The Sankalpa: International Journal of Management Decisions
ISSN: 2454-7425
Volume 12, Issue 1 (January - June 2026)

Effects of Stroboscopic Visual Training on Visual-Motor Performance in Elite Volleyball Players: A Case Study of EST Tajenanet

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Submission: 01/07/2025 Acceptation: 05/12/2025 Publication: 02/02/2026

Abstract

Visual perception and visual-motor coordination are critical determinants of performance in volleyball, a sport characterized by rapid ball tracking, anticipation, and precise spatial awareness. Stroboscopic visual training, which involves intermittent visual occlusion during training, has emerged as an innovative method to enhance visual processing speed and motor response. However, empirical evidence on its effectiveness in elite volleyball remains limited, particularly in Algerian competitive contexts.

This study evaluated the effects of a stroboscopic visual training program on visual-motor performance parameters in elite male volleyball players from EST (Entente Sportive de Tajenanet), competing in the Algerian National Championship Division A.

A pre-post intervention design was implemented with 16 male volleyball players (mean age: 24.3 ± 3.2 years) from EST Tajenanet during the competitive season. The intervention consisted of a 12-week stroboscopic visual training program integrated into regular team training sessions (3 sessions per week, 45 minutes per session). Visual-motor performance was assessed through standardized tests including: visual reaction time, dynamic visual acuity, peripheral vision range, depth perception accuracy, and ball tracking precision. Paired-sample t-tests were used to assess pre-post changes, with significance set at $p < 0.05$.

Significant improvements were observed across all visual-motor parameters. Visual reaction time decreased from 245.3 ms (SD = 28.4) to 218.7 ms (SD = 24.1), $t(15) = 4.892$, $p < 0.001$. Dynamic visual acuity improved from 0.82 (SD = 0.09) to 0.91 (SD = 0.07), $t(15) = -5.234$, $p < 0.001$. Peripheral vision range expanded from 168.4° (SD = 12.3) to 179.2° (SD = 10.8), $t(15) = -3.876$, $p < 0.01$. Depth perception accuracy increased from 78.3% (SD = 8.7) to 88.6% (SD = 6.4), $t(15) = -5.012$, $p < 0.001$. Ball tracking precision improved from 74.2% (SD = 9.1) to 86.5% (SD = 7.3), $t(15) = -6.145$, $p < 0.001$.

A structured stroboscopic visual training program can significantly enhance visual-motor performance in elite volleyball players. The results support the integration of sport vision training methodologies into volleyball training programs, particularly for teams competing at national championship level. The findings have practical implications for coaches seeking evidence-based approaches to improve anticipation, reaction speed, and overall visual performance in competitive volleyball.

Keywords: stroboscopic training; visual training; volleyball; visual-motor performance; elite athletes; visual perception; reaction time; National Championship Algeria

1. Introduction

Volleyball is a complex sport characterized by rapid exchanges, unpredictable ball trajectories, and demands for precise spatial-temporal coordination[1]. Success in volleyball depends not only on physical and technical abilities but also on highly developed perceptual-cognitive skills, particularly visual processing capabilities[2]. Elite volleyball players must continuously track fast-moving objects, anticipate opponent actions, process peripheral information, and execute motor responses within milliseconds[3].

Visual perception encompasses multiple components essential to volleyball performance: visual reaction time (speed of response to visual stimuli), dynamic visual acuity (ability to perceive detail in moving objects), peripheral vision (detection of stimuli outside central focus), depth perception (ability to judge distances accurately), and visual tracking (ability to follow moving objects smoothly)[4]. These visual skills directly influence key volleyball actions including serve reception, setting accuracy, attacking timing, blocking effectiveness, and defensive positioning[5].

Traditional volleyball training emphasizes technical, tactical, and physical preparation, yet visual training often remains neglected despite its documented importance in performance[6]. In recent years, stroboscopic visual training has emerged as an innovative method to enhance visual processing and visual-motor integration. This training approach involves wearing specialized eyewear that creates intermittent visual occlusion through liquid crystal technology, forcing athletes to process visual information more efficiently during brief viewing windows[7].

The theoretical rationale for stroboscopic training is based on neuroplasticity principles: by challenging the visual system through intermittent occlusion, athletes develop enhanced visual attention, improved visual memory, faster visual processing speed, and more efficient predictive capabilities[8]. Research in various sports has demonstrated positive effects of stroboscopic training on reaction time, hand-eye coordination, anticipation, and sport-specific skills[9][10].

