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COMPARISON OF SCOLIOSIS POSTURE ATHLETE'S TABLE TENNIS AND TENNIS AT CHILDREN AND ADOLESCENTS

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ABSTRACT:

1. Introduction: Body posture is very important because it is closely related to health and ergonomics. When exercising, especially on the body's musculoskeletal system there will be physiological responses and adaptations during and after exercise. Table tennis and tennis are included in racquet sports which have the characteristic of using an arm to punch a racquet on the ball. The use of one side of the arm has been known to cause the possibility of scoliosis posture due to one-sided muscle imbalance. At the age of children and adolescents the body is experiencing rapid growth and development and is very easily affected.

2. Aim of the study: To find out how far the influence of table tennis and tennis sports forms athletic scoliosis posture and comparisons between table tennis athletes and tennis.

3. Materials and methods:. The research method used is a comparative causal research approach. The sample in this study were samples that had met the criteria of independent variables totaling 23 people with 16 table tennis athletes at MM Shiamiq Club Manahan and 7 tennis athletes at Yunior Tennis Club Manahan. In this study, the examination of the possibility of scoliosis was assessed by measuring aspects such as leg length discrepancy, plumb line test, scapular winging test, and angle of trunk rotation. Hypothesis testing was carried out using the T-Test technique, which previously carried out normality and homogeneity tests on the sample data. The normality test is done by Ryan-Joiner (similar to Shapiro-Wilk) technique and homogeneity test is done using Levene's Statistic technique with the help of a computer through the Minitab 17 software.

4. Results: From the results of the examination and measurement, Leg Length Discrepancy was obtained in the table tennis sport, were 0.887 ± 0.506 (Mean ± SD) and tennis 1,000 ± 0.493 (Mean ± SD). Plumb line test results on table tennis were 0.600 ± 0.477 (Mean ± SD) and tennis were 0.857 ± 0.556 (Mean ± SD). The results of the angle of trunk rotation in the

table tennis sport were 2.813 ± 1.109 (Mean ± SD) and tennis 2.714 ± 0.756 (Mean ± SD). From the results of scapular winging test obtained (100%) the whole sample was identified as having winging scapula. From the results of the T-test analysis, Leg Length Discrepancy data obtained P-Value value of 0.626. From the results of the T-test analysis, the Plumb Line Test data obtained P-Value value of 0.270. From the results of the T-test analysis, Angle of Trunk Rotation data obtained P-Value value of 0.834.
5. Conclusions: Table tennis and tennis are likely to cause scoliosis posture. There is no significant difference between scoliosis posture between athlete's table tennis and tennis.

KEYWORDS: Table tennis athlete, Tennis athlete, Athlete posture and Scoliosis.

INTRODUCTION

Ergonomics is a science, art and technology that seeks to harmonize the tools, ways and work environment to the skills, abilities and limitations of humans, so that humans can work optimally without the bad influence of their work. From an ergonomics point of view, between task demands and work capacity must always be in a balance line so that high work performance is achieved. In other words, the demands of work assignments should not be too low (underload) and also not too much (overload). Because both, both underload and overload will cause stress. This concept of balance consists of work ability, task demands, and performance. The work ability itself consists of personal characteristics, physiological abilities, psychological abilities, and bio-mechanical abilities [1]. Therefore, body posture has an important role in the concept of ergonomics.

Judging from health, good posture has many benefits related to several things, namely, pain, breathing, stress, digestion, circulation, aesthetics, non-verbal communication, flexibility, athletic performance, stability in fat levels, energy and libido [2].

Physiological response appears during exercise and after the activity is stopped it will return to its original state before exercising. The change takes place right away, called temporary physiological change or response, while physiological changes after doing physical exercise with a certain time span are called permanent changes or adaptations. When exercising, especially on the body's musculoskeletal system there will be physiological responses and adaptations during and after exercise.

Table tennis is a racquet sport that is played by two people (for a single) or two pairs (for a double) that are opposite each other. This game uses a racket made of rubber-coated wooden boards commonly called bet, a ping-pong ball and a table-shaped playing field. The object of the game is to play the ball in a certain way so that the opposing player cannot return the ball. The basic techniques of punching in playing table tennis are forehand punch techniques and backhand punch techniques. The forehand punch technique consists of, forehand drive, forehand push, forehand chop, forehand block, forehand topspin, forehand backspin, forehand sidespin, and forehand flip.

