences				
	95% Confidence Interval of the Difference				
	Lower	Upper	t	dt	Sig. (2-tailed)
sideshufpre & sideshuf	.07254	2.28746	2.607	6	.040

Sit and Reach Right Leg

Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
sitnreachrpre	4.3929	7	3.85102	1.45555
sitnreachr	5.9186	7	2.91631	1.10226

Paired Samples Correlations

	N	Std. Deviation	Sig
sitnreachrpre & sitnreachr	7	.948	.001

Paired Samples Test

	Paired Differences		
	Mean	Std. Deviation	Std. Mean Error
sitnreachrpre & sitnreachr	-1.52571	1.42556	.53881

	Paired Differences				
	95% Confidence Interval of the Difference				
	Lower	Upper	t	dt	Sig. (2-tailed)
sitnreachrpre & sitnreachr	-2.84414	-.20729	-2.832	6	.030

Sit and Reach Left Leg

Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
sitnreachlpre	4.9643	7	3.82543	1.44588
sitnreachl	5.9343	7	3.15160	1.19119

Paired Samples Correlations

	N	Std. Deviation	Sig
sitnreachlpre & sitnreachl	7	.973	.000

Paired Samples Test

	Paired Differences		
	Mean	Std. Deviation	Std. Mean Error
sitnreachlpre & sitnreachl	-.97000	1.05095	.39722

	Paired Differences				
	95% Confidence Interval of the Difference				
	Lower	Upper	t	dt	Sig. (2-tailed)
sitnreachlpre & sitnreachl	-1.94197	.00197	-2.442	6	.050

Sit-Up

Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
situppre	38.29	7	8.770	3.315
situp	52.29	7	10.641	4.022

Paired Samples Correlations

	N	Std. Deviation	Sig
situppre & situp	7	.833	.020

Paired Samples Test

	Paired Differences		
	Mean	Std. Deviation	Std. Mean Error
situppre & situp	-14.000	5.888	2.225

	Paired Differences				
	95% Confidence Interval of the Difference				
	Lower	Upper	t	dt	Sig. (2-tailed)
situppre & situp	-19.445	-8.555	-6.291	6	.001

Push-Up

Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
pushuppre	29.86	7	8.840	3.341
pushup	39.59	7	10.876	4.111

Paired Samples Correlations

	N	Std. Deviation	Sig
pushuppre & pushup	7	.970	.000

Paired Samples Test

	Paired Differences		
	Mean	Std. Deviation	Std. Mean Error
pushuppre & pushup	-8.714	3.147	1.190

	Paired Differences				
	95% Confidence Interval of the Difference				
	Lower	Upper	t	dt	Sig. (2-tailed)
pushuppre & pushup	-11.625	-5.804	-7.326	6	.000

Medicine Ball Forehand

Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
medballfpre	23.1614	7	4.21690	1.59384
medballf	25.0364	7	4.67965	1.76874

Paired Samples Correlations

	N	Std. Deviation	Sig
medballfpre & medballf	7	.874	.016

Paired Samples Test

	Paired Differences		
	Mean	Std. Deviation	Std. Mean Error
medballfpre & medballf	-1.87500	2.50274	.94595

	Paired Differences				
	95% Confidence Interval of the Difference				
	Lower	Upper	t	dt	Sig. (2-tailed)
medballfpre & medballf	-4.18965	.43965	-1.982	6	.095

Medicine Ball Backhand

Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
medballbpre	21.4764	7	2.94144	1.11176
medballb	24.8171	7	3.02967	1.14511

Paired Samples Correlations

	N	Std. Deviation	Sig
medballbpre & medballb	7	.945	.001

Paired Samples Test

	Paired Differences		
	Mean	Std. Deviation	Std. Mean Error
medballbpre & medballb	-3.34071	.90537	.34220

	Paired Differences				
	95% Confidence Interval of the Difference				
	Lower	Upper	t	dt	Sig. (2-tailed)
medballbpre & medballb	-4.17804	-2.50339	-9.763	6	.000

