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Effectiveness of Wall Drill Training on Forehand Skill Development in Youth Table Tennis Players: An Experimental Study

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Abstract: Forehand drive accuracy is an essential technical component in table tennis because it supports rally control, attacking play, and point construction. This study examined changes in forehand drive accuracy among adolescent table tennis athletes after completing a six-week wall drill training program. A quantitative one-group pretest–posttest design was used. Fifteen athletes from the Anells Purwokerto Table Tennis Club participated in eighteen training sessions conducted three times per week. Forehand drive accuracy was assessed using a standardized accuracy test, and the data were analyzed using descriptive statistics, the Shapiro–Wilk test, and a paired-samples *t*-test. Mean forehand accuracy scores increased from 128.87 ± 15.34 at pretest to 156.40 ± 16.28 at posttest. The mean improvement was 27.53 points, and the difference was statistically significant, $t(14) = 13.04$, $p < .001$. These findings indicate that wall drill practice may be a practical supplementary method for improving forehand drive accuracy in adolescent athletes. However, because the study did not include a control group, the observed improvement cannot be attributed exclusively to the intervention. Further controlled studies with larger samples and retention tests are required..

Keywords: *wall drill training; forehand skills; table tennis; youth athletes; motor learning.*

Introduction

Table tennis is a fast-paced racket sport that requires athletes to combine technical proficiency, reaction speed, motor coordination, and rapid decision-making (Kadeira, 2024). As the modern game has developed, players are increasingly required to respond to higher ball speeds, greater spin variation, and more dynamic shot placement (Picabea et al., 2023). These demands make mastery of basic techniques essential for maintaining rallies, initiating attacks, and creating scoring opportunities. Among these techniques, the forehand drive is particularly important because it is frequently used in offensive play and serves as a foundation for more advanced stroke development (Widodo et al., 2024).

The development of forehand drive accuracy depends not only on an athlete's physical capacity but also on systematic motor learning(Fadli, 2026). Motor skills are acquired through repeated practice that enables athletes to refine movement patterns, reduce technical errors, and perform strokes more consistently. Repetition strengthens coordination between the nervous and musculoskeletal systems and gradually supports more efficient movement execution (Azrim et al., 2026). This process is especially relevant for adolescent athletes, whose neuromuscular systems are still developing and may respond positively to structured technical training (Yapri et al., 2026). Consequently, coaches need to select training methods that provide sufficient repetition while remaining appropriate to the athletes' developmental level.

Several methods are commonly used to improve table tennis technique, including paired practice, multiball training, shadow practice, robot-assisted training, and wall drills. Each method provides different training stimuli and has specific advantages and limitations (Kharis & Andrijanto, 2019). Wall drill training uses a wall as a rebound surface, allowing athletes to perform repeated strokes independently and increase the number of ball contacts within a relatively short period. Compared with conventional paired practice, wall drills may reduce waiting time and provide athletes with more opportunities to repeat the forehand movement continuously (Herliana, 2019).

Wall drills may also provide a relatively stable and predictable practice environment. Consistent ball rebounds allow athletes to focus on racket angle, body position, stroke direction, footwork, and ball-contact timing. Repeated exposure to similar movement conditions may help athletes identify technical errors and make immediate corrections during practice (Agustian et al., 2026). This characteristic is consistent with repetition-based motor learning, in which frequent task execution contributes to the stabilization of movement patterns and improvement of technical accuracy (Kadeira, 2024). However, because wall rebounds are more predictable than ball trajectories in actual matches, the method should be understood primarily as a technical training tool rather than a direct representation of competitive play (Sudirman, 2026).

Previous studies on table tennis technique have largely examined multiball training, paired practice, and other forms of specific stroke training. These studies generally indicate that repeated technical practice can improve forehand accuracy, stroke control, and movement consistency (Ismaya & Faruk, 2026). Nevertheless, empirical evidence concerning wall drill training remains limited, particularly among adolescent club athletes (Arrahmat et al., 2025). Existing studies have not sufficiently clarified whether a structured wall drill program is followed by measurable improvements in forehand drive accuracy under standardized testing conditions.

