

# Concept Development on Spin Serve Exercise Model of Lawn Tennis Based Kinovea

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**Abstract**—The article aims to enrich the research approach on the model of exercise serves lawn tennis sports. The development was conducted focus on the study of the development exercise model of spin serve lawn tennis sports based on kinovea. The novelty of the concept model developed is using motions analysis application to get angle movement to correct the fault motion or position of the segment the body data. The results of the study were to develop model exercise through motion pattern spin serve tennis court identification; the spin serves motion pattern was an analysis of biomechanics, to develop spin serve exercise model kinovea based, and motion evaluating use kinovea. Based model stage of serve lawn tennis composed of seven elements, i.e., coiling, ball toss, backswing, uncoiling, strike zona, follow through, Fallin. The next step is to analysis biomechanics of the segment of the body either in the quiet position or moving. That could be useful as essential to developing exercise model design spin serves of lawn tennis using of kinovea application. In sum is the concept of developing a model design spin serve tennis court kinovea based.

**Keywords**—*spin serve of a tennis court, exercise model development, kinovea*

## I. INTRODUCTION

Sports achievements can only be achieved through a planned, systemic and sustainable training process. Tennis court is one type of sports that require skill and physical strength. Player tennis skills can only be achieved with a useful training model. Various commonly used training techniques such as direct movement or through images have been shown to contribute to the ability of tennis players. The next development in the sports training model is the use of video technology. Kinovea is a tool in the form of software that makes it easy for the trainer to control the sequence of movements of the sport accurately. In playing tennis, each game will start with a serve punch. Serve the essential case on a tennis game. The success of effective service is the first advantage to getting the point. Theoretically, the tennis player must dominate all type serve, flat, spin, and slice. The coach should be training the player all three types the serve. The player can make a choice which one of the appropriate types for game conditions and the opponent's weakness. The three types of service can be used at the same time. However, many players were challenging to plan the service condition. The other side, the use of a simple serve technique will make it easier for the opponent to read and will be easy to return attack. The player will lose a point on serve.

Moreover, serving a combination of forehand or backhand is essential to find the opponent weakness. The

worst conditions if double faults occur. Therefore very essential to dominate all three types serve on tennis.

Based on survey result, the tennis player especially at Makassar, Peltha Cup XXII on July 2016 and IMB CBR event at Karebosi tennis court on Oktober 2016 there is 12 ace, 416 double faults, 1613 second serve, and 148 total games. The Data showed that the player did not have weapon serve. About serve without using biomechanics evaluation will be difficult for improvement serve skill. Moreover, the player does not understand movement weakness which has been done. The modern coach uses the camera for capture movement the player. So will understand the weakness of the movement and showing to the player.

Moreover, it will be fast to evaluation to corrective. This case has a different result if using observation evaluation. The using video camera will be more accurate to give data.

The article aimed to describe concept development of exercise model spin serves on lawn tennis sports. Artikel in enriches the knowledge about how to develop of exercise model spin serve. Factually, The reality, spin serve rarely used than flat or slice serve. The professional level, serve is the weapon for getting the first point. The tennis player mostly only two types serve, flat and slice serve. They are very rarely using spin serve. Even though by analyzing the spin serve has greater opportunity success on serve, but it must be done correctly.

The conventional motion techniques exercise the serve tennis using whole movement method of services include practice to hit the ball to serve the area. That Exercise begins from the near net to baseline. That method cause to make a mindset is the critical thing is the ball goes in serving the area. How much better, the right motion and the ball goes in serving the area. Even though right serve movement can make contributions to the ball goes in serving the area. Therefore on developing exercise spin serve model must be based biomechanics system.

The fact shows above; the author wants to introduce how about developing spin serve as a weapon in the second serve, although it can be a weapon in the first serve. There are several steps in the analysis of spin serve: Firstly, analysis of the motion pattern of spin serve — secondly, biomechanics analysis. Thirdly, analysis angel using kinovea and fourthly do a variations the motion model exercise.