In Algeria, volleyball has experienced significant development, with the National Championship Division A representing the highest competitive level for men's volleyball. EST (Entente Sportive de Tajenanet) competes in this elite division, requiring players to maintain exceptional visual-motor performance throughout the demanding competitive season. However, empirical evidence on stroboscopic visual training effectiveness in Algerian volleyball contexts remains absent.

1.1 Research Problem

The following questions guide this investigation:

- Does stroboscopic visual training improve visual reaction time in elite volleyball players?
- Does stroboscopic visual training enhance dynamic visual acuity in competitive volleyball contexts?
- Does stroboscopic visual training expand peripheral vision range in volleyball athletes?
- Does stroboscopic visual training improve depth perception accuracy during volleyball-specific tasks?
- Does stroboscopic visual training enhance ball tracking precision in elite volleyball players?

1.2 Research Objectives

- To evaluate the effects of stroboscopic visual training on visual reaction time in EST Tajenanet volleyball players
- To assess changes in dynamic visual acuity following stroboscopic training intervention
- To measure peripheral vision range improvements after stroboscopic training program
- To determine depth perception accuracy enhancements resulting from stroboscopic training
- To analyze ball tracking precision improvements following stroboscopic visual training

1.3 Research Hypotheses

- Stroboscopic visual training will significantly decrease visual reaction time in elite volleyball players
- Stroboscopic visual training will significantly improve dynamic visual acuity scores
- Stroboscopic visual training will significantly expand peripheral vision range
- Stroboscopic visual training will significantly enhance depth perception accuracy
- Stroboscopic visual training will significantly improve ball tracking precision

2. Materials and Methods

2.1 Study Design

A pre-post intervention design was adopted to evaluate the effectiveness of stroboscopic visual training on visual-motor performance parameters. The study was conducted during the competitive season over a 12-week period, with assessments performed before (pre-test) and after (post-test) the intervention. All training sessions were integrated into the team's regular training schedule to ensure ecological validity and practical applicability.

2.2 Setting and Participants

The study was conducted with EST (Entente Sportive de Tajenanet), a men's volleyball team competing in the Algerian National Championship Division A. The sample consisted of 16 male volleyball players (mean age: 24.3 ± 3.2 years; mean competitive experience: 8.4 ± 2.1 years; mean height: 186.2 ± 6.8 cm). All participants were actively competing during the study period and had no history of visual impairments or neurological conditions.

Inclusion criteria included: (1) active roster member of EST Tajenanet, (2) minimum three years of competitive volleyball experience, (3) normal or corrected-to-normal vision, (4) no history of concussion within six months prior to study, (5) regular participation in team training sessions (≥90% attendance).

2.3 Intervention Program

The stroboscopic visual training program consisted of 12 weeks of structured training, with three sessions per week, each lasting 45 minutes. Training was conducted using stroboscopic eyewear (liquid crystal technology) that creates intermittent visual occlusion at variable frequencies.

The intervention program included the following components:

Phase 1 (Weeks 1-4): Visual Adaptation and Basic Skills

- Stroboscopic frequency: 4-6 Hz (longer visual windows)
- Activities: Ball tossing and catching, partner passing drills, footwork patterns
- Focus: Adaptation to intermittent vision, basic visual-motor coordination
- Duration: 30 minutes stroboscopic training + 15 minutes integration drills

Phase 2 (Weeks 5-8): Progressive Complexity

- Stroboscopic frequency: 6-8 Hz (moderate visual occlusion)
- Activities: Setting drills, attack approach timing, serve reception patterns, blocking movements
- Focus: Sport-specific visual-motor skills, anticipation training
- Duration: 35 minutes stroboscopic training + 10 minutes integration drills

Phase 3 (Weeks 9-12): Game-Specific Integration

- Stroboscopic frequency: 8-10 Hz (shorter visual windows)
- Activities: Small-sided games (2v2, 3v3), game-situation drills, decision-making scenarios
- Focus: Complex visual processing, tactical awareness, competitive application
- Duration: 40 minutes stroboscopic training + 5 minutes cool-down

All sessions followed a standardized warm-up protocol (10 minutes general and visual warm-up) and concluded with cool-down activities (5 minutes). Training intensity and complexity were progressively increased according to the principle of overload. Regular training sessions (technical, tactical, physical) continued as scheduled without modification.

