Forearm Passing Proficiency: A Skills Movement Analysis of Student Athletes In Volleyball

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Article Info

Abstract

Volleyball is a sport that requires technical skills, coordination, and good motor abilities. Mastery of basic techniques is a crucial factor in supporting overall playing performance, particularly the forearm pass, which serves as the initial step in building an attack as well as maintaining ball control against the opponent's offense. This study aims to analyze the forearm passing movement skills of student-athletes based on the preparation, execution, and follow-through phases. This research employed a quantitative descriptive design, with Kinovea version 0.9.5 as the primary instrument for motion analysis. A total of 10 students were selected as research subjects through basic technique observation and joint angle measurement. The results show that 2 students (20%) fell into the "very accurate" category, 7 students (70%) into the "accurate" category, and 1 student (10%) into the "less accurate" category. Kinematic analysis recorded an average knee flexion angle of 106.96° (range 83°–132.9°) and an average shoulder extension angle of 97.05° (range 80.5°–123.2°), both of which fall within the effective range for supporting body stability and ball control. The findings indicate that mastery of basic techniques and good movement coordination significantly contribute to successful forearm passing performance. Overall, these values fall within a range that supports effective execution of the forearm passing technique, suggesting that proper body positioning, fundamental skill proficiency, and coordinated movement play essential roles in determining the quality of students' forearm passing skills.

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INTRODUCTION

Volleyball is a sport that requires technical skills, coordination, and well-developed motor abilities. Mastery of basic techniques is a crucial factor in supporting overall playing performance, particularly the forearm pass, which serves as the initial step in building an attack as well as in maintaining ball control against the opponent's offense (Can et al., 2016; Effendi et al., 2020; Irawan, Permana, Hadi, et al., 2023). Mastery of fundamental techniques is a foundational element that determines the quality of play and the effectiveness of teamwork in team sports (Ramara et al., 2025; Taufiq Hidayat et al., 2025; Zen et al., 2025).

The forearm pass is a technique used to receive or deliver the ball using the forearms, commonly employed to handle serves or low balls. This technique requires body stability, muscular coordination, proper arm angles, and precise timing (Bujang et al., 2025; Irawan, Permana, Nurrahmad, et al., 2023; Rizal & Siska, 2024). The forearm pass is categorized as an effort in volleyball performed to deliver the ball to a teammate within the same court in order to build an offensive pattern (Marzuki & Setyawan, 2023). Errors in arm angle, foot positioning, or body posture may cause the ball to become inaccurate, too high, or difficult to control. Therefore, the forearm pass skill requires deeper and more comprehensive analysis.

Analyzing basic technical skills requires a multidimensional approach that includes objective measurements (such as skill tests, biomechanical video recordings, and match statistics) as well as subjective assessments (such as coach observations). Methodological reviews in sports skill evaluation emphasize that reliable and valid assessment instruments are essential for distinguishing player ability levels, monitoring progress, and designing targeted training programs. Without adequate assessment tools, training interventions may become less focused and less efficient (Faber, 2019; Koopmann et al., 2020; ndriani et al., 2019).

Analysis is a systematic process of breaking down a phenomenon, event, problem, or dataset into smaller components to obtain a comprehensive understanding. Through this process, relationships among components can be identified descriptively, causally, or logically. The purpose of analysis is to gain deeper insight, uncover root problems, and interpret the meaning of each component, thereby enabling accurate conclusions and the formulation of relevant solutions (Cimellaro & Marasco, 2018).

This study aims to examine the forearm passing skills of students at MA Nafa Petekeyan. The variation in basic technical abilities observed in the school environment is often influenced by differences in motor skills, playing experience, and training intensity. These conditions indicate the need for a systematic scientific investigation to analyze the quality of forearm passing movements.

Based on this background, the present study seeks to analyze students' forearm passing skills. The analysis is expected to provide an overview of movement quality, identify common technical errors, and offer

recommendations to improve the effectiveness of volleyball learning. Therefore, the findings of this research can serve as an evaluation reference for physical education teachers in designing more targeted and effective training programs.