In tennis modern the good tennis serves to have seven key motion pattern, such as; coiling, toss, backswing, uncoiling, strike zone, follow throw, fall in. Then, severally analyzed on a biomechanics system for known the angel's

segments of upper and lower extremities — joints of hands, trunk, shoulders, knees, ankles, wrist, and arch of vertebrae. Moreover, then will make variation exercise movement for positive transfer of movement occurs. The variation movement is significant so that the player not bored on to do exercise.

One of the tools to develop the concept of the spin serve exercise is Kinovea. This application is the software that can slow down movement in the video so that observed movements can be analyzed. With the slow-motion technique, researchers can analyze the right physical motion and sensor patterns in the spin serve. With the help of computers, researchers can observe the angular kinematics, the angle of motion in the upper and lower motion parts.

According to Kinovea function, researchers develop the concept of practice spin serve on lawn tennis. The results of the development contribute to the application of the model of lag on both athletic training and training for sports science students.

## II. RESEARCH METHOD

The study is qualitative descriptive to describe concept development stages. This study elaborated the results video of tennis athlete recordings and look at the serve technique on the preparation stage, contact point and follow through. With kinovea, The researcher involved five tennis coaches in identifying motion and then making an analysis. The analysis results form the basis for developing the concept of spin serve practice.

## III. RESULT AND DISCUSSION

### A. Serve Technique

Serve on lawn tennis is the start of the game with player hit the ball diagonally opposite opponent serve area without touch the net and fall in the box serve the area. The rules of lawn tennis serve the players has a double chance of serve in every game. It called first serve and second serve. The serve is the short time to getting the point. So must be done with full power and accuracy. John Isner recorded 113 aces serve on March 2013 [1]. He has a high 200 cm, so when serving the ball sharp angles and has a high level of accuracy. Besides being supported by height, he has the power and biomechanical movement. Therefore we must know tennis serve steps, so that can do correctly. Moreover, then we can practice correctly.

Kind of serve in tennis such as flat serve, spin or kick serve, and slice serves [1]–[7]. The flat serve can have more speed than spin and slice serve. High players will better do flat serve. It is superiority the ball goes an opportunity to target because it will have shape angles.

The sequence serves movement stages:

- The player stands based line near center mark facing the net, the right-hand player foot right one step to backward, so the body sideways to the net. Using a proper grip, and relax.
- Preparing the ball for thrown up by the left hand, put the racquet in the right hand, and the body weight focuses on the right foot.

- Thrown up the ball and release the ball from the straight arm, the excellent toss must send the ball to be reached by the racket.
- Reach the ball at the height by the racket, strengthen arm, elbow, and wrist when swing racket.
- When follow throw, racket and arm will stop after around to beside the waist. Get it balancing to replacing the focus foot by the right foot. Moreover, then ready for the next stroke [3].

Type tennis serves primarily the same way to do, but the difference is angle toss the ball. Naturally, the tennis serve exercise can use the clock method. The flat serve the ball hit on 12 o'clock. The spin serves the ball hit on 11 o'clock, while the slice the ball is hit on 1 o'clock [1].

### B. Flat serve

A flat serve is basic of all serve type, so this type easier skillful early then spin and slice. Rofl classify about flat serve become five crucial points such as; 1) vertical slant., 2) more power., 3) ball contact., 4) to the front., 5) balance [2]. The vertical slant is a straight line that is obliquely formed by both right and left shoulder. The shoulder forms a line and is tilted to get the vertical swing arm at the contact position. More power is the flexion of the wrist when contact to get acceleration and power. Ball contact is the position of the left arm on the right-hand player that crosses the body when making contact with the ball. To the front is the advanced movements of the arm of the beating down to the front of the body. Balance is needed because after the contact body is leaning forward, the balance of the hind legs as a counterweight to the position is straightened backward.

