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MYLOHYOID BRIDGE IN HUMAN MANDIBLES: MORPHOLOGICAL ANALYSIS AND CLINICAL IMPLICATIONS

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ARTIGO ORIGINAL

RESUMO

Contexto: A ponte milo-hioidea (PMH) é uma variação anatômica hiperostótica resultante da ossificação ao longo do sulco milo-hioideo, podendo formar um canal ósseo que transmite o feixe neurovascular milo-hioideo. Embora historicamente considerada um traço antropológico, sua relevância clínica aumentou devido a possíveis implicações em anestesia e cirurgia oral. **Objetivo:** Determinar a frequência e classificar os tipos morfológicos da PMH em mandíbulas humanas secas, e correlacionar os achados com a literatura existente e as implicações clínicas. **Materiais e Métodos:** Foi realizado um estudo observacional descritivo em 64 ramos mandibulares de 32 mandíbulas humanas secas. Os espécimes foram examinados macroscopicamente quanto à presença de PMH. As pontes identificadas foram classificadas como completas ou incompletas de acordo com Hauser e De Stefano (1989), e as formas incompletas foram posteriormente categorizadas como proximais, intermediárias ou distais. Os dados foram analisados por meio de estatística descritiva. **Resultados:** A PMH foi identificada em 6 de 64 ramos mandibulares (9,4%). A distribuição foi simétrica entre os lados. Observou-se ocorrência bilateral em 2 mandíbulas (6,3%) e ocorrência unilateral em 2 mandíbulas (6,3%). Entre os casos bilaterais, um apresentou pontes completas e o outro, pontes incompletas. Todos os casos unilaterais foram incompletos, incluindo um tipo proximal e um distal. Não foram identificadas formas intermediárias. As formas incompletas predominaram no geral. **Conclusão:** A frequência de PMH observada é consistente com valores intermediários relatados na literatura, reforçando sua variabilidade entre populações. Apesar de sua prevalência relativamente baixa, a PMH

possui implicações clínicas relevantes, particularmente em procedimentos anestésicos e cirurgia oral, devendo ser considerada durante avaliações anatômicas e pré-operatórias.

Palavras-chave: Variação Anatômica; Canal Ósseo; Feixe Neurovascular Milo-hioideo; Nervo Alveolar Inferior; Cirurgia Oral; Implantodontia.

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ABSTRACT

Background: The mylohyoid bridge (MHB) is a hyperostotic anatomical variation resulting from ossification along the mylohyoid groove, potentially forming a bony canal that transmits the mylohyoid neurovascular bundle. Although historically considered an anthropological trait, its clinical relevance has increased due to possible implications in anesthesia and oral surgery.
Objective: To determine the frequency and classify the morphological types of MHB in dry human mandibles, and to correlate the findings with existing literature and clinical implications.
Materials and Methods: A descriptive observational study was conducted on 64 mandibular rami from 32 dry human mandibles. Specimens were examined macroscopically for the presence of MHB. Identified bridges were classified as complete or incomplete according to Hauser and De Stefano (1989), and incomplete forms were further categorized as proximal, intermediate, or distal. Data were analyzed using descriptive statistics.
Results: MHB was identified in 6 out of 64 mandibular rami (9.4%). The distribution was symmetrical between sides. Bilateral occurrence was observed in 2 mandibles (6.3%), and unilateral occurrence in 2 mandibles (6.3%). Among bilateral cases, one presented complete bridges and the other incomplete bridges. All unilateral cases were incomplete, including one proximal and one distal type. No intermediate forms were identified. Incomplete forms predominated overall.
Conclusion: The frequency of MHB observed is consistent with intermediate values reported in the literature, reinforcing its variability among populations. Despite its relatively low prevalence, the MHB has relevant clinical implications, particularly in anesthetic procedures and oral surgery, and should be considered during anatomical and preoperative evaluations.
Keywords: Anatomic Variation; Bony Canal; Mylohyoid Neurovascular Bundle; Inferior Alveolar Nerve; Oral Surgery; Implantology.