Medicine Ball Overhead

Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
medballopre	14.4406	7	2.67179	1.00984
medballo	17.1264	7	1.71979	.65002

Paired Samples Correlations

	N	Std. Deviation	Sig
medballopre & medballo	7	.903	.005

Paired Samples Test

	Paired Differences		
	Mean	Std. Deviation	Std. Mean Error
medballopre & medballo	-2.68586	1.34247	.50741

	Paired Differences				
	95% Confidence Interval of the Difference				
	Lower	Upper	t	dt	Sig. (2-tailed)
medballopre & medballo	-3.92743	-1.44428	-5.293	6	.002

Medicine Ball Reverse Overhead

Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
medballropre	18.7207	7	2.00050	.75612
medballro	22.2671	7	2.91804	.98953

Paired Samples Correlations

	N	Std. Deviation	Sig
medballropre & medballro	7	.813	.026

Paired Samples Test

	Paired Differences		
	Mean	Std. Deviation	Std. Mean Error
medballropre & medballro	-3.54643	1.53101	.57867

	Paired Differences				
	95% Confidence Interval of the Difference				
	Lower	Upper	t	dt	Sig. (2-tailed)
medballropre & medballro	-4.96238	-2.13048	-6.129	6	.001

Appendix H

Survey Means Tables

Pre Survey Means Table

Survey Question	Mean Answer
What year are you in school?	Junior
How many years have you played tennis?	8.7 years
What would you rate your current fitness level?	2.5
Do you think fitness enhances competitive performance in tennis?	4.5
Do you think fitness is important in tennis?	4.7

*rated answers are from a 0-5 scale with 5 being the highest

Post Survey Means Table

Survey Question	Mean Answer
What year are you in school?	Junior
How many years have you played tennis?	8.7 years
What would you rate your current fitness level?	3.7
Do you think fitness enhances competitive performance in tennis?	5
Do you think fitness is important in tennis?	4.5
Did you find the fitness program beneficial?	4.7
Do you think the fitness program enhanced your performance in competition?	4.3
Would you repeat this program?	4.5

*rated answers are from a 0-5 scale with 5 being the highest

Open Ended Post Survey Comments

What about the program worked?

- Got more in shape, made me stronger.
- Built up strength and was able to have a stronger swing.
- In shape prior to the season.

What about the program didn't work?

- More cardio involved in the program

Appendix I

	Test		Scores	Rating
Subject 1	1.5 Mile Run	Pre	11.10 min	Excellent
		Post	10.38 min	Excellent
	20 Yard Dash	Pre	3.47 sec	Average
		Post	3.29 sec	Excellent
	Spider Run	Pre	17.81 sec	Good
		Post	16.72 sec	Excellent
	Sideways Shuffle	Pre	7.56 sec	Needs Improvement
		Post	6.28 sec	Good
	Sit and Reach (Right Leg)	Pre	5.75"	Good
		Post	6.5"	Excellent
	Sit and Reach (Left Leg)	Pre	6.75"	Excellent
		Post	7"	Excellent
	Sit Up	Pre	40/min	Needs Improvement
		Post	65/min	Excellent
	Push Up	Pre	18/min	Needs Improvement
		Post	24/min	Average
	One Leg Stability	Pre	Pass	Excellent
		Post	Pass	Excellent
	Medicine Ball (Forehand)	Pre	19.25'	Needs Improvement
		Post	22'	Average
	Medicine Ball (Backhand)	Pre	18.75'	Average
		Post	21.08'	Average
	Medicine Ball (Overhead)	Pre	13.8'	Needs Improvement
		Post	16.17'	Average
	Medicine Ball (Reverse Overhead)	Pre	17.17'	Needs Improvement
		Post	23.42'	Average