METHODS

This study employed a quantitative descriptive design aimed at objectively describing the participants' basic forearm passing skills. Data collection was conducted in a single session at the JUA Arena Volleyball Court, where the court conditions and equipment were standardized to ensure uniform measurement procedures.

The primary instrument used in this study was the Kinovea software version 0.9.5, an open-source video analysis tool widely utilized in sports for observing and evaluating movement skills. Kinovea was selected because it provides frame-by-frame analysis, motion tracking, and measurements of joint angles and movement velocity (Puig-Diví et al., 2019).

Using this application, volleyball forearm passing techniques were analyzed objectively. The recorded movements were processed using slow motion, enabling detailed observation of foot positioning, hand position, stance, and ball rebound based on kinematic data.

The measurements obtained from Kinovea were converted into quantitative data and used to evaluate forearm passing skills based on predetermined technical indicators. The research procedure began with determining the research design and location, followed by selecting 10 student

participants. After preparing the instruments including the camera, tripod, and Kinovea software data collection was carried out through video recording of the forearm pass. The recordings were then analyzed in Kinovea to obtain kinematic data, which were evaluated together with technical observation results. All collected data were analyzed quantitatively to determine skill categories and movement characteristics, culminating in conclusions describing the students' level of mastery in forearm passing.

Participants

The population in this study refers to all students of MA Nafa Petekeyan who serve as the research subjects, consisting of 10 male students from the school. Population is defined as the entire group of subjects or objects possessing specific characteristics determined by the researcher to be studied and used as the basis for drawing conclusions. In quantitative research, defining the population accurately is essential because it determines the extent to which the research findings can be generalized. The more precisely the population is identified, the higher the validity of the results obtained. A population is not limited to humans; it may also include objects, events, values, or particular phenomena, depending on the focus and objectives of the study (Sugiyono, 2020).

Sampling Procedures

The sample in this study consisted of 10 male students who were selected as participants. All participants provided their consent to take part in the study by signing

an informed consent form prior to the research procedure.

Materials and Apparatus

This study required adequate facilities and equipment to obtain accurate motion analysis data in accordance with the research variables. Data collection and processing were carried out using a computer equipped with Kinovea version 0.9.5 as the primary video analysis software. A Xiaomi 12 Lite smartphone camera with specifications of 108 MP (wide), 8 MP (ultrawide), and 2 MP (macro), mounted on a tripod, was used to record the forearm pass movements with stable footage. Additionally, a volleyball, net, and field marker cones were used as practice equipment during data collection. Observation forms and assessment sheets validated by experts, along with writing instruments, were utilized to record observational results and evaluate students' performance throughout the study.

Procedures

The research procedure began with a planning stage that included determining the research design and the study location. Subsequently, research subjects were selected from MA Nafa Petekeyan students who met the predetermined criteria. The next stage involved preparing the research instruments, which included a camera or smartphone, a tripod, a volleyball, and the Kinovea 0.9.5 software for video analysis. After all instruments were prepared, data collection was conducted by recording each participant's forearm pass movements. These recordings were then analyzed using Kinovea to measure the relevant kinematic angles. A technique evaluation was also conducted

based on the forearm pass skill observation sheet. The collected data were analyzed to determine skill categories and interpret kinematic characteristics. The research process concluded with drawing final conclusions regarding the students' forearm pass skill quality based on the findings.

Design or Data Analysis

The data were analyzed using a quantitative descriptive approach with the aid of Kinovea 0.9.5 for frame-by-frame motion analysis to assess the forearm pass technique. Observed parameters included foot positioning, hand alignment, stance, and ball rebound outcomes. The kinematic measurements revealed that during the preparation phase, the average distance between feet was 0.22 ± 0.007 meters with a knee angle of $130.9° \pm 10.33°$. During the execution phase before ball contact, the right knee flexion averaged $123.28° \pm 17.08°$ and shoulder extension $97.01° \pm 17.11°$. At the moment of ball contact, the knee flexion measured $106.96° \pm 13.82°$ and shoulder extension $97.05° \pm 13.40°$. In the follow-through phase, the shoulder angle averaged $113.19° \pm 11.11°$, knee angle $122.15° \pm 18.56°$, and the ball rebound reached 1.562 ± 0.87 meters. These observational data were scored by predetermined technical indicators and subsequently processed using descriptive statistics to depict the skill level of the students' forearm pass.