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Introduction

The mylohyoid bridge (MHB) is a hyperostotic anatomical variation resulting from the ossification of a membrane derived from Meckel's cartilage along the mylohyoid groove (MHG), which may convert it into a bony canal housing the mylohyoid neurovascular bundle. The embryological origin of this structure was described by Ossenberg (1974), who associated it with the persistence of Meckel's cartilage remnants and ossification of the sphenomandibular ligament.

From a morphological perspective, the MHB presents structural variations classified as complete or incomplete, as well as topographical subdivisions into proximal and distal types, as described by Yamano and Yamaguchi (1976) and later systematized by Jidoi et al., (2000). Additional studies, such as that by Furuta (1982), demonstrated that this ossification may result in the formation of a true bony canal with variable dimensions and potential functional implications.

The frequency of the MHB varies widely among different human populations. Classical studies have reported low incidence in Asian populations, such as Sawyer and Kiely (1987), with 2.6%, and Kaul and Pathak (1984), with values ranging from 2.9% to 7.1%. In contrast, higher frequencies have been observed in African populations, as reported by Lundy (1980), who described an incidence of 32.2%. Investigations in ancient populations, including pre-Columbian individuals (Sawyer et al., 1978) and Byzantine mandibles (Turan-Ozdemir and Sendemir, 2006), also demonstrated significant variation, suggesting the influence of genetic, environmental, and microevolutionary factors (Dodo, 1974; Eroğlu, 2011).

Although initially considered an anthropological feature, the MHB has gained increasing clinical relevance. Compression of the mylohyoid neurovascular bundle may be associated with deep pain and neurosensory alterations (Narayana et al., 2007; Covantev & Belic, 2020). Furthermore, the MHB may act as a barrier to the diffusion of local anesthetics, contributing to failures in inferior alveolar nerve block (Rusu et al., 2017; Arifoğlu et al., 2024; Parlak, 2022).

Recent studies, including morphometric analyses (Nikolova et al., 2017), population-based evaluations (Dave et al., 2019; Samanta & Priya, 2023), and imaging investigations (Sen et al., 2025; Madhok et al., 2022), have expanded the understanding

of this anatomical variation, highlighting its relevance in implantology and oral surgery. However, detailed morphological studies in Brazilian populations remain scarce.

Therefore, the present study aims to determine the frequency and classify the types of mylohyoid bridge in dry human mandibles, correlating the findings with the scientific literature and discussing their clinical implications.

MATERIALS AND METHODS

This is a descriptive, observational study based on the analysis of 64 mandibular rami obtained from 32 dry human mandibles belonging to the Anatomy Laboratory of the Federal University of Sergipe.

The specimens were subjected to macroscopic inspection to identify the presence or absence of MHBs. The evaluation was performed under adequate lighting conditions, allowing detailed visualization of the MHG and associated bony formations.

The identified structures were classified according to the criteria of Hauser and De Stefano (1989) as:

(I) complete, when total ossification of the MHG forms a continuous bony canal; and (II) incomplete, when ossification is partial.

Incomplete forms were further subdivided into proximal, intermediate, or distal, according to their relationship with the mandibular foramen, as described by Yamano and Yamaguchi (1976) and Jidoi et al. (2000).

The analysis was performed bilaterally, considering each mandibular ramus as a unit of observation.

Data were recorded in an electronic spreadsheet and analyzed using descriptive statistics, with absolute and relative frequencies calculated for the variables studied.

RESULTS

The MHB was identified in 6 of the 64 mandibular rami analyzed, corresponding to a frequency of 9.4%. The distribution of findings was symmetrical between the right and left sides, with equivalent occurrence in both antimeres.

Among the 32 mandibles analyzed, bilateral occurrence of the MHB was observed in 2 cases (6.3%). Unilateral occurrence was also observed in 2 cases (6.3%).