Tennis is a racquet sport played by two people (for singles) or two pairs (for doubles) who are opposite each other. This game uses a tennis tennis racket, a rubber ball and a tennis court game. The object of the game is to play the ball in a certain way so that the opposing player cannot return the ball. As for the basic techniques of blows in playing tennis, among others; forehand, backhand, volley, serve, lob, drop shot, and smash.

Table tennis and tennis generally use one arm to swing the racquet. Power on one arm when swinging the racket to hit the ball. According to Bloomfield et al. (1994), the use of one side of this arm has been known to cause the possibility of scoliosis posture due to one-sided

muscle imbalance [3]. Children and adolescents who practice this sport may be affected, the formation of scoliosis postures. Coupled with the age of children and adolescents, the body is experiencing rapid growth and development. According to Wolanski (2005) and Angelakopoulos et al. (2008), posturogenesis (postural development) is the process of shaping body posture during this development. This is a very intensive process, especially during childhood [4].

OBJECTIVE

The purpose of the study was to determine the tendency of scoliosis that is owned by athletes at the table tennis age of children and adolescents. The tendency of scoliosis that is owned by athletes at the tennis age of children and adolescents. The influence of both sports on athletes scoliosis age of children and adolescents. And, a comparison of the effects of both sports on athletes scoliosis age of children and adolescents.

MATERIAL AND RESEARCH METHODS

This research was conducted through a causal comparative research approach (ex post facto). The sample in this study is a sample that has met the criteria of independent variables totaling 23 people with 16 table tennis athletes at MM Shiamiq Club Manahan, Surakarta, Indonesia and 7 tennis athletes at the Yunior Tennis Club Manahan, Surakarta, Indonesia. The sample in this study is a member of the population that has met the research criteria. The criteria of this study were to have attended training with a total training time of at least 300 hours.

Examination of the possibility of scoliosis was assessed by measuring aspects such as leg length discrepancy, plumb line test, angle of trunk rotation and scapular winging test. All of these examinations are carried out by a physiotherapist and doctor.

Limb length discrepancy or leg length discrepancy is a condition where there is a difference between the lengths of both legs [5]. To find out the difference in leg length, the measurement of limb length was done by measuring the distance between ASIS (*anterior superior iliac spine*) with the medial malleolus measured by a tape measure, and comparing on both sides [6,7,8].

Plumb line test is a quick visual examination to see whether the spine is straight or not. To do this examination using a pendulum. In a straight spine, when the pendulum is dropped from the spinal segment of *spinous process cervical 7*, the end of the pendulum passes right in the middle of the spinous process along the thoracic and lumbar segments of the spine, the midpoint between the two PSIS (*posterior superior iliac spine*) right and left, the median sacral crest of the os. sacrum and os. coccyx. In scoliosis, the perpendicular lines of the spine will shift to the right or left side of the body and are not right through these parts. The pendulum that is dropped will shift to the right or left side of the body away from these three parts. The results obtained are loading the body weight to the right or left. The distance from the midpoint of both PSIS (posterior superior iliac spine) right and left to the pendulum is measured using a tape measure. The position of the sample stands and the position of the sample foot forms like the letter “V” with an angle of about 30 degrees, then the pendulum is dropped from the spinous process cervical 7.

Patients with the possibility of scoliosis will have lateral bending of the spine, but this curve will cause spinal rotation and the result is a rib hump seen during examination at Adam's forward bend position. Then, the examiner can try to measure the curve and spinal rotation with a scoliometer. The results of measuring the angle of trunk rotation taken are the highest values in the thoracic and lumbar segments.

Scapular winging refers to the os. scapulae that protrude out like wings. Winging scapula is also a useful sign to suggest a fundamental problem on the shoulder. Winging scapula can be caused by injury or dysfunction of the muscles themselves (muscles attached to the os. scapulae) or nerves that supply the muscles. Scapular winging tests consist mainly of "wall push-ups" and observations by the examiner on the os. scapulae to determine positive or negative results.