### C. Slice Serve

This type of service is also called a side spin, which provides lots of spin and control from a flat serve that uses less power. Optimal in placing the slice serve will produce a ball that slides sideways away from the opponent. The player must be able to vary the serve (flat, slice, and spin) so that it is not easy to read by the target of the target ball. Essential steps in performing slice serve techniques are as follows:

#### 1) Preparation

- Hold the racquet using a continental grip
- The upper body is leaning a little further back in the load receiving position.
- Excess body rotation is uncomfortable when backward, one has to tilt a little back, but not too much, and one does not get too far back to get the right position.
- Toss up to the right side for right-handed players, and on the left side for left-handed players. Create a large V shape and allow it to rotate more through the contact.

#### 2) Swing and contact with the rackets (forward swing and contact)

- The racket holder arm continues upward, the elbow is extended, pronates the forearm, so from inside to outside, and the wrist is firmly forward to the outside of the ball. A spin turns sideways on the ball.

- The front shoulder and the tossed arm are rotating to form the extra angle of momentum needed in the slice serve.
- The front corner of the body and shoulders are slightly more closed.
- The position of the front shoulder forms an angle on the racket that produces slices.

### 3) *Advanced motion (follow-through)*

After impacting the racquet with the wrist ball, keep moving around from head to racket parallel to the waist.

#### D. *Spin Serve*

Spin serve is very useful for use in clay lawn or concrete lawn because of high ball reflection and the result of serve movements when crossing the net. This serve makes problems for opponents when trying to restore service, because of high ball bounce and out of the attack area. Topspin serves a good bounce always on the opponent, and a good Kick serves the rebound always far from the opponent depending on the server location and spin. Topspin bounces directly on the opponent's floor about 0.3 meters in front of the feet and bounces on the opponent's body, while the Kick serves aims to bounce away from the opponent.

Preparation for topspin or kick serve the position of the body forms an arch on the back, the waist is pushed forward until parallel to the baseline, and the shoulder forms a backward angle. The head is set, and the shoulder is tilted backward while the body position is held to bend backward. The backward curved position requires sufficient strength to maintain the position supported by contraction of the abdominal muscles. The shoulders remain relaxed after servicing and then rotate forward when servicing because the backward curvature of the body makes the knee load slightly more than other types of serves. In the toss arm from the back forms the letter V to the side with a vertical line. About the backward curvature of the body, the head is also comfortably backward. Then the body moves forward and deals with the ball and racket. On Kick serve always toss up or slightly behind the server. It crosses the left shoulder for the player holding the right hand, and the right shoulder for left-handed players. Toss for spin serve is lower and move up.

Forward swing and contact for the kick serve the body stays facing the side (to the side fence) until the ball is released from the racket — racquet trajectory up and crossing the ball or from left to right from 7 o'clock to 2 o'clock. The player must focus on the upward waist movement. Once forming a full backward arch, the forearm, and racket experience pronation, and slightly extend upwards. Both feet push up correctly, the racket head can tie the ball from the kick serve. Topspin is built from a combination knee extension to the front top with the racket head pushing up and to the side. The difference between wrist laceration at kick serve, and topspin is the difference in angle on the ball hitting the arm. For topspin serve, the tossed ball is rather low and in front of the player, and brushed from 6 o'clock to 12 o'clock (in the clock method) or from bottom to top on the ball, making topspin serve forward. On the kick serve ball hit from 7 to 2, for left-handed players at 5 to 11, or diagonally upwards.

**Follow-through** In the kick serve the wrist wrists are more out of the body and make the racket head rotate head slightly forward. On topspin, it serves a little swing outwards but more upwards and through broader movements

Each type of service has a different direction, so players can choose and combine which types are according to plan. The modern tennis forgets the power of serve classify the serve movement pattern stages into seven stages: (1) *Coiling*; (2) *Ball toss*; (3) *Backswing*; (4) *uncoiling*; (5) *strike zone*; (6) *follow-through*; (7) *fall-in* [5].

1) *Coiling* is the initial movement before servicing; the server must ensure that the upper body rotation is earlier before doing the toss. Although this rotation includes knees and hips slightly bent, the most important thing in tennis is rotation on the shoulder.

