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Section I – Kinesiology

Free-Throw Accuracy Relates to Muscle Symmetry Activation of Masseter and Temporalis Muscles in Amateur Female Basketball Players

by
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The symmetry of masticatory muscles activation may influence postural control and, consequently, sports performance. In basketball, where shooting accuracy is crucial, masticatory muscles symmetrical contraction remains unexplored despite its potential impact on performance. This cross-sectional study was conducted to evaluate whether symmetrical activation of the masseter and temporalis muscles impacts free-throw accuracy in non-elite female basketball players. The study included 25 players who performed 18 free-throws in each of three randomized mandibular positions: mandibular rest, maximum intercuspation, and interdental cotton rolls. Electromyographic activity of the masticatory muscles was recorded before the trials and during each free-throw. We observed that symmetrical (SYM) activation performance of the temporalis muscle in maximum voluntary contraction (MVC) negatively correlated with free-throw accuracy in the resting mandibular position ($r_{(23)} = -0.442$, $p = 0.027$, $r^2 = 0.195$). In maximum intercuspation, SYM activation correlated with accuracy ($r_{(23)} = 0.582$, $p = 0.002$, $r^2 = 0.339$). Participants with higher SYM activation values (≥ 80%) performed better ($t_{(23)} = -2.79$, $p = 0.010$, $g = -1.08$). Thus, masticatory muscle symmetry relates to free-throw accuracy. Higher masseter SYM values in maximum intercuspation lead to better performance. Intraoral devices may help enhance masticatory SYM activation, potentially improving basketball free-throw performance.

***Keywords**: postural control; basketball; athletic performance; electromyography; masticatory muscles*

Introduction

Research suggests that jaw clenching can enhance sports performance by increasing masseter muscle activation (Buscà et al., 2018; Schulze and Busse, 2019), which may improve strength and biomechanics of gestures including other muscle groups such as quadriceps or sternocleidomastoid muscles (Venegas et al., 2009). This phenomenon termed 'concurrent activation potentiation' (CAP) (Ebben, 2006) is believed to increase motor neuron efficiency and reflex responses through neuromuscular pathways (Ebben, 2006; Iida et al., 2010). Studies have shown that jaw clenching facilitates the H-reflex in specific muscle groups such as the tibialis anterior, contributing to postural control (Takada et al., 2000), influenced by both cerebral cortex activation and orofacial sensory input (Sugawara et al., 2005).

Jaw muscle symmetry plays a critical role in postural control, which can impact sports

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performance. These connections have been explained through myofascial chains, via functional links between masticatory, neck, and trunk muscles, and through trigeminal-vestibular connections (Solleveld et al., 2022). In basketball, where shooting accuracy is crucial, jaw muscle symmetry may play a key role. Previous research points out factors such as ball kinematics, shot speed, and the shooting angle as determinants of free-throw success (Kartiko et al., 2019; Nakano et al., 2020), and players with better postural control have shown higher free-throw accuracy (Verhoeven and Newell, 2016).

The cervical spine, linked to the visual and vestibular systems (Hiengkaew et al., 2014; Treleaven, 2008) also contributes to postural stability. Information from the trigeminal nerves can influence balance through muscle tone adjustments in the masticatory muscles, thus impacting standing postural control (Gangloff and Perrin, 2002). This topic is still controversial, as some authors point out that the importance of these afferences is not yet clear (Perinetti, 2006).

While asymmetry in masticatory muscles might impair postural control, evidence is inconclusive (Julià-Sánchez et al., 2019). The discrepancies in the results may be attributed to differences in the complexity of postural tasks and the effectiveness of the neurophysiological mechanisms of the participants (Solleveld et al., 2022). How these muscle asymmetries affect performance variables, such as accuracy, remains unclear. Despite the lack of consensus, several authors have proposed that the trigemino-cervical integration may affect motor precision in complex tasks. In this context, symmetrical activation of masticatory muscles might contribute to enhanced postural control and, consequently, to improved accuracy in motor actions such as free-throw shooting.