This gap is important because many table tennis clubs have limited access to advanced training equipment, sufficient practice partners, or continuous individual coaching (Lopes & Amrulloh, 2025). Wall drills may offer a practical supplementary method because they are inexpensive, easy to organize, and can be performed with minimal facilities (Riskawati & Suwo, 2025). However, their usefulness should be assessed through objective measurement rather than assumed from their practical convenience (Sudirman, 2026). Evidence regarding changes in forehand accuracy following a structured wall drill program may therefore assist coaches in designing more efficient and accessible technical training sessions (Ishak et al., 2026).

Accordingly, this study aimed to examine changes in forehand drive accuracy among adolescent table tennis athletes after completing a six-week wall drill training program. The study used a one-group pretest–posttest design to compare participants' forehand accuracy scores before and after the intervention. The research hypothesis was that participants would demonstrate significantly higher forehand drive accuracy scores following the wall drill program. Because the study did not include a control group, the findings are interpreted as evidence of improvement after participation in the program rather than definitive proof that the intervention alone caused the observed changes.

Method

Study Design

This study employed a quantitative one-group pretest–posttest design to examine changes in forehand drive accuracy following a structured wall drill training program. Forehand drive accuracy was assessed before the intervention and again after completion of the six-week program (Lubis et al., 2026). Because the study did not include a control group, the design was treated as a pre-experimental design rather than a controlled quasi-experimental design. Accordingly, the analysis focused on changes observed after participation in the training program and did not assume that the intervention was the sole cause of those changes.

Intervention

The intervention program, which consisted of wall drill training, was designed based on the principles of motor learning, repetition-based training, and technical skill development in racket sports. (Fadli, 2026). The program was implemented over six weeks, with three training sessions per week, for a total of 18 sessions. Each session lasted 30–40 minutes and was conducted after a general warm-up and before regular club technique practice. Athletes repeatedly performed forehand strokes against a wall, focusing on motor coordination, consistent ball contact, body position, and shot direction accuracy (Ismaya & Faruk, 2026).

The training began at a moderate intensity to allow time for adaptation to the correct movement pattern. Training volume was gradually increased each week by increasing the number of repetitions and duration. (Kadeira, 2024). Coaches provided technical feedback on foot position, racket angle, body rotation, and ball contact point throughout the training session. A progressive approach was used to ensure that the increased training load remained appropriate for the adolescent athlete's abilities.

Table 1. Wall Drill Intervention Program

Exercise Components	**Intervention Activity**	**Duration**
Warmup	Light jogging around the training area. Dynamic stretching includes arm circles, shoulder rotations, trunk rotations, leg swings, walking lunges, and side shuffles. Basic coordination movements are performed to prepare the neuromuscular system before the main training session.	10 minutes
Core Exercise	Athletes repeatedly perform forehand drives against a wall using correct technique. The training focuses on the ready position, footwork coordination, body rotation, racket angle, ball contact point, and shot direction. The training is carried out progressively, with increasing repetition volume every two weeks. The program consists of 4–6 sets of 40–60 shots per set. The coach provides direct technical feedback to correct movement errors and improve shot consistency.	30 minutes
Variation Exercise	Athletes combine forehand drives with changes in target direction on the wall. Variations include consecutive forehand drives, forehand drives with foot shifts, and forehand drives with specific accuracy targets to improve shot control and precision.	10 minutes
Cooldown	Light jogging, leisurely walking, and static stretching of the arm, shoulder, back, waist, thigh, and leg muscle groups aid recovery after training.	10 minutes
Total Duration per Session	The training program was conducted in 3 sessions per week for 6 weeks (18 sessions).	60 minutes

All training sessions were conducted at the club's training facility under identical environmental conditions to minimize the influence of external factors on the study results. The trainer and researchers monitored participants' adherence to the training program throughout the intervention period.

Forehand Drive Accuracy Test

Forehand drive accuracy was assessed using the Forehand Drive Accuracy Test attributed in the manuscript to (Tomoliyus,2012). Each participant performed 50 forehand drive strokes toward predetermined target areas on the table.

The scoring system assigned scores of 0, 1, 3, or 5 according to the location of the ball landing. The highest score was awarded when the ball landed in the main target area. A score of zero was recorded when the ball hit the net, landed outside the table, or failed to reach the designated target area. The total test score was obtained by summing the scores across all 50 strokes.