Figure 1. Winging scapula test; A. The sample must be open enough to allow proper inspection of the entire back. B. Range of motion checks will show dynamic and static deformities. C. “Wall push-ups” are used to evaluate serratus anterior palsy (palsy). D. Shrug shoulders evaluate trapezius paralysis (palsy).[9]

Then, the results of this measurement data will be tested by using the T-test technique, which previously tested the normality and homogeneity of the sample data. The normality test is done by Ryan-Joiner (similar to Shapiro-Wilk) technique and homogeneity test is done using Levene’s Statistic technique with the help of a computer through the Minitab 17 software.

RESULT

Examination and measurement

From the examination and measurement of samples, the results of the research data in the table below are obtained.

Table 1. Data of Research Results

Sample Number	Sport	Scapular Winging		Angle of Trunk Rotation (xº)		Leg Length Discrepancy (cm)			Plumb Line Test (cm)		
		L	R	Th	Lum	L	R	Difference	L	0	R
1	TT	-	+	-	3º	**76,4**	75,1	1,3			0,8
2	TT	-	+	6º	6º	**93,7**	91,9	1,8	1,7		
3	TT	-	+	-	3º	71,7	**73,1**	1,4	1,2		
4	TT	-	+	-	2º	**85,7**	85,5	0,2			0,5
5	TT	-	+	2º	2º	**88,2**	87,8	0,4			0,4
6	TT	-	+	4º	4º	**71,6**	70,1	1,5	1,3		
7	TT	-	+	2º	2º	68,9	**69,4**	0,5	0,3		
8	TT	-	+	3º	3º	74,3	**75,2**	0,9	0,5		
9	TT	-	+	2º	2º	**86,2**	86,1	0,1	0,3		
10	TT	-	+	2º	2º	74,5	**75,2**	0,7			0,9
11	TT	-	+	3º	3º	**73,7**	73,1	0,6		√	
12	TT	-	+	2º	2º	**70,2**	69,1	1,1	0,7		
13	TT	-	+	2º	2º	**72,4**	72,0	0,4	0,5		
14	TT	-	+	-	2º	67,3	**68,1**	0,8		√	
15	TT	-	+	4º	4º	**86,4**	85,0	1,4	0,2		
16	TT	-	+	3º	3º	**84,2**	83,1	1,1			0,3
17	T	-	+	4º	4º	**80,7**	79,4	1,3	1,4		
18	T	-	+	2º	2º	**74,3**	73,7	0,6		√	
19	T	-	+	2º	2º	76,5	**76,8**	0,3			0,7
20	T	-	+	3º	3º	84,5	**85,9**	1,4	1,3		
21	T	-	+	3º	3º	**78,1**	76,5	1,6	1,4		
22	T	-	+	3º	3º	**77,8**	77,2	0,6			0,3
23	T	-	+	2º	2º	72,3	**73,5**	1,2	0,9		

TT : Table Tennis; T : Tennis; Th : Thoracal; Lum : Lumbal; L : Left; R : Right.
Bold : dominant.

Descriptive statistics

From the research data obtained descriptive statistics in the table below.

Table 2. Descriptive Statistics of Research Results

Measurement Data	Sports	Mean±SD	Unit
Leg Length Discrepancy	Table Tennis	0,887±0,506	Centimeter (cm)
	Tennis	1,000±0,493	
Plumbline Test	Table Tennis	0,600±0,477	Centimeter (cm)
	Tennis	0,857±0,556	
Angle of Trunk Rotation	Table Tennis	2,813±1,109	Degree (º)
	Tennis	2,714±0,756	

Leg Length Discrepancy is classified into 3 categories based on the magnitude of the difference; mild (difference < 3 cm), moderate (difference, 3-6 cm) and severe (difference > 6 cm), from this categorization [10] the results of the study are presented in the table below.

Table 3. Research Results Based on Leg Length Discrepancy Category

Sports	Leg Length Discrepancy Results Category	Frequency
Table Tennis	Mild	16
	Moderate	-
	Severe	-
Tennis	Mild	7
	Moderate	-
	Severe	-

Plumb line measurement results in the sagittal plane, the balance is considered abnormal if the distance is more than (>) 2 cm on radiological examination (X-ray), from this categorization [11] the results of the study are presented in the table below.