2.4 Variables and Measures

Independent variable: Stroboscopic visual training program (12 weeks, 3 sessions/week)

Dependent variables: Visual-motor performance parameters

The Sankalpa: International Journal of Management Decisions
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Volume 12, Issue 1 (January - June 2026)

1. **Visual Reaction Time (VRT):** Measured using computerized visual reaction test. Participants responded to visual stimuli appearing randomly on screen. Average response time across 30 trials recorded in milliseconds.
2. **Dynamic Visual Acuity (DVA):** Assessed using moving Landolt C optotypes at standardized velocity. Participants identified gap orientation in moving targets. Scores ranged from 0.0 to 1.0 (higher scores indicate better acuity).
3. **Peripheral Vision Range (PVR):** Measured using perimetry test. Participants fixated on central target while detecting peripheral stimuli appearing at various angles. Total visual field range recorded in degrees.
4. **Depth Perception Accuracy (DPA):** Evaluated through three-dimensional ball distance estimation task. Participants estimated distance to volleyballs positioned at various depths. Accuracy percentage calculated across 20 trials.
5. **Ball Tracking Precision (BTP):** Assessed using volleyball-specific tracking task. Participants tracked volleyball trajectory during simulated game scenarios and predicted landing position. Precision percentage calculated across 25 trials.

2.5 Control of Confounding Variables

Several potential confounders were controlled to enhance internal validity:

- All participants underwent standardized visual screening prior to study enrollment
- Testing conditions (lighting, room temperature, time of day) were standardized across pre- and post-assessments
- Participants were instructed to maintain normal sleep patterns and avoid alcohol 24 hours before testing
- Regular training volume and competitive schedule remained consistent throughout intervention period
- Same trained examiner conducted all visual assessments using standardized protocols
- Testing order was randomized within each assessment session to control for fatigue effects

2.6 Statistical Analysis

Data were analyzed using SPSS (Statistical Package for the Social Sciences, version 26.0). Descriptive statistics (mean, standard deviation, minimum, maximum) were calculated for all variables at pre-test and post-test. Normal distribution was verified using Shapiro-Wilk test. Paired-sample t-tests were used to assess the significance of pre-post changes for each dependent variable. Effect sizes were calculated using Cohen's d (small: 0.2, medium: 0.5, large: 0.8). The level of significance was set at $p < 0.05$ for all analyses. Pearson correlation coefficients were calculated to examine relationships between baseline values and magnitude of improvement.

3. Results

3.1 Visual Reaction Time

Visual reaction time showed significant improvement following the stroboscopic training intervention. Pre-test mean was 245.3 ms (SD = 28.4), which decreased to 218.7 ms (SD = 24.1) at post-test, representing a 10.9% improvement.

Measurement	Sample Size (n)	Mean (SD)	Min-Max	Change
Pre-test VRT	16	245.3 (28.4) ms	198-289 ms	-26.6 ms
Post-test VRT	16	218.7 (24.1) ms	182-261 ms	(-10.9%)

Table 1: Visual reaction time descriptive statistics before and after stroboscopic training intervention

The paired-sample t-test revealed a statistically significant difference between pre-test and post-test, $t(15) = 4.892$, $p < 0.001$, with a large effect size (Cohen's $d = 1.02$). This indicates that the stroboscopic training program produced substantial improvements in visual reaction speed.

Variable	Mean Difference	SD Difference	t-value	df	p-value
VRT (Pre-Post)	26.6 ms	21.7	4.892	15	< 0.001

Table 2: Paired-sample t-test results for visual reaction time (Cohen's d = 1.02)

3.2 Dynamic Visual Acuity

Dynamic visual acuity demonstrated significant enhancement following the intervention. Pre-test mean score was 0.82 (SD = 0.09), which improved to 0.91 (SD = 0.07) at post-test, representing an 11.0% improvement.

Measurement	Sample Size (n)	Mean (SD)	Min-Max	Change
Pre-test DVA	16	0.82 (0.09)	0.68-0.95	+0.09
Post-test DVA	16	0.91 (0.07)	0.79-1.00	(+11.0%)

Table 3: Dynamic visual acuity descriptive statistics before and after stroboscopic training intervention

The paired-sample t-test showed a statistically significant improvement, $t(15) = -5.234$, $p < 0.001$, with a large effect size (Cohen's $d = 1.16$). This suggests that stroboscopic training effectively enhances the ability to perceive detail in moving objects.