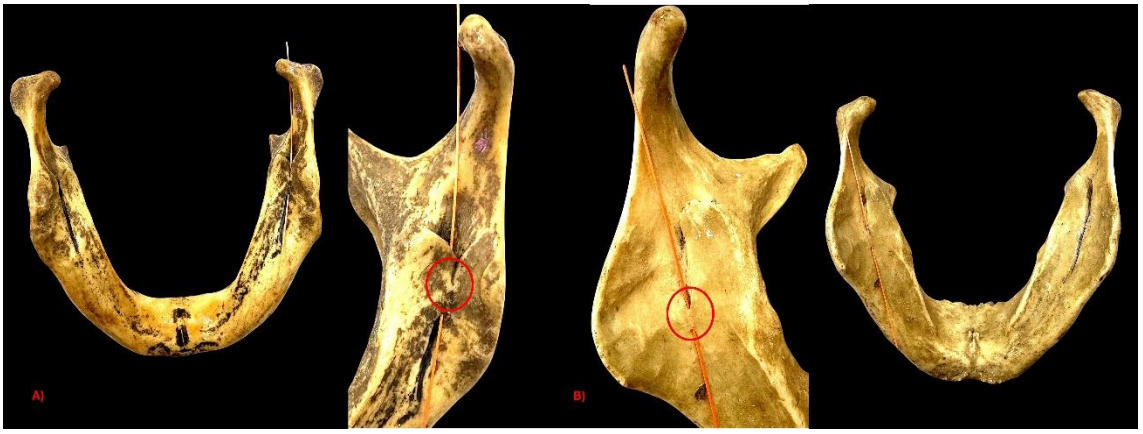
In bilateral cases, a complete bridge was observed in one mandible (**Figure** 1), while an incomplete bridge was observed in another (**Figure** 2). In unilateral cases, both bridges were classified as incomplete (**Figure** 3), with one proximal (**Figure** 3A) and the other distal (**Figure** 3B). No intermediate forms were identified in the analyzed sample.

Overall, incomplete forms predominated, with a low overall frequency of occurrence in the studied sample.

Figure 1. Bilateral complete MHB

Figure 2. Bilateral incomplete MHB

Figure 3. Unilateral incomplete MHB



Discussion

The frequency of 9.4% observed in the present study falls within the intermediate range reported in the literature, approximating the values described by Narayana et al. (2007) (7.2%), Nikolova et al. (2017) (7–11%), and Turan-Ozdemir and Sendemir (2006) (8.9%). These findings suggest that the prevalence of MHB tends to range between 6% and 11% across different populations.

However, the literature demonstrates considerable global variability. Studies such as Sawyer and Kiely (1987) reported low frequencies (2.6%), while Kaul and Pathak (1984) found values between 2.9% and 7.1%. In contrast, Lundy (1980) reported one of the highest prevalences (32.2%) in African populations. Similarly, Sawyer et al. (1978) reported a frequency of 17.6% in pre-Columbian populations. According to Ossenberg (1974), MHB frequency may range from approximately 1% to 60%, depending on the population studied.

This heterogeneity, summarized in **Table** 1, highlights the absence of a universal pattern and supports the hypothesis that MHB is a multifactorial trait influenced by genetic, environmental, and functional factors (Jidoi et al., 2000; Eroğlu, 2011).