Table 4. Research Results Based on the Plumb Line Test Category

Sports	Plumb Line Test Results Category	Frequency
Table Tennis	Balanced	16
	Not balanced	-
Tennis	Balanced	7
	Not balanced	-

Cutting criteria for checking the angle of trunk rotation as follows; trunk rotation within normal limits: ATR from 0º - 3º, Intermediate trunk rotation: ATR 4º - 6º, Relevant trunk rotation and high likelihood that the child has scoliosis: ATR ≥ 7º, from this categorization [12] the results of the study presented in the table in below this.

Table 5. Research Results Based on Angle of Trunk Rotaion Categories

Sports	Angle of Trunk Rotation Result Category	Frequency
Table Tennis	Within normal limits	13
	Intermediate	3
	Scoliosis	-
Tennis	Within normal limits	6
	Intermediate	1
	Scoliosis	-

Inferential statistics

1. Leg length discrepancy

Based on the results of the analysis of the normality test of table tennis data group, the P-value value is > 0.100. Based on the results of the analysis of the normality test of the tennis data group, the P-Value value is > 0.100. Based on the results of the homogeneity test analysis obtained P-Value value of 0.843. Based on the results of the T-test analysis, the P-

Value value is 0.626. In this average difference test Ho is rejected because the value of P-Value > α (0.626 > 0.05). Thus it can be concluded that "There is no significant difference in the value of the difference in the length of the legs between athlete's table tennis and tennis".

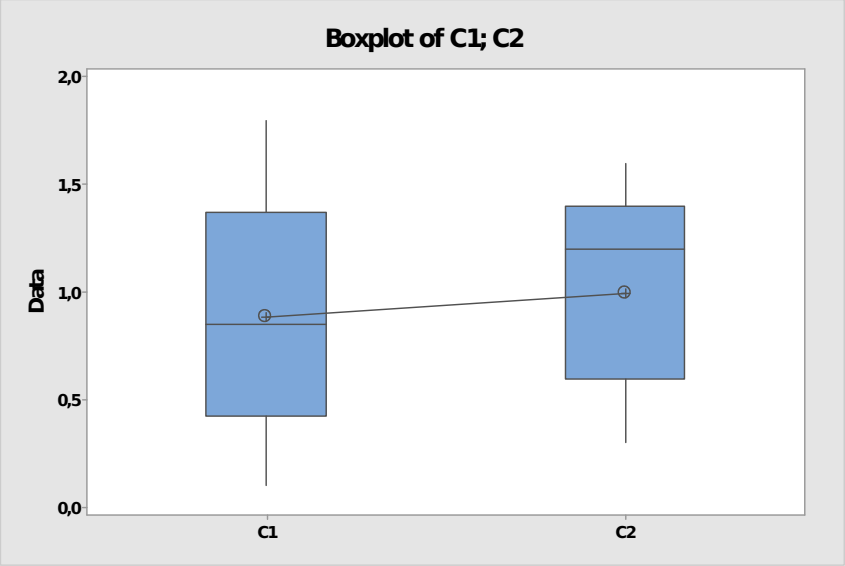

Figure 2. Leg length discrepancy boxplot.

2. Plumb line test

Based on the results of the analysis of the normality test of table tennis data group, the P-value value is > 0.100. Based on the results of the analysis of the normality test of the tennis data group, the P-Value value is > 0.100. Based on the results of the homogeneity test analysis obtained P-Value value of 0.526. Based on the results of the T-test analysis, the P-Value value is 0.270. In this average difference test Ho is rejected because the value of P-Value > α (0.270 > 0.05). Thus it can be concluded that "There is no significant difference in the value of the pendulum shift distance between athlete's table tennis and tennis".