This study aimed to: 1) determine whether symmetrical activation of masticatory muscles would affect free-throw accuracy, and 2) evaluate whether participants with higher symmetry values would perform better across different jaw positions.

Methods

Participants

Twenty-five amateur female basketball players aged 18–44 were recruited. All of them played in the women's regional first division (the second of five divisions), training three hours a week and participating in a competitive match on the weekend. The recruitment and data collection period took place between February and March 2024.

Exclusion criteria included participants under 18 years of age, people with missing teeth, periodontal disease, temporomandibular disorders, bruxism, current orthodontic treatment or wearing occlusal splints, orofacial trauma, or postsurgical conditions affecting the craniomandibular area. Players treated with botulinum toxin in the masticatory muscles in the previous 6 months, physical therapy treatment in the stomatognathic system in the previous 15 days, or players reporting muscle relaxant intake in the 48–72 h before the start of data collection were also excluded. Personal, sociodemographic, and anthropometric data were collected via a questionnaire.

Sample Size Calculation

The required sample size was determined using a bilateral repeated measures test with a 95% confidence level, a beta error < 0.2, a standard deviation of 5, and a minimum detectable difference of 4 units, resulting in 15 free-throws per set (adjusting for 15% losses).

Measures

EMG Measurements

Bilateral surface electromyography (SEMG) measurements of the masseters and the anterior bundle of the temporalis muscle were taken using a mDurance R surface EMG device (mDurance Solutions SL, Granada, Spain) (Molina-Molina et al., 2020). It consisted of three parts: 1) the device included a portable Shimmer3 EMG unit (Realtime Technologies Ltd., Dublin, Ireland) which was a bipolar SEMG sensor composed of two channels with a sampling rate of 1024 Hz. This unit used a bandwidth of 8.4 kHz with 24-bits signal resolution, with an overall amplification of 100–10,000 V/V; 2) the "mDurance" mobile application (Android) which received the generated data, and 3) cloud-based analysis software to store, filter, and analyze the data (Molina-Molina et al., 2020). SEMG cuts were made starting at 0.5 s before and ending 0.5 s after the EMG peak observed in the shot to avoid noise interference and to account for

postural adjustments (Bouisset and Do, 2008; Fourcade et al., 2018). A fourth-order low-pass Butterworth filter (20–450 Hz) was applied to raw data, and the root mean square (RMS) and maximum voluntary contraction (MVC) were recorded. The device recorded in minimum 25-ms sequences. The device measured the activation symmetry of each pair of muscles as an activation function per unit of time. These EMG waves of paired muscles were compared by computing a percentage overlapping coefficient (SYM), that ranged between 0 (maximal asymmetry) and 100% (perfect symmetry), as referred elsewhere (Ferrario et al., 2000; Solleveld et al., 2022). Based on previous research, these values were expressed as a percentage, considering SYM ≥ 80% as a symmetrical contraction (Ferrario et al., 1993).

Free-Throw Accuracy Assessment

Accuracy was measured for each mandibular position: RP (rest position, with closed lips and no dental contact), MIP (maximum intercuspation, with closed lips and maximum clenching), and OVD (increased occlusal vertical dimension, with closed lips and cotton rolls of 0.8 mm in diameter x 3.8 mm in length placed between the dental arches). An instructor provided randomized shot sequences. Each player performed 18 free-throws in a row in each jaw position, 54 free-throws per player. No recordings were made for each first, ninth, and eighteenth shot, thus making 15 shots for each mandibular position. The first three throws were used for familiarisation and were not included in the analysis. This procedure ensured that the 15 analysed throws reflected consistent performance under the specified condition. Another observer, unaware of the current mandibular positioning, recorded the number of successful shots. Players rested for one minute between sets.

The trials were conducted on an official basketball court with an official ball for national women's competitions, with a circumference of between 72.4 and 73.7 cm, weighing between 510 and 567 g.

All study participants performed the free throws with no instruction or imposition on how to execute each personal routine, allowing for a natural shooting technique.

