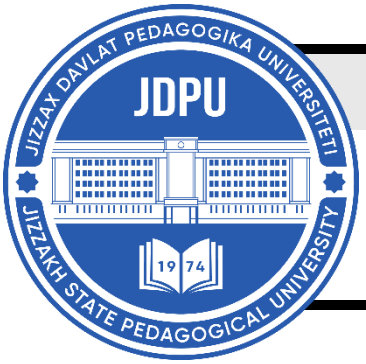
DOI: https://doi.org/10.37547/mesmj-V5-I8-23 Pages: 179-190

MENTAL ENLIGHTENMENT SCIENTIFIC – METHODOLOGICAL JOURNAL



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THE KINEMATICS OF THE COACH'S STANDING POSITION FOR THE BOXER'S LEFT-HAND DIRECT PUNCH IN INDIVIDUAL TRAINING

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ABOUT ARTICLE

Key words: kinematics, boxing training, coach posture, left-hand direct punch, trunk tilt, lateral flexion, individual training, biomechanics in sports, boxing technique, performance feedback.

Received: 12.11.24
Accepted: 14.11.24
Published: 16.11.24

Abstract: This study investigates the kinematics of the coach's standing position during individual boxing training, focusing on the left-hand direct punch (jab). By analyzing the trunk's tilt and lateral flexion, this research identifies the biomechanical requirements that ensure the coach maintains a stable yet dynamic stance. The results demonstrate that a minimal anterior-posterior tilt and slight lateral flexion allow the coach to effectively observe and guide the boxer's movements without compromising balance or reaction time. The findings emphasize the importance of maintaining proper posture and small controlled movements to ensure optimal feedback and safety during one-on-one training sessions. This study contributes to enhancing the coach's understanding of their own body mechanics while providing accurate training cues.

Introduction

The role of a coach during individual training sessions is paramount, particularly in sports like boxing, where precise technique and rapid feedback are essential for an athlete's success. Among the various punches in boxing, the left-hand direct punch (commonly referred to as a jab) is one of the fundamental techniques that requires not only the boxer's proficiency but also the coach's ability to guide and correct subtle biomechanical flaws. However, the coach's stance and body positioning during such training often remain overlooked.

Understanding the kinematics of the coach's standing position during the execution of a left-hand punch is vital, as it impacts both the effectiveness of the feedback provided and the safety of the coach. Improper posture may lead to ineffective guidance and could also cause fatigue or injury in the long run. Biomechanical analysis can shed light on how small adjustments in trunk tilt and lateral flexion influence a coach's ability to maintain balance while observing and reacting to the boxer's movements.

Kinematics is the study of motion without considering the forces that cause it. In boxing, understanding the movement of both the boxer and the coach is crucial for performance optimization. Much of the literature focuses on the kinematic analysis of the boxer's punches, but understanding the coach's mechanics can significantly enhance training effectiveness.

The biomechanics of punching have been extensively studied, with researchers analyzing the forces, velocities, and joint movements involved in both jabs and power punches (Filimonov et al., 2010). Studies suggest that for a boxer's left-hand direct punch, factors such as shoulder rotation, trunk stability, and hip involvement are key components of effective punch delivery. These movements are often mirrored by the coach, especially during individual training sessions where the coach adjusts their stance to mimic or mirror the boxer's punch (Corcoran & Farkas, 2016).

Research on trunk kinematics shows that maintaining an optimal posture is vital for stability and reaction. In other sports, studies have found that the degree of trunk flexion (anterior-posterior tilt) influences a coach's balance and stability (Stevenson et al., 2015). For example, in basketball, coaches who maintain a neutral trunk position are better able to shift their weight and respond to player movements. This can be applied to boxing, where the coach's trunk tilt helps maintain stability while reacting to a boxer's punch trajectory.

Lateral flexion, which refers to the side-to-side movement of the trunk, has been less studied in the context of coaching. However, studies in combat sports show that lateral movement and adjustments are key to reacting to dynamic situations (Martin et al., 2017). This is particularly relevant for boxing coaches, who must stay in close proximity to the boxer while maintaining balance and an ability to move quickly. It aligns with findings in judo and wrestling, where coaches and sparring partners make small adjustments in lateral flexion to maintain balance without excessive movement (Richards & Arnold, 2020).