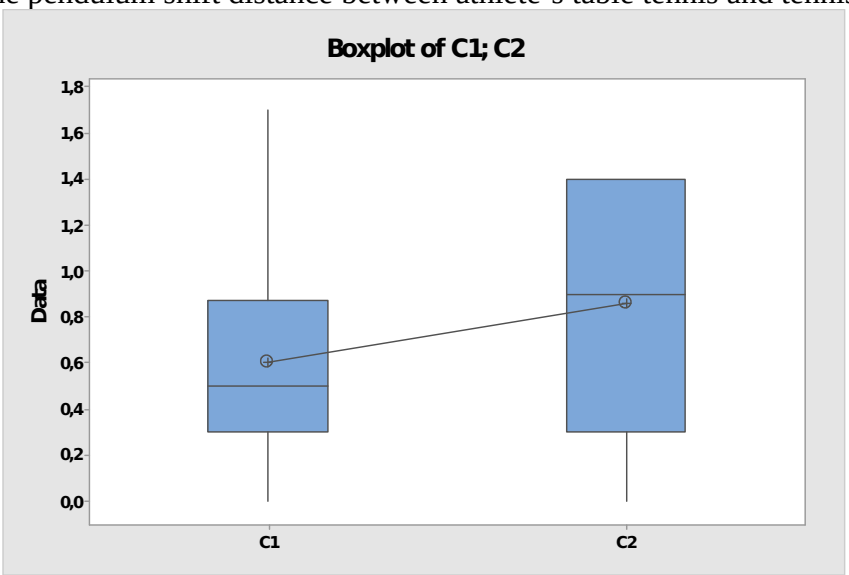

Figure 3. Plumb line test boxplot.

3. Angle of trunk rotation

Based on the results of the analysis of the normality test of table tennis data group, the P-value value is > 0.100. Based on the results of the analysis of the normality test of the tennis data group, the P-Value value is > 0.100. Based on the results of the homogeneity test analysis, the P-Value value is 0.473. Based on the results of the T-test analysis, the P-Value value is 0.834. In the average difference test Ho is rejected because the value of P-Value > α (0.834 > 0.05). Thus it can be concluded that "There is no significant difference in the angle of trunk rotation value between athlete's table tennis and tennis".

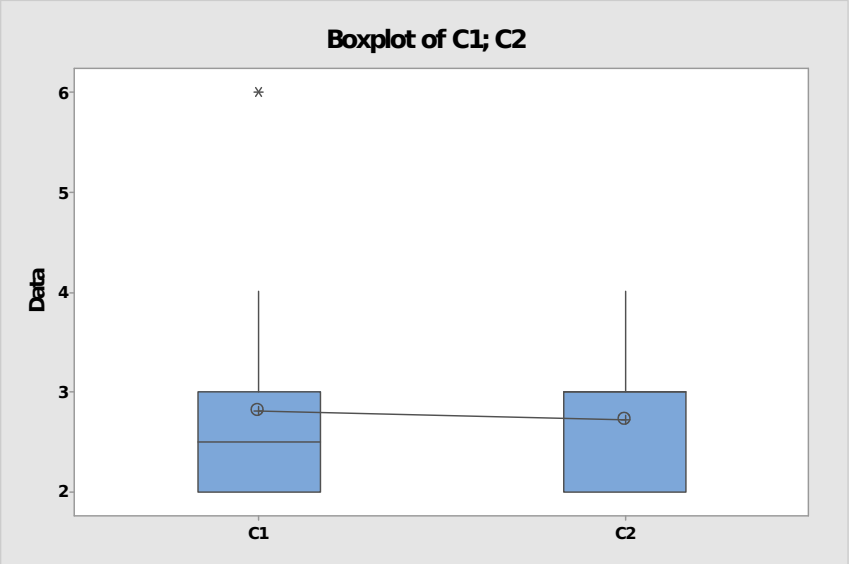

Figure 4. Angle of trunk rotation boxplot.

DISCUSSION

Scoliosis posture of table tennis and tennis athletes

1. Mechanism of scoliosis posture formation in table tennis and tennis athletes

Tennis is a sport with cycle and non-cycle movements, both types of motion are alternately supporting each other in the effort of tennis players reaching and hitting the ball accurately and precisely. In the tennis service movement, for example, the optimal coordination (timing) of these body segments will allow the transfer of speed efficiently through the body, which moves from one body segment to the next. The speed of the previous body part is added to the next body segment which increases its speed to the cumulative total. Notice how the speed of all body segments collects in the "stair effect" to help build the speed of the racket before the collision.

Parts of body	Biomechanics
Leg	Knees (Flexion and Extension)
↓	↓
Hip	Hip Rotation
↓	↓
Trunk	Trunk Rotation
↓	↓
Arm or Shoulder	Arm Rotation about The Shoulder
↓	↓
Elbow	Elbow Extension-Forearm Pronation
↓	↓
Wrist	Wrist flexion

Figure 5. Body segments that play a role and a series of biomechanical coordination in the tennis service movement.