SEMG Study Protocol and Variables

Each participant's face was cleaned with a 90% alcohol solution to reduce impedance. Disc pre-gelled Ag/AgCl electrodes of the 10-mm diameter were placed bilaterally and parallel to the muscle fiber direction on the masseters and anterior bundles of the temporalis muscles following the SENIAM protocol (Hermens et al., 2000), using two separate (right and left) channels. A reference electrode was positioned on the frontal bone (Figure FS1 in Supplementary Material).

Before the trial, participants performed MVCs through a maximum dental clench in the intercuspation position (6 repetitions of 6 s, with 2–3 s of rest in between). The mean RMS and MVC values obtained served as each player's baseline for maximal muscle activation. The mDurance software calculated the average SYM activation values of the MVCs and the SYM activation values of the 15 selected shots. Based on these values, participants were grouped into "Symmetrical" (SYM ≥ 80%) or "Asymmetrical" (SYM < 80%) groups. The data were then analyzed according to free-throw accuracy in each jaw position.

Design and Procedures

This cross-sectional study, adhering to STROBE guidelines (von Elm et al., 2007), recorded free-throw accuracy and electromyographic data from the masseter and temporalis muscles across three mandibular positions: mandibular rest (RP), maximal intercuspation (MIP), and increased occlusal vertical dimension (OVD) (Figure 1).

The study was approved by the Institutional Ethics Committee at the Camilo José Cela University, Madrid, Spain (code number: 09_22_UEMDTT; approval date: 06 October 2022) following the Declaration of Helsinki. All participants read and signed written informed consent before taking part in the study.

Statistical Analysis

Data normality was assessed using the Shapiro-Wilk test. For normally distributed data, Pearson correlations and Student's *t*-tests were used; for non-normal data, Spearman correlations and Mann-Whitney U tests were applied. Effect sizes were estimated using the coefficient of determination (r^2) for correlations and Hedges' *g* for group comparisons. Statistical significance was set at $p \leq 0.05$. All analyses were performed using the SPSS software package (IBM SPSS Statistics for Macintosh, Version 25.0, Armonk, NY, USA: IBM Corp).

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Results

Descriptive Results

Table S1 in Supplementary Material shows demographic characteristics, free-throw accuracy percentages, and SYM activation values in each mandibular position (mean ± standard deviation and 95% CI). Table 1 shows the between-group values, represented as mean ± standard deviation, and the number of participants assigned to each group.

Statistical Results

Pearson correlations were analyzed between free-throw accuracy, MVCs' SYM activation values, and each mandibular position of SYM activation (Table 2). Temporalis SYM activation during MVCs negatively correlated with free-throw accuracy in the RP ($r_{(23)} = -0.442$, $p = 0.027$, $r^2 = 0.195$; Figure 2) indicating a medium effect size. In MIP, masseter SYM activation positively correlated with accuracy ($r_{(23)} = 0.582$, $p = 0.002$, $r^2 = 0.339$; Figure 3) indicating a large effect size. For the OVD position, no significant correlation was shown at the $p \leq 0.05$ level.

The Student *t*-test using a SYM activation value ≥ 80% as an indicator of a good performance showed that participants with masseter SYM activation ≥ 80% in the MIP position had significantly higher accuracy than those below this threshold ($t_{(23)} = -2.79$, $p = 0.010$; Figure 4). Hedges' *g* was calculated being equal to −1.08, which implied a large effect size in the between-group analysis. No significant accuracy differences were observed in the RP or OVD positions for either muscle (Table S2 and Table S3 in Supplementary Material).

Table 1. Muscle SYM activation values of particular groups of players.

	Symmetrical group (SYM ≥ 80%)	Asymmetrical group (SYM < 80%)
Masseter SYM activation		
MVC	85.03 ± 4.17 (n = 13)	60.00 ± 20.06 (n = 12)
RP	88.17 ± 7.08 (n = 6)	51.53 ± 22.69 (n = 19)
MIP	88.46 ± 7.06 (n = 13)	52.50 ± 14.33 (n = 12)
OVD	86.00 ± 3.87 (n = 5)	47.80 ± 21.47 (n = 20)
Temporalis SYM activation		
MVC	90.93 ± 4.35 (n = 10)	68.56 ± 9.78 (n = 15)
RP	92.40 ± 6.22 (n = 5)	47.55 ± 21.58 (n = 20)
MIP	89.83 ± 4.89 (n = 12)	61.08 ± 19.79 (n = 13)
OVD	89.50 ± 9.32 (n = 4)	52.62 ± 21.39 (n = 21)

SYM activation, average symmetry activation value; MVC, maximum voluntary contraction; RP, rest position; MIP, maximal intercuspation position; OVD, altered occlusal vertical dimension position

Table 2. Pearson correlations among free-throw accuracy and SYM values in each mandibular position.