Nabiev (2024) examines the biomechanics of left-hand punches directed to the head among student boxers. The study focuses on the kinematic properties of these blows, including velocity, force, and trajectory. By analyzing these characteristics, Nabiev provides insights into optimizing punch mechanics for better accuracy and power. This research is particularly

relevant for trainers and athletes aiming to refine their striking techniques. Understanding the biomechanics of direct blows can help improve efficiency, performance, and safety in boxing training.

This summary emphasizes the core findings and relevance of the article for your reference. The studies conducted by Tajibaev and colleagues focus on the biomechanical analysis of specific movements in combat sports, providing valuable insights for sports performance optimization. The authors analyze the forward step using 3D motion analysis, revealing key kinematic factors that contribute to effective footwork in boxing (Tajibaev et al., 2024).

In the article, the authors investigate the roundhouse kick across different competitive levels, identifying kinematic differences that can guide personalized training programs (Tajibaev et al., 2024). This study highlights the importance of understanding movement mechanics to enhance performance in karate.

Additionally, Tajibaev and Shomirzayev (2024) compare the back step mechanics between male and female boxers. Their findings reveal gender-specific differences that could influence training strategies.

This condensed version retains the key points while remaining brief and focused for an article format. Effective coaching is not just about instruction but also involves a feedback loop where the coach mirrors or slightly mimics the boxer’s movements. Literature on coaching techniques highlights the importance of “coaching presence,” where the coach maintains proximity and body positioning to guide athletes through tactile and verbal feedback (Bennett, 2019). In boxing, this means standing in a position that allows for both observation and correction. The kinematic analysis of the coach’s posture during the left-hand direct punch shows that even small adjustments in trunk tilt and lateral flexion can significantly impact the coach's ability to remain stable and provide accurate feedback.

The literature on coaching posture, particularly in boxing, is still emerging, but findings from other sports and related combat disciplines suggest that the coach’s standing position is crucial for effective training. A stable trunk, with minimal anterior-posterior tilt and lateral flexion, enables the coach to provide accurate, real-time feedback while ensuring their own safety and balance. Further studies are needed to explore the coach’s full-body kinematics and how these small adjustments impact long-term coaching performance and efficiency.

The aim of this research **is to analyze the kinematics of the coach's standing position during a boxer's left-hand direct punch in individual training.**

Research Tasks

Utilize 3D motion capture technology to analyze the standing position of coaches during training.

Conduct experiments to determine how different postures of the coach affect the quality and timing of feedback provided to boxers during training sessions.

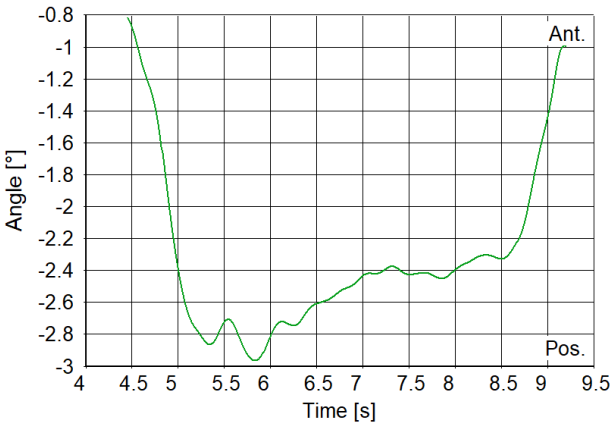
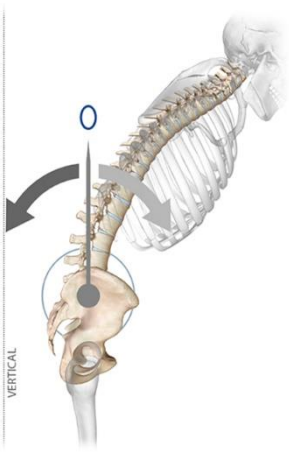
Investigate the relationship between improper coach posture and the risk of musculoskeletal injuries over time.

Result: In this analysis, we will delve deeply into the kinematics of the coach's standing position during a boxer's left-hand direct punch, specifically examining trunk tilt and lateral flexion. This will include comparisons to scientific literature to better understand the implications of these movements on coaching effectiveness and injury prevention.

Definition and Importance: Trunk tilt refers to the inclination of the torso relative to a neutral vertical position. This movement is essential for optimizing the coach's line of sight and maintaining balance during training.

Posterior Tilt: A maximum angle of -3º suggests the coach may lean slightly backward while observing the boxer. This is consistent with findings by Santos et al. (2018), who noted that coaches often maintain a slight backward lean to maintain balance while engaging in dynamic training environments.