In general, the muscle groups used when playing tennis are the calves (*gastrocnemius and soleus*) are the first muscle groups involved when playing. The gastrocnemius is the largest muscle behind the calf or the lower leg, and the soleus is the smaller muscle located below it. Next to the calf link or upper leg, these muscles are *hamstring* and *quadriceps* on the front of the thigh. Strength and energy are then transferred to the next link, namely *gluteus maximus* and *medius*, otherwise known as buttock muscles. Muscles of *abdominals, obliques, latissimus dorsi* and *erector spinae* are the next major muscle groups in the kinetic sequence. The abdominal muscles known as the "six pack" consist of the *rectus abdominis* which extends from the ribs to the front of the *os. pubic* and *abdominus transversal* that wrap around the middle of the body. Obliques muscle are on the side of the body, and erector spinae are the muscles that stretch along the spine. Latissimus dorsi is the largest muscle in the back and together with the abdominal muscles support the body as a whole. The kinetic link of the upper body includes the main muscles of the chest, shoulders, upper back and arms. Pectoral muscles include *muscle deltoids* and *rotator cuff* which are a group of four muscles that support the shoulder joint. The main muscles used in the upper back are *rhomboid* and *trapezius* which point to the next link of the upper arm including *biceps* and *triceps*. Then the last muscles of the circuit are the *forearm flexor* and *extensor*. The muscle activation of the kinetic circuit is not much different between table tennis and tennis.

Human movement and function requires a long balance and muscle strength between the opposing muscles around the joint. Normal amounts of opposing force between muscles are needed to keep bones centered on the joints during movement; this is considered as "muscle balance". On the other hand, "muscle imbalance" occurs when the opposing muscles give a different direction of stress due to the "tightness" and/or "weakness". When the muscles are too tight, the joints tend to move in that direction and are limited in the opposite direction because this is usually the "path of at least prisoners". Muscle imbalance can be characterized by differences in each side-to-side (right versus left) or front-to-back (antagonist versus agonist) in length or muscle strength.

There are 2 causes of known muscle imbalance. First is the biomechanical cause of repetition of movement in one direction or continuous posture. The second cause is neuromuscular imbalance because it predisposes to certain muscle groups that become tense or weak.

In terms of posture of table tennis and tennis athletes, the contraction of the body muscles is dominated by one side of the body in the field of sagittal anatomy which divides the body into the right side "*dextra*" and the left side "*sinistra*". Because the muscles on one side of the right or left contract more, this makes the muscles tighter than the opposite side. The length and strength of the muscles on the tight side are different from the opposite side, which is considered weaker. This makes the bones and joints pulled toward a firmer muscle and gives effect to changes in the shape of the joints out of the normal position.

In the posture of table tennis and tennis athletes, the activation of upper body muscles when playing can be started from the muscles of the abdominals, obliques, latissimus dorsi and erector spinae, then rhomboid and trapezius, the pectoral muscles including the muscles of the deltoids and rotator cuff, and the the last flexor and extensor forearm. Some of these muscles, *origins* or *insersio* muscles attach to the spine (vertebrae) and ribs (thorax). So, when some of these muscles have excessive tension, the muscle will pull the spine to the tight side of the muscle in the sagittal plane (left or right) and will form a scoliosis posture.

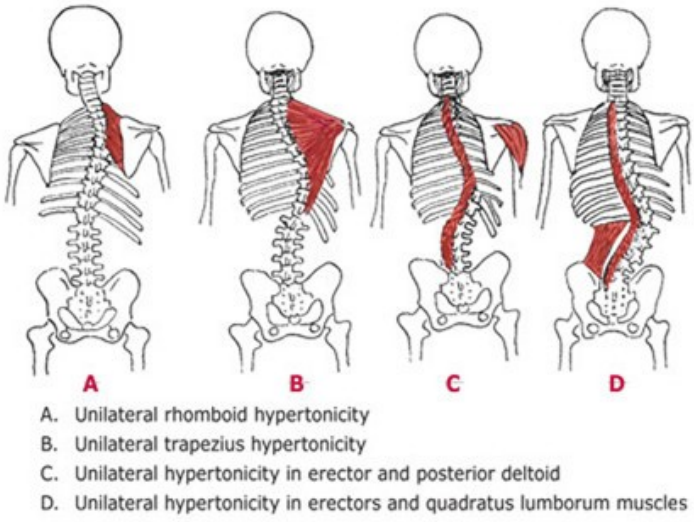

Figure 6. Illustration of several hypertonic muscles.