	Accuracy RP		Accuracy MIP		Accuracy OVD	
	r	*p*	r	*p*	r	*p*
Masseter SYM activation						
MVC	0.12	0.53	0.27	0,181	0.08	0.69
RP	0.05	0.81				
MIP			**0.58**	**0.002**		
OVD					0.11	0.58
Temporalis SYM activation						
MVC	**−0.44**	**0.027**	−0.17	0.39	−0.11	0.57
RP	−0.02	0.89				
MIP			−0.004	0.98		
OVD					0.35	0.08

Significant values are in bold font. SYM, average symmetry activation value; MVC, maximum voluntary contraction; RP, rest position; MIP, maximal intercuspation position; OVD, altered occlusal vertical dimension position

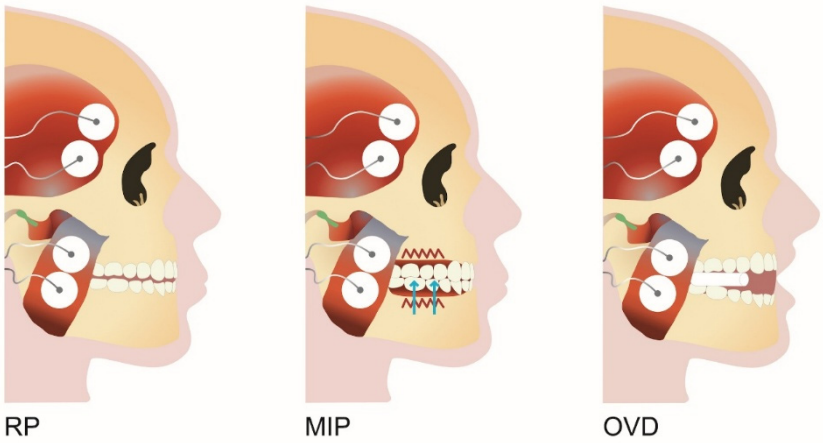

Figure 1. Schematic diagram of the mandibular position.
RP: Rest position; MIP: Maximum intercuspation position; OVD, altered occlusal vertical dimension position

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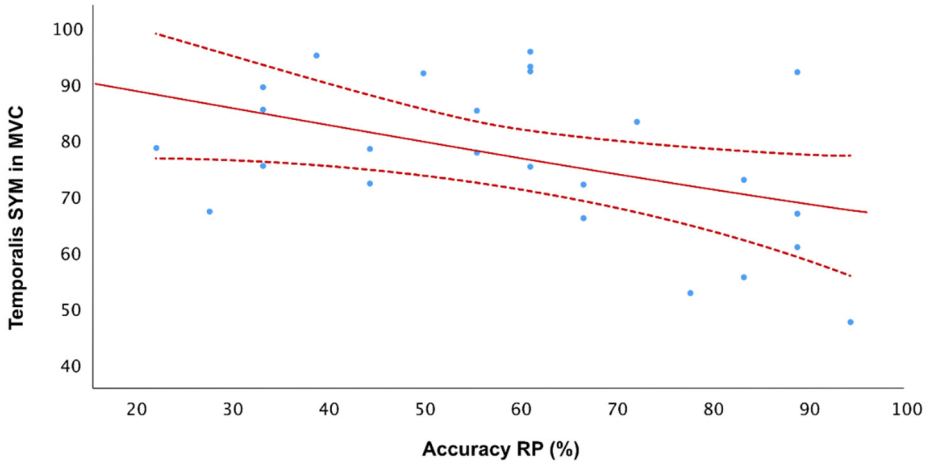