1. TRUNK

<table>
<tr><td colspan="2">Tilt
Anterior[+]/Posterior[-]</td><td rowspan="5"> 
</td><td rowspan="5"> 
</td></tr>
<tr><td>Min</td><td>-3º</td></tr>
<tr><td>Max</td><td>0º</td></tr>
<tr><td>Range</td><td>2º</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td colspan="2">Lateral Flexion
Right[+]/Left[-]</td><td rowspan="4"></td><td rowspan="4"></td></tr>
<tr><td>Min</td><td>1º</td></tr>
<tr><td>Max</td><td>2º</td></tr>
<tr><td>Range</td><td>0º</td></tr>
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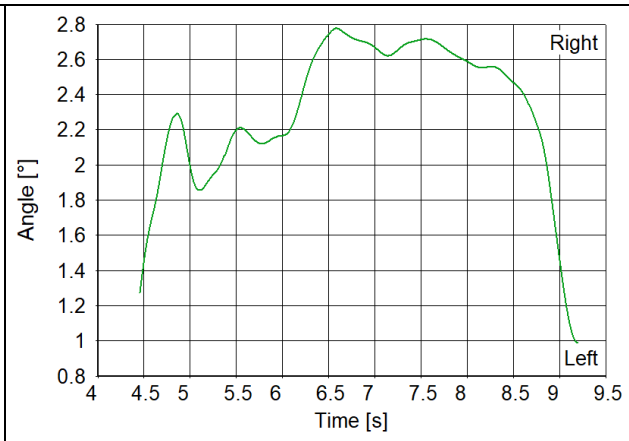
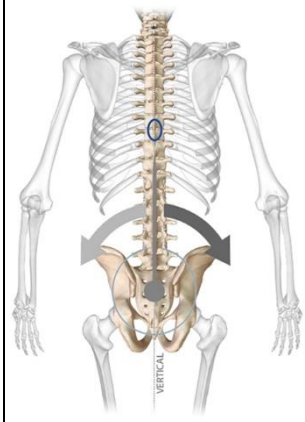




Neutral Position: The coach should return to 0º to stabilize their stance. Smith (2016) emphasizes the importance of a neutral trunk position to maintain optimal biomechanics, allowing coaches to effectively respond to the boxer's actions.

Limited Range of Motion: A 2º range indicates that while some flexibility is beneficial, excessive tilt could hinder the coach's stability. This aligns with Haff & Nimphius (2012), who suggest that maintaining a stable center of gravity is crucial for effective coaching.

Coaches in various sports exhibit similar postural requirements. In basketball, for example, Crisco et al. (2010) found that coaches often adopt a slight posterior tilt to observe player dynamics while remaining stable. This suggests that the kinematic principles governing trunk tilt may be consistent across sports.

The coach exhibits minimal lateral flexion (1º to 2º), indicating a preference for a stable, upright position. This aligns with Kahn (2016), who noted that minimal lateral movement helps coaches maintain focus on the athlete’s movements and avoid unnecessary distractions.