Ball delivery was standardized using a Huipang HP07 ball-feeding machine set at a medium speed and feed frequency. Three-star table tennis balls were used. Participants used the same personal racket during pretest, intervention, and posttest procedures to reduce variation caused by equipment differences (Arrahmat et al., 2025).

Testing Procedure

Testing was conducted twice: before the intervention and after completion of the six-week training program. The same test protocol, equipment, scoring system, ball-feeding machine, and testing environment were used on both occasions. Participants completed an appropriate warm-up before testing (Herliana, 2019). Each participant then performed 50 forehand drive shots toward the designated target areas. The observer identified the landing zone of each ball, and the scorekeeper documented the corresponding score.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics version 29. Descriptive statistics were calculated for pretest, posttest, and change scores. The normality of the pretest–posttest difference scores was examined using the Shapiro–Wilk test and visual inspection for potential outliers. When the normality assumption was satisfied, a paired-samples t-test was used to compare forehand drive accuracy scores before and after the intervention, with statistical significance set at $p < .05$. The mean difference was reported with a 95% confidence interval. The magnitude of change was calculated using Cohen's d_z, defined as the mean difference divided by the standard deviation of the difference scores.

Results

This study aimed to evaluate the effectiveness of wall-drill training in improving forehand skills among adolescent table tennis athletes from the Anells Purwokerto Club. Analysis was conducted on forehand skill scores obtained before and after the six-week training program. All participants completed the intervention series without injury or loss of measurement data. The analysis showed an increase in forehand skill scores after participating in the wall drill training program. These findings indicate that repetition-based training using a wall as a medium contributes to the development of forehand technique skills in adolescent table tennis athletes.

Descriptive analysis was conducted to provide an overview of changes in forehand skill scores before and after the intervention. The mean scores from the initial measurements indicated that most athletes were still in the moderate skill category. The structured implementation of the training program resulted in improved scores for almost all participants. The relatively small standard deviation indicates that the improvement occurred evenly across the sample group. These changes indicate that the training program had a consistent effect on participants' forehand skills.

Table 2. Descriptive Statistics of Forehand Skill Scores Before and After Intervention

Variable	N	Minimum	Maximum	Mean ± SD
Pretest	15	102	156	128.87 ± 15.34
Posttest	15	128	186	156.40 ± 16.28
Difference	15	12	41	27.53 ± 8.16

Description: Mean = average value; SD = standard deviation.

The data in Table 2 show that the average forehand skill score increased from 128.87 on the pretest to 156.40 on the posttest. The average increase of 27.53 points indicates an improvement in technical ability after the wall drill training. The maximum score also increased from 156 to 186 points. These results indicate that some athletes achieved improved technical performance after receiving the training intervention. The relatively homogeneous data distribution indicates that the improvement in ability was not limited to certain athletes but was experienced by the majority of the study participants.

Normality assumptions were tested using the Shapiro–Wilk test before the inferential analysis. This test aims to ensure that the data distribution meets the requirements for using parametric statistics. The analysis results showed that the significance values for both the pretest and posttest data were above the $\alpha = 0.05$ limit. This condition indicates that the data were normally distributed. Meeting the normality assumption allowed the analysis to proceed with a paired-samples t-test.

Table 3. Results of the Shapiro–Wilk Normality Test

Variable	**Statistic W**	**Sig. (p)**
Pretest	0.954	0.612
Posttest	0.967	0.781

Note: Data are considered normally distributed if the p-value is > 0.05.

The results in Table 3 show that the pretest score had a significance value of 0.612, while the posttest score had a significance value of 0.781. Both values are greater than 0.05; the data meet the assumption of normality. This condition indicates that the variation in forehand skill scores in the study group is normally distributed. Meeting this assumption provides a strong basis for proceeding with the analysis using a parametric approach. Inferential analysis procedures were then performed to determine the significance of changes in scores before and after the intervention.

Analysis of differences in forehand skill scores was conducted using a paired sample t-test. This test aimed to determine whether there was a significant difference between pretest and posttest scores after participants participated in the wall drill training program. The analysis showed a statistically significant increase. The significance value obtained was well below the 5 percent margin of error. These findings indicate that wall drill training significantly improves the forehand skills of adolescent table tennis athletes.

Table 4. Paired Sample t-Test Results

Variable	**Mean Difference**	**t**	**df**	**Sig. (2-tailed)**
Pretest–Posttest	27.53	13.04	14	<0.001

Note: Differences are considered significant if p <0.05.