Figure 2. Scatter plot of the temporalis SYM MVC regarding accuracy in the RP.
Solid red line = adjusting line; dotted lines = 95% CI

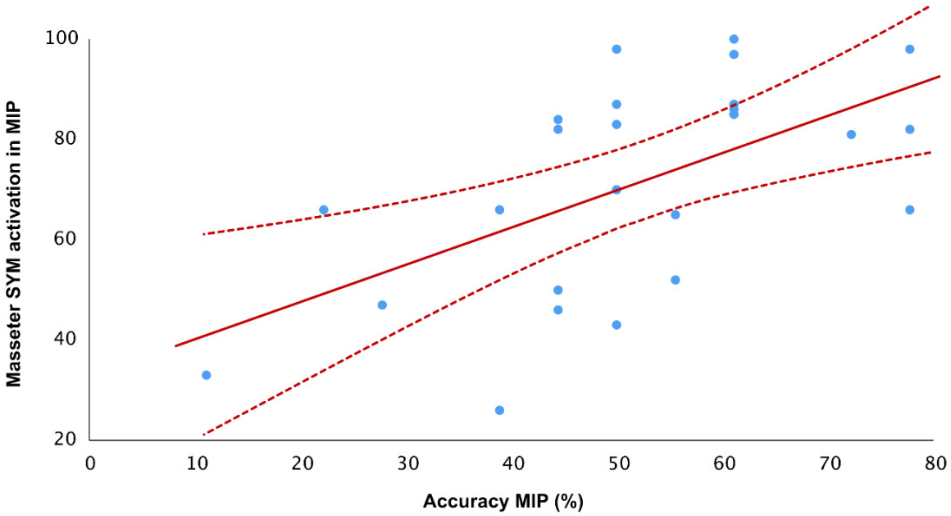

Figure 3. Scatter plot of masseter SYM activation in the MIP regarding accuracy in the MIP.
Solid red line = adjusting line; dotted lines = 95% CI

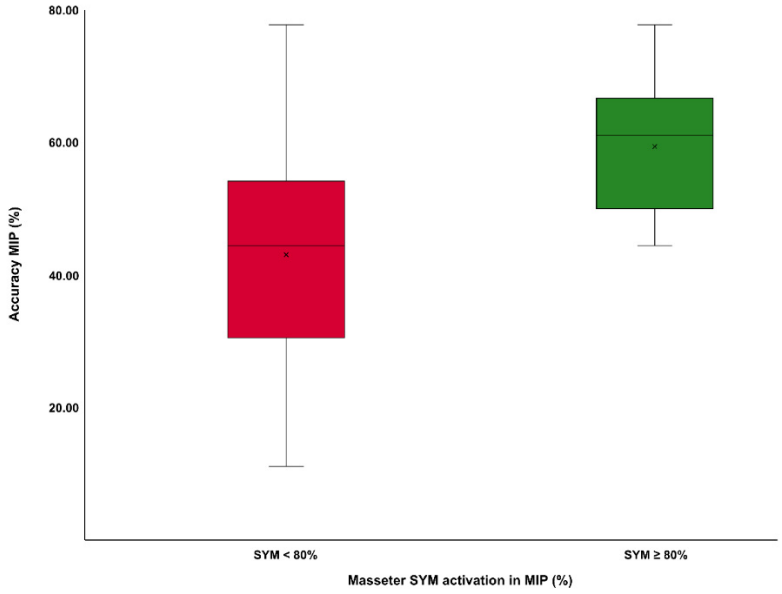

Figure 4. Boxplots of the groups divided by their masseter SYM activation values (cut-off point = 80%) in the MIP position regarding shot accuracy in the MIP.