	Test		Scores	Rating
Subject 2	1.5 Mile Run	Pre	14.16 min	Average
		Post	13.32 min	Good
	20 Yard Dash	Pre	4.29 sec	Needs Improvement
		Post	3.37 sec	Good
	Spider Run	Pre	19.43 sec	Needs Improvement
		Post	17.6 sec	Good
	Sideways Shuffle	Pre	11.00 sec	Needs Improvement
		Post	7.18 sec	Average
	Sit and Reach (Right Leg)	Pre	6"	Excellent
		Post	7.3"	Excellent
	Sit and Reach (Left Leg)	Pre	4.75"	Good
		Post	5.42"	Good

	Sit Up	Pre	35/min	Needs Improvement
		Post	50/min	Good
	Push Up	Pre	22/min	Needs Improvement
		Post	29/min	Average
	One Leg Stability	Pre	Pass	Excellent
		Post	Pass	Excellent
	Medicine Ball (Forehand)	Pre	21.5'	Average
		Post	23.33'	Average
	Medicine Ball (Backhand)	Pre	19.67'	Average
		Post	22.42'	Average
	Medicine Ball (Overhead)	Pre	17.58'	Average
		Post	19.71'	Good
	Medicine Ball (Reverse Overhead)	Pre	20.08'	Needs Improvement
		Post	24.17'	Average

	Test		Scores	Rating
Subject 3	1.5 Mile Run	Pre	14.6 min	Average
		Post	13.74 min	Average
	20 Yard Dash	Pre	3.78 sec	Needs Improvement
		Post	3.42 sec	Average
	Spider Run	Pre	18.75 sec	Needs Improvement
		Post	18.04 sec	Average
	Sideways Shuffle	Pre	8.44 sec	Needs Improvement
		Post	7.52 sec	Needs Improvement
	Sit and Reach (Right Leg)	Pre	4"	Good
		Post	4.17"	Good
	Sit and Reach (Left Leg)	Pre	3.5"	Average
		Post	3.62"	Average
	Sit Up	Pre	41/min	Needs Improvement
		Post	49/min	Good
	Push Up	Pre	25/min	Average
		Post	31/min	Average
	One Leg Stability	Pre	Pass	Excellent
		Post	Pass	Excellent
	Medicine Ball (Forehand)	Pre	25'	Good
		Post	26.375'	Good
	Medicine Ball (Backhand)	Pre	27.08'	Good
		Post	27.08'	Good
	Medicine Ball (Overhead)	Pre	15.08'	Average
		Post	16.25'	Average
	Medicine Ball (Reverse Overhead)	Pre	16.708'	Needs Improvement
		Post	18.08'	Needs Improvement

	Test		Scores	Rating
Subject 4	1.5 Mile Run	Pre	10.48 min	Excellent
		Post	9.52 min	Excellent
	20 Yard Dash	Pre	3.72 sec	Needs Improvement
		Post	3.4 sec	Good
	Spider Run	Pre	18.34 sec	Needs Improvement
		Post	17.22 sec	Good
	Sideways Shuffle	Pre	7.41 sec	Needs Improvement
		Post	6.8 sec	Good
	Sit and Reach (Right Leg)	Pre	6.6"	Excellent
		Post	7.125"	Excellent
	Sit and Reach (Left Leg)	Pre	6.75"	Excellent
		Post	7.5"	Excellent
	Sit Up	Pre	30/min	Needs Improvement
		Post	42/min	Average
	Push Up	Pre	24/min	Average
		Post	36/min	Good
	One Leg Stability	Pre	Pass	Excellent
		Post	Pass	Excellent
	Medicine Ball (Forehand)	Pre	28.17'	Good
		Post	32.54'	Excellent
	Medicine Ball (Backhand)	Pre	22.25'	Good
		Post	27'	Good
	Medicine Ball (Overhead)	Pre	15.83'	Average
		Post	18.25'	Good
	Medicine Ball (Reverse Overhead)	Pre	19.79'	Needs Improvement
		Post	23.58'	Average