Variable	Mean Difference	SD Difference	t-value	df	p-value
DVA (Pre-Post)	-0.09	0.07	-5.234	15	< 0.001

Table 4: Paired-sample t-test results for dynamic visual acuity (Cohen's d = 1.16)

3.3 Peripheral Vision Range

Peripheral vision range expanded significantly following the training program. Pre-test mean was 168.4° (SD = 12.3), which increased to 179.2° (SD = 10.8) at post-test, representing a 6.4% expansion.

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Measurement	Sample Size (n)	Mean (SD)	Min-Max	Change
Pre-test PVR	16	168.4° (12.3)	148-186°	+10.8°
Post-test PVR	16	179.2° (10.8)	162-198°	(+6.4%)

Table 5: Peripheral vision range descriptive statistics before and after stroboscopic training intervention

The paired-sample t-test indicated a statistically significant increase, $t(15) = -3.876$, $p < 0.01$, with a medium-to-large effect size (Cohen's d = 0.94). This demonstrates that stroboscopic training can expand functional peripheral vision.

Variable	Mean Difference	SD Difference	t-value	df	p-value
PVR (Pre-Post)	-10.8°	11.1	-3.876	15	0.002

Table 6: Paired-sample t-test results for peripheral vision range (Cohen's d = 0.94)

3.4 Depth Perception Accuracy

Depth perception accuracy improved substantially following the intervention. Pre-test mean accuracy was 78.3% (SD = 8.7), which increased to 88.6% (SD = 6.4) at post-test, representing a 13.2% improvement.

Measurement	Sample Size (n)	Mean (SD)	Min-Max	Change
Pre-test DPA	16	78.3% (8.7)	65-92%	+10.3%
Post-test DPA	16	88.6% (6.4)	78-98%	(+13.2%)

Table 7: Depth perception accuracy descriptive statistics before and after stroboscopic training intervention

The paired-sample t-test revealed a statistically significant improvement, $t(15) = -5.012$, $p < 0.001$, with a large effect size (Cohen's d = 1.36). This indicates that stroboscopic training significantly enhances three-dimensional spatial judgment.

Variable	Mean Difference	SD Difference	t-value	df	p-value
DPA (Pre-Post)	-10.3%	8.2	-5.012	15	< 0.001

\end{table>

3.5 Ball Tracking PrecisionBall tracking precision demonstrated the most substantial improvement among all measured variables. Pre-test mean precision was 74.2% (SD = 9.1), which increased to 86.5% (SD = 7.3) at post-test, representing a 16.6% improvement. \begin{table}

Measurement	Sample Size (n)	Mean (SD)	Min-Max	Change
Pre-test BTP	16	74.2% (9.1)	58-88%	+12.3%
Post-test BTP	16	86.5% (7.3)	74-98%	(+16.6%)

Table 8: Paired-sample t-test results for depth perception accuracy (Cohen's d = 1.36)

The paired-sample t-test showed a statistically significant improvement, $t(15) = -6.145$, $p < 0.001$, with a very large effect size (Cohen's d = 1.50). This represents the strongest training effect observed in the study.

Variable	Mean Difference	SD Difference	t-value	df	p-value
BTP (Pre-Post)	-12.3%	8.0	-6.145	15	< 0.001

Table 9: Paired-sample t-test results for ball tracking precision (Cohen's d = 1.50)

3.6 Summary of Results

All five visual-motor performance parameters demonstrated statistically significant improvements following the 12-week stroboscopic visual training intervention. Effect sizes ranged from medium-large (PVR: d = 0.94) to very large (BTP: d = 1.50), indicating that the intervention produced substantial practical benefits in addition to statistical significance.

4. Discussion

The main finding of this study is that a structured 12-week stroboscopic visual training program can significantly enhance multiple dimensions of visual-motor performance in elite volleyball players. All five measured parameters—visual reaction time, dynamic visual acuity, peripheral vision range, depth perception accuracy, and ball tracking precision—showed statistically significant improvements with medium-to-very-large effect sizes, supporting the effectiveness of stroboscopic training in competitive volleyball contexts.

4.1 Visual Reaction Time Enhancement

The 10.9% reduction in visual reaction time (from 245.3 ms to 218.7 ms) represents a substantial improvement with direct implications for volleyball performance. In volleyball, rapid visual processing is essential for successful serve reception, defensive digs, and blocking reactions[11]. The improvement observed aligns with previous research demonstrating that stroboscopic training enhances neural processing efficiency by forcing the visual system to extract and process information during brief viewing windows[8][9].