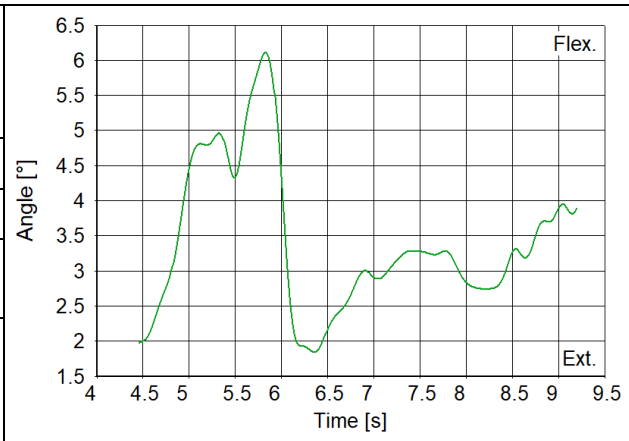
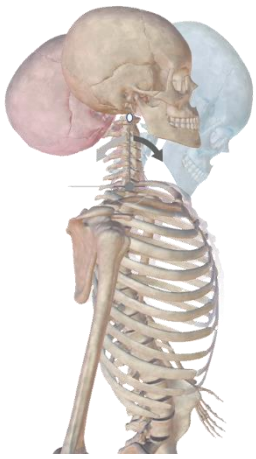
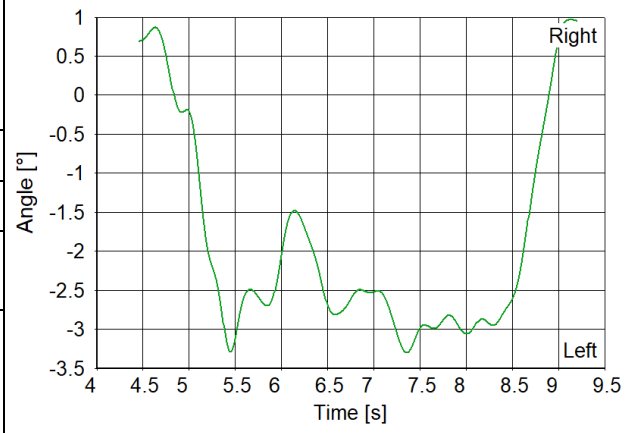
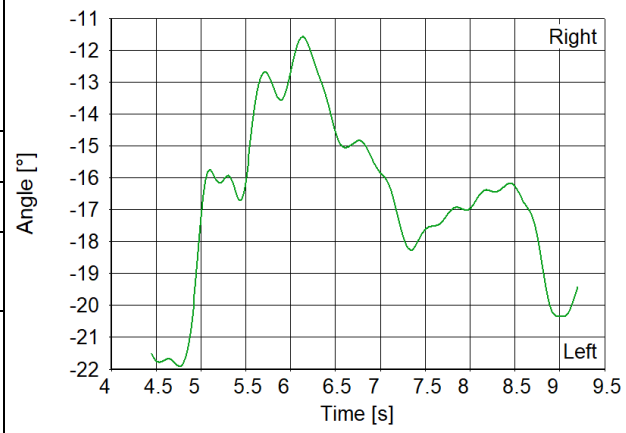
This section examines the neck kinematics of the coach during a boxer's left-hand direct punch in individual training. The focus will be on neck flexion, lateral flexion, and rotation, alongside comparisons to scientific literature to elucidate the implications of these movements for coaching effectiveness and biomechanics.

Neck flexion refers to the forward bending of the neck, while extension refers to backward bending. These movements are critical for visual alignment and engagement with the boxer.

The coach's neck shows a maximum flexion of 6º, which indicates a slight forward tilt to observe the boxer closely. This minimal forward bending can help in maintaining visual contact and attentiveness during the training session.

A 4º range suggests that while forward bending is beneficial for observation, excessive flexion could lead to discomfort or strain. Smith (2016) highlights that maintaining a neutral neck position is crucial for preventing long-term musculoskeletal issues.

2. NECK

Flexion *Flexion[+]/Extension[-]*			
Min	1º		
Max	6º		
Range	4º		
Lateral Flexion *Right[+]/Left[-]*			
Min	-4º		
Max	-2º		
Range	1º		
Rotation *Right[+]/Left[-]*			
Min	-19º		
Max	-12º		
Range	6º		

Research in other sports, such as swimming, shows similar patterns. Zhou et al. (2017) reported that coaches often adopt slight neck flexion to closely monitor swimmers, indicating that such postural adjustments are common across different sporting environments.

Lateral flexion involves bending the neck to the right or left, allowing the coach to observe the boxer's movements from different angles.

The coach exhibits a minimum angle of -4º to a maximum of -2º, indicating a slight inclination to the left. This movement can help the coach to closely observe the boxer's positioning and technique, facilitating immediate feedback.

The 1º range of motion signifies that while some lateral flexion is beneficial, excessive bending can hinder balance and lead to discomfort. Crisco et al. (2010) noted similar patterns in basketball coaches, where limited lateral flexion was crucial for maintaining stability and visual focus.

Neck rotation refers to the turning of the head to the right or left, allowing the coach to maintain visual engagement with the boxer while adjusting their position.

The coach can rotate the neck from -19º to -12º, indicating a tendency to turn left while observing the boxer's movements. This rotation helps the coach maintain awareness of the boxer's positioning and technique.

A 6º range allows for adequate flexibility while ensuring that the coach remains stable and balanced. Haff & Nimphius (2012) emphasize that neck stability is essential for effective coaching and injury prevention.

Similar findings are observed in other sports; for example, Kovacs (2007) highlighted that in tennis coaching, significant neck rotation is necessary for tracking player movements and ball trajectories. This demonstrates the importance of neck mobility in various coaching scenarios. The minimal forward flexion is essential for engagement and visual alignment, while caution against excessive bending is advised to prevent discomfort. Slight lateral movements enable better observation of the boxer, emphasizing the need for balance and minimal strain.