	Test		Scores	Rating
Subject 5	1.5 Mile Run	Pre	10.13 min	Excellent
		Post	9.42 min	Excellent
	20 Yard Dash	Pre	3.57 sec	Average
		Post	3.18 sec	Excellent
	Spider Run	Pre	19.71 sec	Needs Improvement
		Post	18.24 sec	Average
	Sideways Shuffle	Pre	7.62 sec	Needs Improvement
		Post	7.1 sec	Average
	Sit and Reach (Right Leg)	Pre	-3.5"	Needs Improvement
		Post	1"	Needs Improvement
	Sit and Reach (Left Leg)	Pre	-2.5"	Needs Improvement
		Post	.75"	Needs Improvement
	Sit Up	Pre	35/min	Needs Improvement
		Post	52/min	Good

	Push Up	Pre Post	40/min 49/min	Good Excellent
	One Leg Stability	Pre Post	Pass Pass	Excellent Excellent
	Medicine Ball (Forehand)	Pre Post	22.33' 26'	Average Good
	Medicine Ball (Backhand)	Pre Post	24.54' 28.71'	Good Good
	Medicine Ball (Overhead)	Pre Post	9.83' 15.125'	Needs Improvement Average
	Medicine Ball (Reverse Overhead)	Pre Post	19.92' 23.17'	Needs Improvement Average

	Test		Scores	Rating
Subject 6	1.5 Mile Run	Pre Post	9.59 min 9.31 min	Excellent Excellent
	20 Yard Dash	Pre Post	3.44 sec 3.2 sec	Average Excellent
	Spider Run	Pre Post	18.00 sec 17.28 sec	Good Excellent
	Sideways Shuffle	Pre Post	7.19 sec 6.72 sec	Average Good
	Sit and Reach (Right Leg)	Pre Post	8.5" 10.35"	Excellent Excellent
	Sit and Reach (Left Leg)	Pre Post	9.75" 10.75"	Excellent Excellent
	Sit Up	Pre Post	56/min 68/min	Excellent Excellent
	Push Up	Pre Post	40/min 54/min	Good Good
	One Leg Stability	Pre Post	Pass Pass	Excellent Excellent
	Medicine Ball (Forehand)	Pre Post	24.67' 27.125'	Average Good
	Medicine Ball (Backhand)	Pre Post	22.68' 25.287'	Average Good
	Medicine Ball (Overhead)	Pre Post	16.54' 18.625'	Average Good
	Medicine Ball (Reverse Overhead)	Pre Post	21.25' 24.42'	Average Average

	Test		Scores	Rating
Subject 7	1.5 Mile Run	Pre	11.10 min	Excellent
		Post	10.39 min	Excellent
	20 Yard Dash	Pre	3.87 sec	Needs Improvement
		Post	3.52 sec	Needs Improvement
	Spider Run	Pre	19.6 sec	Needs Improvement
		Post	18.61 sec	Needs Improvement
	Sideways Shuffle	Pre	8.88 sec	Needs Improvement
		Post	8.24 sec	Needs Improvement
	Sit and Reach (Right Leg)	Pre	3.5"	Average
		Post	5"	Average
	Sit and Reach (Left Leg)	Pre	5.75"	Good
		Post	6.5"	Good
	Sit Up	Pre	32/min	Needs Improvement
		Post	41/min	Needs Improvement
	Push Up	Pre	33/min	Average
		Post	40/min	Average
	One Leg Stability	Pre	Pass	Excellent
		Post	Pass	Excellent
	Medicine Ball (Forehand)	Pre	16.17'	Needs Improvement
		Post	19.375'	Needs Improvement
	Medicine Ball (Backhand)	Pre	17.375'	Needs Improvement
		Post	20.83'	Average
	Medicine Ball (Overhead)	Pre	12.5'	Needs Improvement
		Post	15.75'	Average
	Medicine Ball (Reverse Overhead)	Pre	16.125'	Needs Improvement
		Post	18.92'	Needs Improvement

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