From a neurophysiological perspective, intermittent visual occlusion during training likely stimulates adaptations in both the visual cortex and motor planning regions. Athletes learn to anticipate visual information, improve visual memory encoding, and reduce the latency between visual stimulus detection and motor response initiation[12]. For EST Tajenanet players competing at the National Championship level, this enhanced reaction speed translates to improved defensive coverage and faster offensive decision-making.

4.2 Dynamic Visual Acuity Improvement

The 11.0% improvement in dynamic visual acuity (from 0.82 to 0.91) indicates enhanced ability to perceive detail in moving objects—a critical skill for volleyball where ball speeds can exceed 100 km/h during attacks[13]. Dynamic visual acuity is essential for accurate setting, precise attack placement, and effective serve reception[4][5].

Research suggests that stroboscopic training improves dynamic visual acuity through two mechanisms: enhanced smooth pursuit eye movements (ability to track moving objects) and improved predictive capabilities (ability to anticipate object trajectories)[14]. The intermittent occlusion forces athletes to fill in missing visual information through prediction, leading to more efficient visual processing strategies that persist when vision is continuous[7].

For volleyball players, improved dynamic visual acuity enables better ball tracking during complex rallies, more accurate judgment of ball spin and trajectory, and enhanced ability to read opponent movements during game situations[15].

4.3 Peripheral Vision Range Expansion

The 6.4% expansion in peripheral vision range (from 168.4° to 179.2°) represents a functionally significant enhancement in visual awareness. Volleyball requires continuous monitoring of multiple players, the ball, and court boundaries simultaneously[3]. Expanded peripheral vision enables players to maintain central focus on the ball while detecting teammate positions, opponent movements, and spatial relationships across the court[16].

The mechanism underlying peripheral vision enhancement through stroboscopic training relates to attentional distribution and visual field utilization. When central vision is intermittently occluded, athletes naturally recruit peripheral vision more extensively, leading to neuroplastic adaptations that improve peripheral detection sensitivity and expand the functional visual field[17].

For EST Tajenanet players, this expanded peripheral awareness enhances court coverage, improves defensive positioning, facilitates better communication and coordination with teammates, and enables more effective tactical decision-making during complex game situations[18].

4.4 Depth Perception Accuracy Enhancement

The 13.2% improvement in depth perception accuracy (from 78.3% to 88.6%) has profound implications for volleyball performance, as accurate distance judgment is essential for timing attacks, positioning blocks, and executing precise passes[19]. Depth perception depends on binocular vision (stereopsis) and monocular cues including motion parallax, relative size, and texture gradients[20].

Stroboscopic training enhances depth perception through two pathways: improved visual-motor calibration (more accurate mapping between visual input and motor output) and enhanced predictive processing (better use of incomplete visual information to judge distances)[21]. The intermittent occlusion requires athletes to make distance judgments with reduced visual information, forcing the visual system to optimize depth cue utilization.

Enhanced depth perception in volleyball manifests as improved attack timing (jumping at optimal moment relative to set trajectory), more effective blocking (positioning hands at correct distance from net), and better spatial awareness during defensive movements[5][13].

4.5 Ball Tracking Precision Improvement

The 16.6% improvement in ball tracking precision (from 74.2% to 86.5%) represents the largest effect observed in this study (Cohen's d = 1.50), suggesting that stroboscopic training is particularly effective for enhancing object tracking capabilities. Ball tracking precision is arguably the most volleyball-specific visual skill measured, as successful performance depends entirely on continuous, accurate ball tracking throughout rallies[22].

The substantial improvement can be explained by multiple training-induced adaptations: enhanced predictive tracking (ability to anticipate ball trajectory based on early flight information), improved smooth pursuit gain (efficiency of eye movements tracking moving objects), reduced catch-up saccades (fewer corrective eye movements needed), and better visual-motor synchronization (coordination between visual tracking and motor preparation)[23][24].

Research in neuroscience demonstrates that stroboscopic training enhances the dorsal visual stream—the "where" pathway responsible for motion processing, spatial awareness, and visual-motor integration[25]. By training under degraded visual conditions, athletes develop more robust internal models of ball flight physics, enabling accurate trajectory prediction even when visual information is incomplete[26].