2. Relation of leg length discrepancy, plumb line test, angle of trunk rotation and scapular winging with scoliosis

Leg length discrepancy greater than 1 cm affects normal body alignment affecting the spinal joints, sacroiliac and hip and legs [5]. Regarding standing posture, several authors have found an association between LLD and scoliosis [13,14,15], while one study has found unclear relationships [16]. The most common compensation for limb length differences in posture is functional scoliosis [17]. Functional, or false LLD is the result of muscle (tight / weak) or joint stiffness in all joints of the lower extremity or spine. Some of the more common causes can be caused by pronation or supination of one leg in relation to another, abduction / adduction of hip stiffness / contracture, knee hyperextension due to weakness of the femoris quadriceps, and lumbar scoliosis [18].

Lateral lateral spinal translation is an important clinical sign in patients with scoliosis and lower back pain [19,20,21,22]. Doctors usually measure the trunk line in adolescent follow-up with scoliosis using a plumbline, determining the horizontal displacement of the midline [23].

Thoracic scoliosis can cause the chest to twist into an unusual position. This can cause the chest, pelvis and hips to become misaligned, which then creates recognizable scoliosis rib humps. Whether scoliosis is curved left or right, bending (bowling) causes the muscles to

tense on one side and weak, extended muscles on the other side. This causes the ribs on the concave side to be pressed closer, and the ribs on the opposite side are further apart. The hump of a rib can usually be seen at the point where the rib cage is separate. As scoliosis develops, the spine and spinous processes in the main curve area rotate towards the curve of the curve. On the concave side of the curve, the ribs are close together. On the convex side, they are far apart. When the spinal segment rotates, the spinous process deviates more and more to the concave side and the ribs follow the spinal rotation. The posterior ribs on the convex side are pushed posteriorly, causing a rib hump that is typically seen in thoracic scoliosis. The anterior ribs on the concave side are pushed anteriorly. [24]. The criteria for angle of trunk rotation > 7º in the thoracic or right convex curve and the angle of trunk rotation > 6º for thoracolumbar and lumbar or left convex curve are sufficient to identify patients with Cobb angles 25º or more [25].

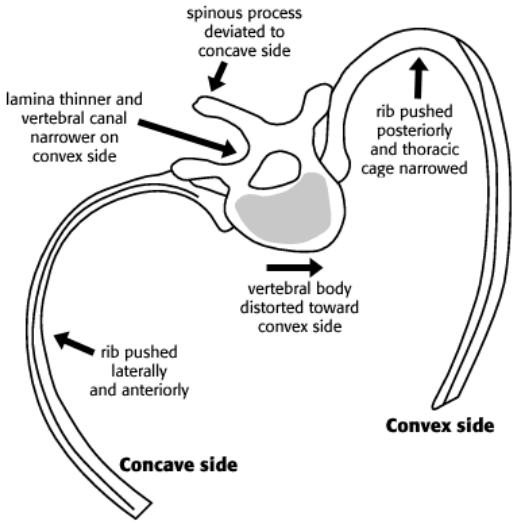

Figure 7. Typical distortion of the spine and ribs in thoracic scoliosis [24].