Discussion

The aim of the present study was to determine whether symmetrical activation of masticatory muscles would affect free-throw accuracy, and to evaluate whether individuals with higher symmetry values would perform better across different jaw positions. The symmetrical activation of the different masticatory muscles influenced free-throw accuracy measured under different conditions. This effect seems contradictory since it can either produce a negative, null, or positive impact on the shot accuracy of female players. The opposing correlations observed between temporalis MVC SYM activation in the rest mandibular position and masseter SYM activation in the MIP position suggest that different masticatory muscles may influence free-throw accuracy in distinct ways. While greater symmetry of muscle activation of the temporalis muscles when performing the MVCs negatively impacted shot accuracy in the RP, greater symmetry of activation of the masseter muscles in maximum intercuspation improved it. This could be due to the specific roles these muscles play in jaw stabilization and the potential for different neuromuscular pathways to impact motor control. The CAP mechanism proposed by Ebben states that clenching could increase remote muscle activation via the H reflex, cortical overflow strength, and resistance training. Yet, it does not refer to precision performance (Ebben, 2006; Ebben et al., 2008). This process may be the basis for better outcomes in jumping, explosive strength, and running kinematics when using an intraoral device (Cesanelli et al., 2021; Miró et al., 2023). Current research shows that a jaw position itself has no impact on free-throw accuracy, but there is a relationship between masticatory muscle activation in maximum intercuspation and in an occlusal altered dimension that impacts free-throw performance when executing a shot (Delgado-Delgado et al., 2024). Those researchers pointed out that increased muscle activity in the MIP position related to higher accuracy for the right masseter. Additionally, they found worse performance for

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increased masticatory muscle activity in the OVD position, yet they did not analyze the symmetry of contraction in these muscles. We observed that players with higher temporalis symmetry, when performing the MVCs, were less accurate in free-throws when shooting with a resting jaw position. However, lower symmetry values for temporalis muscles are related to temporomandibular disorders (TMD) (Mapelli et al., 2016) which could lead to worse performance, although this has been studied for endurance, not accuracy (Wänman, 2012). Our results show higher accuracy with greater masseter symmetry shooting in the MIP position, which is consistent with the CAP, but we must keep in mind that free-throw accuracy relies on diverse physical techniques, such as shot preparation, postural control, ball-to-ground distance, the angle shot, a backward ball spin, as well as flowing movement and control (Pakosz et al., 2021). Regarding other body structures, Arboix-Alió et al. (2025) found slower change-of-direction performance outcomes in those female elite basketball players who presented greater inter-limb asymmetry. In other sports, lower limb asymmetry appears unrelated to running economy and performance in runners (Blagrove et al., 2021), but it has been shown to affect postural control in the dominant leg of soccer players (Solleveld et al., 2022). However, the former study did not examine electromyographic asymmetry, as it relied on dynamometry to assess lower limb muscle strength. In contrast, the latter explored asymmetry between the masseter and temporalis muscles in relation to postural control, which is more relevant to myogenous TMD. Nevertheless, their analysis of paired muscle symmetry yielded non-significant results.

In our study, those shots in the MIP position were taken by ordering the players to clench. Thus, the CAP mechanism might underlie the improvement in shooting accuracy by impacting balance control when clenching, as better outcomes in masticatory muscle symmetry are related to less body sway (Julià-Sánchez et al., 2019). Leroux and colleagues showed the impact of clenching on leg power exerted in paravertebral muscle symmetry in elite rowers, using a splint that deflected the mandible laterally by 4 mm (Leroux et al., 2018). Muscle activity was measured with a strength device (Dyno Concept 2) during the leg press exercise, and the symmetry of paravertebral muscles with a manual test such as the standing flexion test (Conde-Vázquez and Mohíno-Fernández, 2022). Although the legs exerted power decreased and the asymmetry for the standing flexion test increased in those rowers wearing the silicone splint, we are unaware of the validity of the Dyno Concept 2. Furthermore, the evaluators were not blinded in the different tests and the standing flexion test showed no validity in current research.