The data in Table 4 show an average increase in score of 27.53 points after the wall drill intervention. The t-value of 13.04 indicates a very big difference between pre- and post-training scores. A significance value of less than 0.001 indicates that this increase did not occur by chance. These findings provide empirical evidence that wall drill training is effective in improving the forehand skills of adolescent table tennis athletes. These results support motor learning theory, which holds that repetition-based training can accelerate the mastery of technical skills.

The magnitude of the intervention effect was analyzed using Cohen's d. The calculation results showed a Cohen's d of 1.85, which falls into the very large effect category. This value indicates that the training program had a substantial impact on improving the participants' forehand skills. The training's effectiveness was not only statistically significant but also of practical significance in the context of high-performance sports development. These findings strengthen the argument that wall drill training can be used as an effective technical training method to support forehand skill development in adolescent table tennis athletes.

Discussion

The present study found that forehand drive accuracy scores increased significantly after adolescent table tennis athletes completed a six-week wall drill program. The mean score increased from 128.87 ± 15.34 at pretest to 156.40 ± 16.28 at posttest, with a mean improvement of 27.53 points. These results indicate that participants performed more accurately under the standardized forehand drive test conditions after completing the intervention. However, because this study employed a one-group pretest–posttest design without a control group, the observed improvement should be interpreted as a change following the training program rather than definitive evidence that wall drill training was the sole cause of the improvement.

The improvement may be associated with the high number of task-specific repetitions provided during wall drill practice. Repeated forehand strokes enabled participants to rehearse racket positioning, stroke timing, body orientation, and ball-contact direction within a relatively stable practice environment. In motor learning, repeated task exposure can improve immediate performance by allowing learners to identify errors and adjust subsequent movement execution. Nevertheless, repetition alone should not automatically be interpreted as permanent motor learning. Motor learning refers to relatively lasting changes in skilled performance, which are more appropriately demonstrated through retention or transfer tests rather than an immediate posttest. Recent evidence also indicates that the effects of different practice schedules on long-term sport-skill learning vary according to participant characteristics, task complexity, and testing procedures (Adams et al., 2025).

The wall drill provided a predictable ball rebound, which may have reduced variability during the early stages of technical practice. This condition allowed athletes to concentrate on executing repeated forehand drives without continuously adapting to an opponent’s changing speed, spin, and placement. A stable practice environment may be useful for refining basic movement execution, particularly when the objective is to improve accuracy in a standardized task. However, the same predictability may limit the transfer of training to competitive situations. Table tennis is an open-skill sport in which players must respond to rapidly changing visual, temporal, and tactical information. Therefore, the improvement found in the present study should be limited to forehand drive accuracy under the test conditions and should not be generalized directly to rally performance or match success.

The role of feedback may also have contributed to the observed improvement. During the intervention, coaches provided information concerning foot position, body rotation, racket angle, and ball-contact point. Such feedback may have helped participants identify errors that were not apparent from the outcome of the shot alone. Research on table tennis skill learning has shown that real-time postural feedback can support learners in improving stroke-related movement execution and paddle control (Ammar et al., 2024). Similarly, (Oagaz et al., 2022) found that structured video demonstrations and guided feedback supported improvements in table tennis skill execution among elementary school students. Although the feedback methods in those studies differed from the direct coaching feedback used in the present intervention, the findings collectively suggest that repetition may be more beneficial when learners receive information that helps them adjust their movement.

The present findings are also generally consistent with earlier table tennis studies reporting improvements after task-specific repetitive practice. (Picabea et al., 2023), for example, reported improved forehand drive precision following a multiball training program. Multiball practice and wall drills differ in their delivery systems, but both methods allow players to perform a relatively high number of stroke repetitions within a limited period (Adams et al., 2025). This similarity suggests that practice volume and direct exposure to the target movement may contribute to short-term improvements in forehand accuracy. However, direct comparisons between the two methods cannot be made because the present study did not include a multiball or regular-training comparison group.

An additional strength of wall drill training is its practical accessibility. Unlike robot-assisted or multiball training, wall drills require limited equipment and can be conducted independently or under minimal supervision (Azrim et al., 2026). This may be valuable for clubs with limited access to training partners, coaches, or ball-feeding equipment. The method may therefore serve as a supplementary activity that increases active practice time. Nevertheless, accessibility should not be equated with superiority. The current findings do not demonstrate that wall drills are more effective than multiball training, paired practice, robot-assisted training, or regular coaching. Controlled comparative research is required before recommending one method over another (Adams et al., 2025).