Scapular winging is most often categorized anatomically as medial or lateral, although categorization based on primary and secondary etiology is also useful. Primary scapular winging occurs when muscle weakness interferes with the normal balance of the scapulothoracic complex. Secondary scapular winging occurs when glenohumeral joint pathology interrupts scapular coordinated movements. [26]. Primary scapular winging describes dysfunction in one or more scapulothoracic stabilizers (ie, serratus anterior, trapezius, rhomboids) which cause muscle imbalance in scapular alignment. Secondary scapular winging occurs in association with other pathologies (e.g, subacromial bursitis, glenohumeral joint disorders) [26]. According to Gozna & Harris (1979) and Kauppila & Vastamäki (1996), the most common cause of primary scapular winging is paralysis of the serratus anterior muscle after damage or injury to the long thoracic nerve. These nerve injuries include compression, traction, and lacerations [26]; the most common injury is neurapraxia after blunt injury or stretching. According to Kauppila (1993) and Vastamaki & Kauppila (1993), the surface section along the lateral chest wall places a long thoracic nerve at risk of compression and contusions [26]. According to Galano et al. (2008), driving accidents, falling from heights, and sports accidents are reported causes [26]. According to Wiater & Flatow (1999), sudden depression in the shoulder and round neck is the cause of stretching injury that has been quoted in serratus anterior palsy [26]. According to Fiddian & King (1984), athlete collisions, including soccer players and ice hockey and wrestlers, are at

risk of injury to long thoracic nerves [26]. Repetitive activity with the head tilted away from the nerves and arms above the head - as happens in baseball pitchers, javelin throwers, and tennis servers - can place thoracic nerves long at stretching [26]. So it can be concluded that there is no connection or relationship between scapular winging and scoliosis.

Comparison scoliosis posture of athlete's table tennis and tennis

Table tennis won many factors compared to tennis. Important factors considered for table tennis include flexibility, balance/coordination, reaction time, tactics, motivation and skills. Surprisingly, aerobic ability is considered very similar between the two sports. [27]

1. Table tennis

Table tennis is a sport that relies on smooth movements that occur very quickly and the execution of the right shot. This is a reaction sport that must respect the mental and physical skills needed to compete at a high level. Players must rely on accurate anticipation of their opponent's attacks, constant vigilance, react to the sound of the ball, and the right biomechanics that allow them to choose and execute motion patterns that provide the best chance of winning the rally. In table tennis in particular, exceptional ball speed and short distances between opponents allow very little time to react and execute punches.

2. Tennis

Modern tennis games have evolved from basic technical sports to explosive sports as they become more dynamic and faster based on strength, speed, and power with higher stroke speeds and services leading game services to be a key factor in game success [28,29, 30]. The functional link observed between dominant upper and lower leg muscle strength and the ranking position of competitive tennis players reinforces the idea that physical attributes have a strong influence on tennis performance and may be an important determinant for successful participation in elite tennis [31,32,33].

3. Comparison result both of sports

In table tennis, this sport's reaction time outperforms tennis. With more repetition in time units compared to tennis, the formation of scoliosis postures in table tennis athletes has a greater likelihood compared to tennis athletes. More repetition in units of time than tennis, table tennis raises the possibility of greater muscle tension than tennis, this creates a one-sided imbalance that is more likely than tennis. On the other hand, in tennis, strength is needed especially for strokes and services. Strength can be influenced by body composition, especially muscle mass, more muscle mass formation can increase the strength of the stroke. Strength in the arm to make a more powerful stroke on tennis, influences the formation of scoliosis posture on the tennis athletes, which has a greater likelihood compared to table tennis athletes. Stronger muscle contraction compared to table tennis, tennis can result in greater muscle tension compared to table tennis, this causes a one-sided imbalance that is more likely than table tennis. Therefore, table tennis outperforms tennis in terms of more repetition in time units, while tennis outperforms table tennis in terms of strength of muscle performance, both of which can affect the athlete's scoliosis posture.

CONCLUSION

The tendency of scoliosis that is owned by athletes in table tennis age children and adolescents is mild scoliosis category. The tendency of scoliosis that is owned by athletes in tennis age children and adolescents is mild scoliosis category. There is a significant influence on the sports of table tennis and tennis on the tendency of athlete's scoliosis to age children and adolescents. There is no significant difference in the influence between the sports of table tennis and tennis on the tendency of athletes to scoliosis ages of children and adolescents. Table tennis makes it possible to form scoliosis postures in athletes with greater likelihood

than tennis because of more repetition in time units. Tennis makes it possible to form scoliosis postures in athletes with a greater likelihood than table tennis because of the need for more muscle strength to do a more powerful stroke. Do additional exercises on the sides of the arms and legs that are not dominant, to maintain muscle balance. Doing freestyle swimming in the context of recreational sports can maintain the balance of muscle activation between one side and the other.

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