2) *Ball toss*, Release the ball up vertically according to the type of service and the ball loose when the throwing arm is straight. The important thing in doing toss is the angle and height of throwing. The flat ball serves thrown in a vertical angle in front of the head. For slice serve the ball is thrown over the right side of the head (for right-handed players), while for a spin serve the ball is thrown over the left side of the head.

3) *Backswing* is a swing of the arm back as a prefix before hitting the ball from the toss. After the ball is released from the thrower's hand, the swinging stage begins. The hand of the ball thrower, body and racket away from the net and approaching the back fence. Body weight moves from the front foot to the hind leg.

4) *The uncoiling* process is an arrangement in motion, foot shifts, and body rotation again facing the net, without any serve rotation rhythm disturbance. In this process, the first pitch thrower (toss) full extension upwards starts to come down next to the body or crosses the front around the chest, before impact.

5) *Strike zone*, after the process the uncoiling stage is complete, and the process of hitting the ball starts with pivot synchronization, foot drive, and rotation core for strength when contacting up. Researchers refer to energy transfer as a chain of kinematics. The head of the racket passes through the hands and racquet with the player's head. The racket holder's elbow is almost pointing towards the net, the arm is bent, and the battering arm beside the ear is like calling. While the hand of the pitcher (toss), tucked in the stomach or crossed in front of the chest when the forearm rotates. Slip the left hand into a vital function, the shoulder armpits rotate slowly, or all three connect to the kinematic chain. Physically it is known that one connector stops suddenly and the next connector will experience a fast acceleration. Strong Sabetan occurs in the forearm pronation motion towards the top above. Based on tennis research that 70% of the serve ball velocity results from the internal rotation and hand speed.

6) *Follow-through*: When the arm has reached full pronation, then enter the follow-through stage. A split second after the ball is released from the surface of the racket, the thumb of the hand of the bat starts to point down. The hand suddenly stops and is placed in the stomach or the chest as the inertia of the kinematic chain which causes the

body to pull from the floor. The important thing from this stage is that no consensus is trying to jump when hit when serving.

7) *Fall in:* In the final stage of this service is landing inside the field area. The first leg to land is the front foot and is followed quickly by the back foot (on the right-hand player). In this stage, the throwing arm of the tossed ball is swung to the left far behind the body slowly as a process of slowing down.

**E. The Serve Anatomy**

Broadly speaking there are three main phases in serve and anatomically can be seen in the following figure:

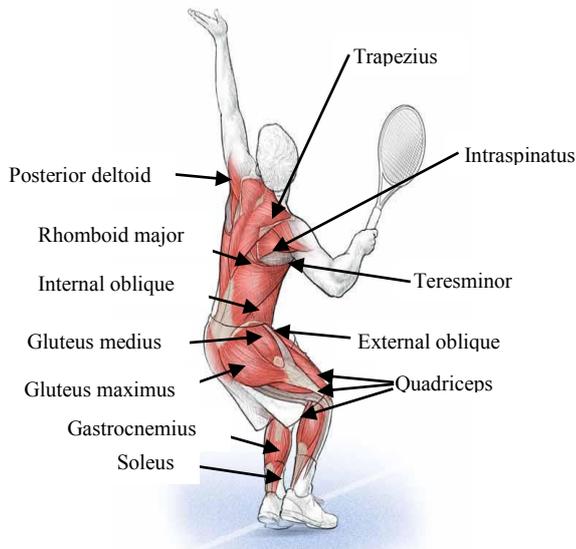


Fig. 1. The anatomy Loading Phase[8]