Previous studies have highlighted functional relationships among the stomatognathic system, the oculomotor system, the cervical spine, and the vestibular nuclei, given the role of head stabilization in maintaining gaze and enhancing postural control (Buisseret-Delmas et al., 1999). Trigeminal afferents have been shown to play a significant role in human balance (Julià-Sánchez et al., 2019). The sensory information transmitted to the trigeminal nuclei may be influenced by intraoral devices such as occlusal splints, which aim to achieve a centric mandibular position. These devices have been associated with improvements in sports performance related to strength (Buscà et al., 2016), agility, and the vertical jump in basketball players (Buscà et al., 2018). However, they appear to have no significant effect on accuracy-based tasks such as 10-m pistol shooting or professional golfers' putting precision and strength (Dias et al., 2018; Pae et al., 2013; Ringhof et al., 2015). A comprehensive review by Cesanelli et al. (2021) emphasizes the importance of individualized assessment—both for oral health and athletic performance—particularly in cases where the centric condylar articular position may influence outcomes. Enhanced occlusal stability has been linked to increased masseter activity during strength tasks. In contact sports, the use of occlusal splints should also be evaluated for their potential impact on precision of activities. It is important to recognise that free-throw accuracy depends not only on physical factors, but also on practice, motivation, and attentional focus (Shooli et al., 2024), as well as on visuomotor afferents (Wunderlich et al., 2020).

Recent studies show the impact of neuromuscular training on sports performance, which leads to improvements in agility, strength, and balance (Akbar et al., 2022). Incorporating these approaches into basketball training could potentially lead to similar enhancements in free-

throw accuracy. Moreover, considering that temporomandibular dysfunction may persist in asymptomatic stages, it could still lead to neuromuscular alterations that negatively affect sports performance and increase injury risk. Similar findings have been reported in amateur basketball players with asymptomatic patellar tendinopathy, who showed altered muscle coordination and increased tendon loading during landing tasks (Li et al., 2025).

Masticatory muscle activity may represent an additional factor to consider by coaches and athletes, especially in contexts where neuromuscular efficiency and postural control are key. Although the present findings are based on non-elite participants and should be interpreted with caution regarding their generalizability, the large effect sizes observed suggest a potential for performance-related relevance. Future research could explore practical applications, such as coordination drills for symmetrical activation of the masseter and temporalis muscles (i.e., biofeedback), or the use of custom intraoral devices to promote balanced jaw muscle function. Moreover, tailoring training programs based on individual muscle symmetry profiles might further optimize performance in specific tasks. Further research should focus on the SYM activation variable in basketball accuracy, analyzing different court shot positions, comparing dynamic and static tasks, considering the player's level, and the presence of TMD. Moreover, future studies should consider longitudinal designs to explore these relationships over time and in varied athletic populations and explore these cross-sport applications to determine the universality of the observed effects, i.e., the analysis of these relationships in other precision sports such as golf, archery, or pistol shooting would also be of interest.

Limitations

Our findings indicate an association between muscle symmetry and free-throw accuracy, however, due to the cross-sectional design, no causal inferences can be made. Although the sample size might be considered small for generalization, the SEMG dataset included over 1500 recordings when combining MVCs and free-throw trials, and the sample calculation was based on the number of shots rather than the number of players.

A key limitation is that participants were not elite or highly trained athletes, which restricts the generalizability of our findings to professional or high-performance sport contexts. Future studies should replicate these findings in more competitive populations to assess the consistency and relevance of the observed effects.

Additionally, although players answered regarding pain in the temporomandibular region, no clinical assessment for TMD was performed. SEMG activity may have been influenced by undiagnosed malocclusions, as no prior dental evaluation was conducted. Other potentially confounding variables, such as training history, the fatigue level, or the psychological state, were not controlled. Free-throws were carried out during training sessions, which may differ from the competitive context. Lastly, the presence of surface EMG electrodes and wiring may also have impacted performance.

Conclusions

Symmetrical activation of the masticatory muscles is associated with free-throw accuracy in female amateur players, both at mandibular rest and during maximum clenching. Individuals with higher masseter symmetrical activation achieve better shot outcomes in maximum intercuspation. While the findings point to the potential benefits of targeted muscle training, the observed inconsistencies underscore the need for further investigation. By addressing the limitations and expanding on these initial findings, future research could pave the way for innovative training methods that enhance athletic performance through neuromuscular optimization.

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SUPPLEMENTARY MATERIAL

Table S1. Demographic characteristics, accuracy percentages, and SYM activation values.