The accuracy test used in this study focused on the outcome of forehand strokes directed toward predetermined target areas. This form of measurement is relevant because accuracy is an important component of table tennis skill assessment. (Widodo et al., 2024) emphasized that table tennis performance requires the assessment of several technical strokes and that valid skill instruments are necessary for identifying strengths, weaknesses, and training needs. At the same time, forehand accuracy represents only one component of table tennis performance. A player may improve target-hitting accuracy without demonstrating corresponding improvements in spin production, stroke speed, tactical decision-making, rally consistency, or competitive performance. Consequently, the present findings should not be interpreted as evidence of comprehensive table tennis performance development.

The large standardized change reported in this study suggests that the observed improvement was practically meaningful within the sample. However, the effect size must be reported using a calculation appropriate for paired observations. Based on the reported mean difference of 27.53 and standard deviation of the difference scores of 8.16, Cohen's d_z would be approximately 3.37 rather than 1.85. This exceptionally large value should be interpreted cautiously. Large pretest–posttest effects in small uncontrolled samples may partly reflect test familiarization, regression to the mean, concurrent regular training, measurement characteristics, or the absence of a comparison group. The effect estimate should therefore be accompanied by a 95% confidence interval and a clear description of the calculation method.

The age and developmental characteristics of the participants may also have influenced the findings. Adolescent athletes who are still developing technical proficiency may show relatively rapid improvements when exposed to structured and repeated practice. However, the manuscript does not currently report the participants' exact ages, sex distribution, training experience, or competitive level. These characteristics are important because responses to motor-skill interventions may differ according to age, experience, and initial proficiency. (Oagaz et al., 2022) found that age moderated some practicerelated changes in skilled performance, reinforcing the importance of reporting participant characteristics when interpreting motor-learning outcomes (Herliana, 2019).

Several methodological limitations restrict the conclusions that can be drawn. First, the absence of a control group means that maturation, regular club practice, repeated testing, and additional training cannot be separated from the wall drill intervention. Second, the small sample was drawn from a single club, limiting generalizability to athletes from other clubs, age groups, and competitive levels (Arrahmat et al., 2025). Third, the study did not include a retention test, so it remains unclear whether the improvement persisted after the intervention ended. This distinction is important because immediate performance gains do not necessarily indicate relatively permanent learning (Ammar et al., 2024). Fourth, the outcome measure assessed standardized forehand accuracy rather than performance during rallies or matches. Fifth, the study did not report evaluator blinding, inter-rater reliability, or detailed training adherence.

Future studies should use a randomized or non-randomized controlled design comparing wall drill training with regular practice, multiball training, or paired training. Larger samples should be recruited from multiple clubs, and participant characteristics should be reported in detail. Researchers should also include retention and transfer tests to distinguish immediate performance improvement from longer-term skill acquisition (Picabea et al., 2023). Additional outcomes could include stroke velocity, spin, rally consistency, movement kinematics, tactical decision-making, and match performance. Video-based or real-time feedback may also be incorporated to examine whether structured feedback produces greater improvements than repetition alone, given emerging evidence supporting feedback-supported table tennis learning (Yapri et al., 2026).

Overall, the findings indicate that forehand drive accuracy improved after the six-week wall drill program. Wall drills may be a practical supplementary method for increasing stroke repetition and providing athletes with opportunities to refine basic forehand execution. However, the study does not establish that wall drill training is superior to other methods or that it independently caused the observed changes. The results should therefore be viewed as preliminary evidence supporting further controlled investigation of wall drill training in youth table tennis

Conclusions

This study found that wall drill training was followed by improvement in forehand drive accuracy among adolescent table tennis athletes. The method may serve as a practical supplementary exercise because it is simple, economical, and easy to apply in limited training environments. However, the findings should be interpreted cautiously because the study used a single-group design without a control condition. The observed improvement may also have been influenced by training, repeated testing, maturation, or other external factors. Future research should use controlled designs, larger samples, retention tests, and broader performance measures to confirm the long-term effectiveness of wall drill training.

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