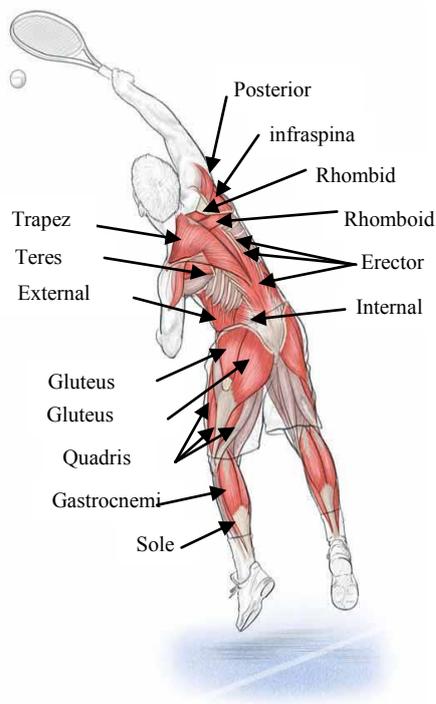


Fig. 2. The anatomy Acceleration phase [8]

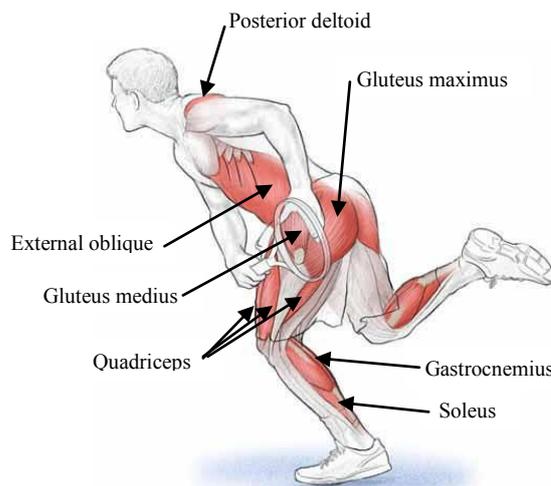


Fig. 3. The anatomy follow throw Phase[8]

**F. Procedure Development Concept**

Development of the concept of the spin serves practice model with kinovea through the procedure in figure 4.

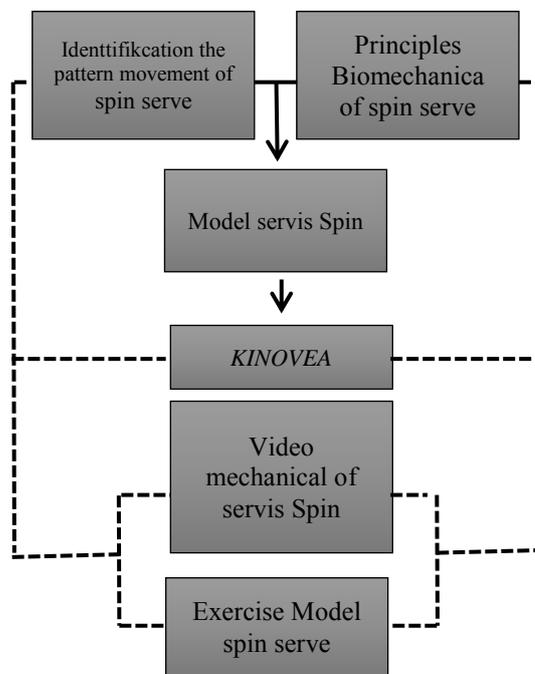


Fig. 4. Concept Development Procedures

The procedure of development concept of exercise spin serve of lawn tennis started from identification type spin review of mechanics motions on biomechanics analyzed. Analysis anatomy muscle involved and the position expected in the motion spin serve. In practice, the author analyzed the professional video of spin serve use kinovea application. The next step author making the map concept from the server, the spin anatomy muscle, the motion mechanics down and the last result obtained is the body position and movement, and that is the concept as a basis to making a model exercise spin serve in lawn tennis.

The result of development concept as the map of spin serve, which produces the concept for development model of spin serve. The analysis development on the map concept as

the segment body position and movement which must be exercised for can pattern movement of spin serve. The map

concept of spin serve patterns shown in Table 1.