Table 1. Frequency, degree of ossification, and laterality of the MHB in different populations

Author / Year	Sample (mandíbles - M/rami - R)	Overall Frequency (%)	Degree of Ossification	Unilateral (%)	Bilateral (%)
Ossenberg (1974)	36 M	16.67	Mixed	—	—
Yamano & Yamaguchi (1976)	3901 R	18.4	Mixed	—	—
Jidoi et al., (2000)	3919 R	11.4	Mixed	—	—
Furuta (1982)	178 M	4.2	Mixed	50.0	50.0
Dodo (1974)	314 M	12.7	Mixed	82.5	17.5
Kaul & Pathak (1984)	794 R	4.4	—	48.57	51.43
Sawyer et al., (1978)	244 R	17.6	Incomplete	27.8	72.2
Sawyer & Kiely (1987)	468 R	2.56	Incomplete	90.9	9.1
Lundy (1980)	146 R	32.2	Mixed	65.7	34.3
Turan-Ozdemir (2006)	89 R	9.0	Incomplete	—	—
Narayana et al., (2007)	264 M	7.2	Incomplete	68.42	31.58
Eroğlu (2011)	454 R	9.47	Incomplete	—	—
Dave et al., (2019)	300 M	15.66	Mixed	63.8	36.2
Nikolova et al., (2017)	448 M	9.6	Mixed	67.44	32.56
Arifoğlu et al., (2024)	90 R	1.1	Incomplete	100	0.0
Parlak, (2022)	90 R	1.1	Incomplete	100	0.0
Rusu et al., (2017)	1 M	100	Mixed	100	0.0
Hosapatna et al., (2014)	50 M	6.0	Incomplete	100	0.0
Samanta & Priya (2023)	120 R	2.5	Incomplete	100	—
Present study	64 R	9.4	Mixed	50.0	50.0

Legend

Complete → total ossification of the MHG

Incomplete → partial ossification

Proximal (lingular) → near the mandibular foramen

Distal → farther from the mandibular foramen

Intermediate → intermediate position along the groove

Mixed → coexistence of more than one type within the same study

Most studies report a predominance of incomplete forms, particularly proximal (lingular) variants, although considerable variation exists in location and degree of ossification.

In the present study, no difference was observed between the right and left sides, consistent with findings from Narayana et al. (2007), Dave et al. (2019), and Turan-Ozdemir and Sendemir (2006).

The bilateral occurrence of 6.3% observed in this study was higher than that reported by Nikolova et al., (2017) (~3.1%) and slightly higher than that reported by Dave et al., (2019) (~5.3%). In contrast, Lundy (1980) reported substantially higher rates (>30%), reinforcing population variability.

Morphologically, incomplete forms predominated in unilateral cases, in agreement with Narayana et al., (2007) and Samanta and Priya (2023). The presence of complete forms in bilateral cases may reflect more advanced stages of ossification, as suggested by Ossenberg (1974).

Overall, MHB frequency ranges from approximately 5% to 10% in most populations, with extremes from 2% to over 30%, reinforcing the influence of multiple factors on its occurrence.

Clinically, the MHB is highly relevant. Compression of the mylohyoid neurovascular bundle may lead to pain and paresthesia (Covantev & Belic, 2020). Additionally, the bridge may act as a barrier to anesthetic diffusion, contributing to failure of inferior alveolar nerve block (Rusu et al., 2017; Arifoğlu et al., 2024; Parlak et al., 2022). Imaging studies (Sen et al., 2025; Madhok et al., 2022) emphasize the importance of preoperative assessment due to critical anatomical relationships.

Thus, although often considered a minor anatomical variation, the MHB has significant clinical implications and should be carefully considered in dental, surgical, and implantological practice.

Conclusion

The MHB showed a frequency of 9.4% in the analyzed sample, with symmetrical distribution between sides and relevant morphological variability, predominantly incomplete forms. These findings are consistent with the literature, which demonstrates wide population variability.

The results highlight the importance of recognizing the MHB in anatomical studies and clinical practice, particularly due to its potential impact on anesthetic, surgical, and implantological procedures. Furthermore, they emphasize the need for its consideration in preoperative evaluations to minimize complications and therapeutic failures.

Although often underestimated, the MHB represents an anatomical variation with significant clinical relevance, justifying its inclusion in routine anatomical and radiological assessments.

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CONFLICT OF INTERESTS

The authors declare no conflict of interests.

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