RESULT

The lower forearm pass skill was analyzed based on three main phases: the preparation phase (initial stance), the

execution phase (ball contact), and the follow-through phase (final movement) (Machali, 2021). Figure 1 illustrates these phases of the forearm pass movement. In the preparation phase, the player stands with feet shoulder-width apart, knees slightly bent, and the body leaning forward. Both arms are brought together and extended forward with the thumbs aligned to form a stable platform for ball contact. In the execution phase, the movement is performed through a coordinated upward and forward motion involving the knees, hips, and forearms toward the incoming ball. Ball contact occurs on the lower forearms, with an appropriate body elevation angle to control the direction and trajectory of the ball. In the follow-through phase, the player directs the arms toward the intended target in alignment with the ball's rebound path while shifting body weight forward to maintain balance and continuity of motion (D. P. Wicaksono et al., 2014).
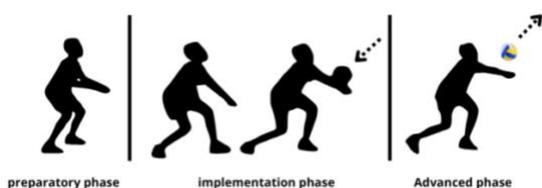

Figure 1. Volleyball forearm pass.

Table 1 presents the results of the analysis of the fundamental forearm pass skills of students at MA Nafa Petekeyan, which include foot position, hand position, stance stability, and ball rebound outcome. Supporting kinematic data were obtained using the Kinovea 0.9.5 software and are presented to strengthen the assessment of each technical component.

Table 1. Kinematic data of forearm pass skill analysis.

N=10	Mean ± SD	Min	Max
Preparation Phase			
Legs Distance (m)	0,22 ± 0,07	0,10	0,35
Stance Angle (º)	130,9 ± 10,34	119,1	148,0
Execution Phase			
Stance Angle (º)	123,28 ± 17,08	107	151,9
Arm Angle (º)	97,01 ± 17,11	70,8	121,0
Knee Flexion (º)	106,96 ± 13,82	83,0	132,9
Arm Extension (º)	97,05 ± 13,40	80,5	123,3
Follow-through Phase			
Arm Angle (º)	113,19 ± 11,11	88,0	126,1
Knee Angle (º)	122,15 ± 18,56	100,0	153,4
Ball Rebound (m)	1,562 ± 0,87	0,46	2,9

The analysis of basic movement skills in forearm passing among 10 students of MA Nafa Petekeyan showed that 2 students (20%) were categorized as *very accurate*, 7 students (70%) as *accurate*, and 1 student (10%) as *less accurate*. These findings were obtained through the basic forearm passing skill test used in the study.

The right knee flexion angle of the students had an average value of 106.96°, with a range from 83° to 132.9°. This indicates that most students were able to flex their knees within the 100°–130° range, reflecting a stable body position during the execution of the forearm pass. The shoulder extension angle showed an average of 97.05°, with a minimum value of 80.5° and a maximum of 123.2°. These values describe the ability of the arms to swing backward as part of the preparation phase before generating forward momentum.

Variations in knee flexion and shoulder extension angles among students reflect differences in movement characteristics and flexibility levels; however, all values remained within an effective range that supports the execution of proper forearm passing technique. The measurements of shoulder extension and knee flexion were taken during the execution phase, specifically at

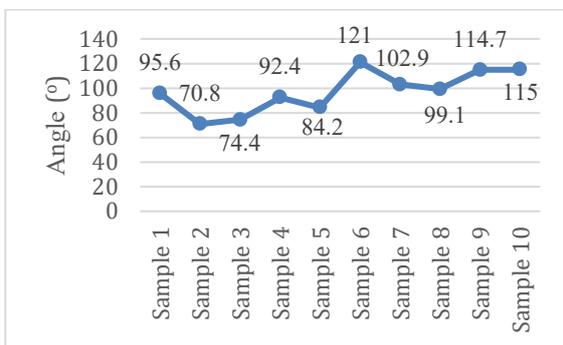the moment of impact, and the results are presented in Figures 2 and 3.