TABLE I. MAP OF CONCEPT

Tennis Serve		Biomechanics	Segment	Analysis development concept
Preparation	Coiling	Balance	Shoulders	<ol style="list-style-type: none"> <li>1. Angle to two legs (right and left)</li> <li>2. Moving the weight point from the front foot to the back foot</li> <li>3. The angle of the elbow, knee, spine, spine</li> <li>4. Muscle thigh and calf contractions</li> <li>5. Angles on the head and neck</li> <li>6. Trajectile motion, left hand and stump, elbow and racket</li> <li>7. Trunk rotation</li> </ol>
	Ball Toss	Inertia	Lower arms	<ol style="list-style-type: none"> <li>1. Transfer of weight points</li> <li>2. Head angle</li> <li>3. Angles of both shoulders</li> <li>4. The angle of the upper arm</li> <li>5. The angle of both knees</li> <li>6. Thrunk rotation</li> <li>7. Left elbow angle</li> <li>8. Right elbow angle and racket leaf position</li> <li>9. The angle of the throw from the frontal direction</li> <li>10. Throw height</li> <li>11. Spine angle</li> <li>12. Trajectile release of the ball by the finger</li> </ol>
	Backswing	Coordination-continue	Wrist	
Contact point	Uncoiling	Range of motion	Elbow	<ol style="list-style-type: none"> <li>1. The angle of the ball thrower arm</li> <li>2. Projectile throwing arm</li> <li>3. The angle of throwing arm elbow</li> <li>4. Transfer of weight points</li> <li>5. Projectile forearm</li> <li>6. Projectile leaf racket</li> <li>7. Point of contact ball with a racket</li> <li>8. Pronation of the forearm</li> <li>9. The speed of internal hand rotation.</li> <li>10. The angle of both feet</li> <li>11. Body angle</li> </ol>
	Strike zone	Segmental inter motion	Grip	
Follow-through	Follow-through	Force motion	Hip	<ol style="list-style-type: none"> <li>1. Both feet landing off the floor</li> <li>2. The front foot lands inside the field area</li> <li>3. Back knee angle</li> </ol>
	Fall in	Force time	Foot	
		Optimal projectile		
		Spin		

In the development of the concept exercise model, spin serves based kinovea always the implementation of biomechanics. Kinovea has an important role to obtain the result of that optimal serve and also has also been linked to minimize over a motion that can cause injured segments that are important in the body.[9]–[13]. The success in the tennis also serves important analysis laws biomechanics who requires to movement in segments of the body to move according to a pattern of mechanics which needed in order to increase power serve.[14]–[17]. The use of the tools a camera that integrated with motion analysis application as kinovea who researcher do will give more the data accurate and also very helpful in see weakness and how which should be achieved, as practiced. [9] Thus analysis biomechanics by kinovea application and the tools and cameras were the foundation of the development of the concept model exercise spin serve lawn tennis that is going to be to translate into in the form of an exercise variation motion to suit the needs of motion in improved the skills of spin serve in lawn tennis.

#### G. Discuss

The development of the exercise concept spin serves by using kinovea very helpful in solving the weakness in the process of motion caused by faulty position on each segment the body had a role in the success of a motion spin serve. Researcher, in the development of the movement concept, get exercise model accurate according to the motion theory required in technique motion itself, the laws of mechanical

motion of the body, and physiology segments of the body when do motion. The reality, the process of exercise motion had not reflected on the conceptual learning and more holistic. Exercise model only based on the process repetition of the result of pattern motion spin serve, and not yet on how their exercise model to transfer movement in order to obtain pattern motion determined technically. The biomechanics is essential in the process of motion movement in spin serve in lawn tennis useful in the development of the concept through map the concept of the result of the analysis researcher will help tennis coaches will to coaching skill of spin serves in lawn tennis. The word “data” is plural, not singular.

#### IV. CONCLUSION

The concept of developing a spin tennis court serve model starts with the identification of spin serve motion patterns. To be able to identify can be in the form of a review of some literature which is then analyzed. The following steps examine the concept of motion that has been analyzed biomechanically so that each phase of the movement can be known which body segments are involved and how the movement is. The next step is with kinovea analysis to find out each angle of several body segments that perform a series of motion patterns from each phase. The final step can be made a variation of the exercise movement model based on the movement of the body segment, and the effective angle in the spin serve.

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