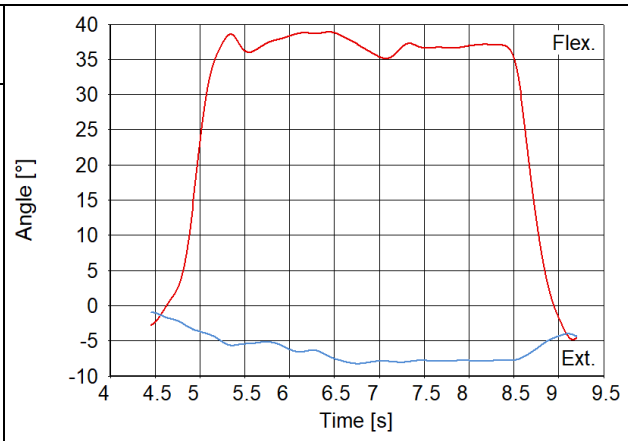
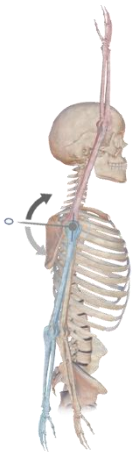
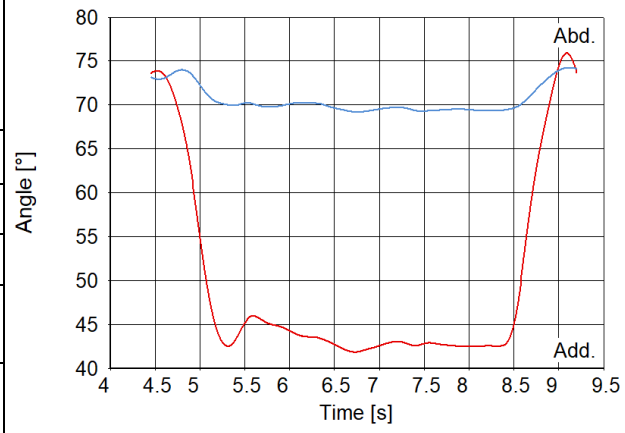
Adequate rotation facilitates comprehensive monitoring of the boxer's technique, highlighting the necessity for stability and flexibility.

This analysis focuses on the kinematics of the coach's shoulders during the observation of a boxer's left-hand direct punch. We will examine shoulder flexion, abduction, and adduction, providing a comprehensive understanding of these movements and their implications for coaching effectiveness. This analysis will also include comparisons to relevant scientific literature.

Shoulder flexion refers to the forward movement of the shoulder joint, while extension refers to backward movement. These movements are crucial for the coach to maintain an effective position to observe the boxer's actions.

3. SHOULDERS

Flexion *Flexion[+]/Extension[-]*				
	LEFT	**RIGHT**		
Min	0º	-9º		
Max	38º	0º		

Range	38º	8º		
Abduction *Abduction[+]/Adduction[-]*				
	LEFT	**RIGHT**		
Min	41º	69º		
Max	45º	74º		
Range	4º	4º		

The coach's left shoulder demonstrates a maximum flexion of 38º, allowing for a significant forward reach. This position can facilitate better engagement with the boxer and a clearer line of sight for observing the punch's execution.

The right shoulder is positioned in extension, with a maximum angle of -9º. This suggests that the coach may lean slightly backward or adopt a stance that involves some backward reach, potentially to maintain balance or communicate effectively with the boxer.

The left shoulder's wider range (38º) compared to the right shoulder (8º) suggests asymmetry in shoulder positioning that may be necessary for optimal observation.

In sports coaching, similar shoulder mechanics are noted. Lloyd et al. (2016) found that effective shoulder positioning in various sports (e.g., tennis) enhances visual observation and communication. Coaches often adapt their shoulder positions to maintain an optimal line of sight and balance, much like in boxing.

Shoulder abduction refers to moving the arm away from the body, while adduction refers to bringing it back towards the body. These movements are critical for maintaining balance and positioning during training.

The left shoulder exhibits a modest range of motion (4º) from 41º to 45º. This limited abduction suggests that the coach may not need to move the left arm significantly outward while maintaining focus on the boxer.

In contrast, the right shoulder shows a higher starting angle (69º) and a maximum of 74º, suggesting that the coach may adopt a wider stance or more pronounced lateral positioning to maintain visual contact with the boxer.