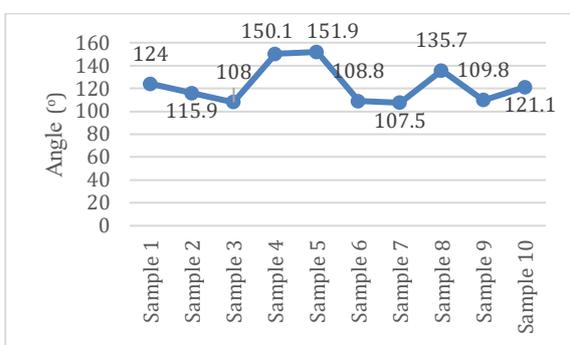Figure 2. Shoulder extension angle.

Figure 3. Knee flexion angle.

DISCUSSION

Forearm passing is a fundamental volleyball technique that requires coordinated body movement through three primary phases: the preparation phase, the execution phase, and the follow-through phase. The literature states that a stable initial position feet shoulder-width apart, knees flexed, and arms aligned together helps players create an effective platform to control the ball's rebound (basic volleyball technique literature). In the execution phase, a simultaneous push from the knees, hips, and forearms is necessary to generate optimal rebound control. The follow-through phase functions to maintain movement continuity and body stability after ball contact (I. Yulias & J. Budi,

2013; Setya & Asim, n.d.; F. Wicaksono et al., 2020).

The findings of this study conducted at MA Nafa Petekeyan indicate that most students were able to perform the forearm passing technique correctly. A total of 70% of students were categorized as "accurate" and 20% as "highly accurate," aligning with the theory that mastery of fundamental posture directly contributes to the accuracy of the ball's trajectory. These results are consistent with previous research reporting that mastery of basic techniques is significantly associated with the quality of forearm passing among school-aged players (Iakandar, 2013).

Biomechanical analysis conducted using the Kinovea application showed that the students' average knee flexion angle was 106.96°, which falls within the ideal range for supporting body stability during ball reception. Biomechanics literature explains that knee flexion between 100° and 130° enhances balance and allows players to better absorb ball impact. This finding is also consistent with other studies showing that deeper knee positions improve passing-control success among beginner and intermediate athletes (Afdi et al., 2019; Pieter Pelamonia et al., 2021).

The students' average shoulder extension angle of 97.05° demonstrates sufficient arm swing capacity. Movement theory notes that adequate shoulder extension is important for generating stable forward momentum during the execution phase (Machali, 2021). This result aligns with previous biomechanical

studies reporting that larger shoulder extension angles allow for more effective energy transfer from the body to the arms, thereby improving forearm passing accuracy (Chan & Indrayeni, 2018; Ishak et al., 2023).

Variations in movement angles among students indicate differences in flexibility, experience, and coordination; however, all values remained within the effective range recommended in volleyball technique literature (Janwar, 2019). Overall, this study reinforces the findings of Ramara et al., (2025), which emphasize that the combination of correct initial posture, joint flexibility, and coordinated movement plays an essential role in improving forearm passing performance among students.

CONCLUSION

This study indicates that the forearm passing skills of students at MA Nafa Petekeyan fall into the good category, with 2 students (20%) classified as very accurate, 7 students (70%) as accurate, and 1 student (10%) as less accurate. Kinematic analysis using Kinovea 0.9.5 shows that the students' average knee flexion angle is 106.96°, indicating a stable body position during the execution of the forearm pass. Additionally, the average shoulder extension angle of 97.05° reflects sufficient arm swing capability at the moment of impact. Overall, these values fall within the range that supports the effectiveness of the forearm passing technique, leading to the conclusion that mastery of basic techniques, proper body positioning, and coordinated movement play crucial roles in determining the quality of students' forearm passing performance.

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