Variable	Mean ◎ SD	95% CI
Age	29.28 ◎ 8.40	25.81–32.75
Body mass	62.64 ◎ 6.58	59.92–65.36
Body height	1.72 ◎ 0.07	1.68–1.74
% Accuracy RP	59.78 ◎ 21.41	50.94–68.62
% Accuracy MIP	51.56 ◎ 16.55	44.72–58.39
% Accuracy OVD	58.23 ◎ 22.69	48.86–67.59
Temporalis SYM MVC	77.51 ◎ 13.71	71.85–83.17
Masseters SYM MVC	73.02 ◎ 18.87	65.23–80.81
Temporalis SYM RP	56.52 ◎ 26.66	45.52–67.52
Masseters SYM RP	60.32 ◎ 25.52	49.78–70.86
Temporalis SYM MIP	74.88 ◎ 20.53	66.40–83.36
Masseters SYM MIP	71.2 ◎ 21.34	62.39–80.01
Temporalis SYM OVD	58.52 ◎ 24.14	48.56–68.48
Masseters SYM OVD	55.44 ◎ 24.71	45.24–65.64

RP, rest position; MIP, maximal intercuspation position; OVD, altered occlusal vertical dimension position; SD, standard deviation; SYM, average symmetry value; MVC, maximum voluntary contraction; CI, confidence intervals

Table S2. Between-groups accuracy for SYM activation MVC values in each mandibular position.

			Accuracy		*t*	95% CI	*p*
			Mean	SD			
Masseters	RP	SYM MVC < 80%	56.95	23.46	−0.62	−23.40–12.51	0.53
		SYM MVC ≥ 80%	62.40	19.92			
	MIP	SYM MVC < 80%	47.69	18.27	−1.13	−21.07–6.18	0.27
		SYM MVC ≥ 80%	55.13	14.60			
	OVD	SYM MVC < 80%	54.17	20.94	−0.85	−26.69–11.09	0.40
		SYM MVC ≥ 80%	61.97	24.41			
Temporalis	RP	SYM MVC < 80%	62.60	23.80	0.79	−11.18–25.25	0.43
		SYM MVC ≥ 80%	55.56	17.57			
	MIP	SYM MVC < 80%	50.00	20.79	−0.67	−16.06–8.28	0.51
		SYM MVC ≥ 80%	53.89	6.96			
	OVD	SYM MVC < 80%	58.15	28.40	−0.02	−17.11–16.74	0.98
		SYM MVC ≥ 80%	58.34	10.88			

RP, rest position; MIP, maximal intercuspation position; OVD, altered occlusal vertical dimension position; SD, standard deviation; SYM, average symmetry value; MVC, maximum voluntary contraction; CI, confidence intervals

Table S3. Between-groups accuracy by jaw position and SYM activation values.

			Accuracy		*t*	95% CI	*p*
			Mean	SD			
Masseters	RP	SYM RP < 80%	60.23	19.35	0.18	−19.27–23.07	0.85
		SYM RP ≥ 80%	58.33	29.12			
	MIP	SYM MIP < 80%	43.05	17.42	**−2.796**	**−28.44–−4.25**	**0.010**
		SYM MIP ≥ 80%	59.40	11.42			
	OVD	SYM OVD < 80%	58.06	23.53	−0.072	−24.80–23.13	0.94
		SYM OVD ≥ 80%	58.89	21.37			
Temporalis	RP	SYM RP < 80%	58.89	23.17	−0.40	−26.98–18.09	0.68
		SYM RP ≥ 80%	63.33	13.37			
	MIP	SYM MIP < 80%	54.70	15.35	0.98	−7.16–20.26	0.33
		SYM MIP ≥ 80%	48.15	17.77			
	OVD	SYM OVD < 80%	58.47	19.53	0.12	−24.62–27.66	0.90
		SYM OVD ≥ 80%	56.94	39.64			

Significant values are in bold font. RP, rest position; MIP, maximal intercuspation position; OVD, altered occlusal vertical dimension position; SD, standard deviation; SYM, average symmetry value; CI, confidence intervals

Figure FS1. Representation of electrodes' placement.

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