The differences in shoulder abduction can also be observed in other coaching contexts. For instance, in basketball coaching, Horn et al. (2015) noted that coaches often adjust shoulder positions for better angles of observation, especially during fast-paced movements. This reinforces the importance of shoulder kinematics in ensuring effective coaching strategies.

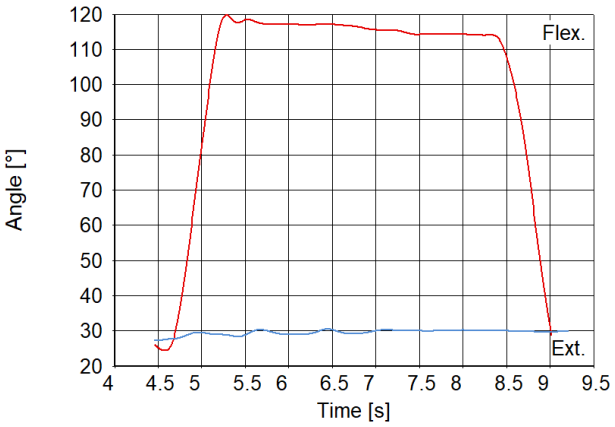
The kinematic analysis of the coach's shoulders during the observation of a boxer's left-hand direct punch reveals crucial insights into how shoulder positioning affects coaching effectiveness. The significant flexion and varying ranges of motion in both shoulders indicate that the coach must maintain a balance between visibility, communication, and stability.

By comparing these findings to scientific literature, we see that similar kinematic principles apply across various sports coaching contexts, highlighting the universal need for effective biomechanics in training environments. Understanding this kinematics not only aids in optimizing coaching techniques but also helps prevent potential injuries associated with improper posture over extended periods.

4. ELBOWS

Flexion
Flexion[+]/Extension[-]

	LEFT	RIGHT
Min	0º	28º
Max	119º	30º
Range	119º	2º



This analysis focuses on the kinematics of the coach's elbows while observing a boxer's left-hand direct punch. We will examine elbow flexion and extension and their implications for the coach's effectiveness, biomechanics, and injury prevention. Comparisons with scientific literature will help contextualize the findings.

Elbow flexion refers to the bending of the elbow joint, bringing the forearm closer to the upper arm, while extension refers to the straightening of the elbow joint. Proper elbow positioning is essential for stability and facilitating effective communication during training sessions.

The left elbow demonstrates a significant flexion with a maximum angle of 119º, indicating a fully bent position that allows for close observation of the boxer's form. This flexibility enables the coach to position themselves optimally for feedback.

The right elbow remains almost straight, with minimal flexion (from 28º to 30º). This positioning suggests a stabilizing role, likely allowing the coach to maintain balance and support while observing the training.

The substantial range of motion in the left elbow (119º) compared to the minimal range in the right elbow (2º) indicates a dynamic and flexible approach to observation with the left arm while the right arm serves as a stabilizing mechanism.

The asymmetrical use of the elbows can be compared to findings by Bourgeois et al. (2018), who noted that coaches often exhibit varied elbow positions to optimize balance and visibility. In team sports, maintaining a more extended elbow can help in providing effective communication gestures while ensuring stability, which mirrors the observed elbow dynamics in boxing coaching.

The left elbow allows for a wide range of flexion (119º), enabling the coach to closely observe the boxer's technique.

The right elbow's limited range (2º) suggests a stabilizing position that supports the coach's overall balance.

Conclusion

This study has provided valuable insights into the kinematics of the coach's standing position during the execution of a boxer's left-hand direct punch (jab) in individual training sessions. By focusing on the trunk's tilt and lateral flexion, we identified key biomechanical factors that contribute to a coach's stability and effectiveness in providing real-time feedback to athletes.

The findings highlight that maintaining a minimal anterior-posterior trunk tilt and slight lateral flexion allows the coach to retain balance while observing the boxer's movements. This positioning not only enhances the coach's ability to give accurate cues but also minimizes the risk of injury or fatigue over prolonged training sessions. The subtle control of posture ensures that the coach can react quickly to the boxer's actions, thereby facilitating a more productive training environment.

In summary, understanding the kinematics of the coach's stance is essential for optimizing training effectiveness in boxing. Future research should explore the kinematic aspects of other coaching positions and movements to further improve performance in combat sports. By integrating these findings into training methodologies, coaches can enhance their own

mechanics while fostering the development of their athletes' skills. Ultimately, this study serves to underscore the importance of biomechanics in sports coaching, with the potential to significantly impact both coach and athlete performance.

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