For volleyball players, enhanced ball tracking precision translates directly to performance improvements across all skills: serve reception (earlier trajectory detection), setting (more accurate ball placement), attacking (better timing and contact), blocking (improved anticipation), and defense (faster reaction to opponent attacks)[27].

4.6 Practical Implications

The findings of this study have several practical implications for volleyball training programs:

1. **Integration into training periodization:** Stroboscopic visual training can be effectively integrated into regular training sessions (3 sessions/week, 45 minutes) without disrupting technical, tactical, or physical preparation.
2. **Progressive overload:** The three-phase progression (adaptation → sport-specific → game integration) allows athletes to systematically develop visual skills while minimizing frustration and maintaining motivation.
3. **Cost-effectiveness:** While stroboscopic eyewear requires initial investment, the equipment is durable, requires no consumables, and can be used across multiple seasons and athletes.
4. **Competitive advantage:** At elite levels where physical and technical capabilities are relatively homogeneous, enhanced visual-motor performance provides meaningful competitive differentiation.
5. **Injury prevention potential:** Improved peripheral vision, depth perception, and reaction time may reduce injury risk by enhancing awareness of teammates, opponents, and environmental hazards[28].

4.7 Limitations

Several limitations should be acknowledged. First, the study employed a pre-post design without a control group, limiting causal inferences about the intervention. While the magnitude and consistency of improvements across all variables suggest genuine training effects, maturation, practice effects, and placebo effects cannot be definitively ruled out. Future research should employ randomized controlled designs with appropriate control conditions.

Second, the study focused on visual-motor performance measurements rather than game performance outcomes. While the measured variables are theoretically and empirically linked to volleyball performance, direct assessment of competitive performance (e.g., win percentage, individual statistics, coach ratings) would strengthen practical validity.

Third, the 12-week intervention period, while producing significant improvements, does not address long-term retention or maintenance requirements. Longitudinal research is needed to determine optimal training frequency for maintaining visual-motor enhancements and whether periodic "booster" sessions are necessary.

Fourth, the sample consisted exclusively of male elite volleyball players from a single team, limiting generalizability to female athletes, different competitive levels, and other volleyball contexts. Replication across diverse populations is necessary.

Fifth, individual response variability was not systematically analyzed. Some athletes may respond more favorably to stroboscopic training based on baseline visual abilities, learning style, or neuroplasticity capacity. Future research should identify predictors of training responsiveness to enable personalized prescription.

5. Conclusion

This study demonstrates that a structured 12-week stroboscopic visual training program, integrated into regular team training sessions, produces significant improvements in visual-motor performance among elite male volleyball players competing in the Algerian National Championship Division A. All five measured parameters—visual reaction time, dynamic visual acuity, peripheral vision range, depth perception accuracy, and ball tracking precision—showed statistically significant enhancements with medium-to-very-large effect sizes.

The findings support the following conclusions:

- Stroboscopic visual training significantly decreases visual reaction time in elite volleyball players (10.9% improvement, Cohen's d = 1.02)
- Stroboscopic visual training significantly improves dynamic visual acuity scores (11.0% improvement, Cohen's d = 1.16)
- Stroboscopic visual training significantly expands peripheral vision range (6.4% improvement, Cohen's d = 0.94)
- Stroboscopic visual training significantly enhances depth perception accuracy (13.2% improvement, Cohen's d = 1.36)
- Stroboscopic visual training significantly improves ball tracking precision (16.6% improvement, Cohen's d = 1.50)

These results have important practical implications for volleyball training programs. Coaches and sport scientists should consider integrating stroboscopic visual training into periodized training plans, particularly for teams competing at elite levels where marginal performance gains translate to competitive advantages. The training is feasible, cost-effective, and can be implemented without disrupting traditional training components.

Future research directions include: (1) randomized controlled trials with appropriate control groups, (2) investigation of dose-response relationships to optimize training frequency and duration, (3) assessment of transfer effects to actual game performance and competitive outcomes, (4) longitudinal studies examining retention and maintenance requirements, (5) exploration of individual difference variables that predict training responsiveness, (6) application to female athletes and different competitive levels, and (7) investigation of potential synergistic effects when combined with other perceptual-cognitive training methods.

The integration of evidence-based sport vision training, including stroboscopic methods, into volleyball preparation represents a promising avenue for enhancing performance at the highest competitive levels. For EST Tajenanet and other teams competing in elite championships, the adoption of systematic visual training may provide meaningful competitive advantages in a sport where visual-motor excellence is paramount.

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