Int. J. Morphol.,
43(4):1307-1312, 2025.

A Novel Formula for the Accurate Localization of the Mandibular Foramen Based on Osteometric Measurements

Una Fórmula Novedosa para la Localización Precisa del Foramen Mandibular Basada en Mediciones Osteométricas

Burak Küçük[1]; Abdullah Ortadeveci[1]; Aybegum Balci[2]; Yadigar Akbas[1] & Tuna Karahan[2]

KÜÇÜK, B.; ORTADEVECI, A.; BALCI, A.; AKBAS, Y. & KARAHAN, T. A novel formula for the accurate localization of the mandibular foramen based on osteometric measurements. *Int. J. Morphol., 43(4)*:1307-1312, 2025.

SUMMARY: This study examines the osteometric characteristics of the human mandible, with a particular focus on the localization of the mandibular foramen—a crucial anatomical landmark for surgical and anesthetic procedures. Accurate identification of this structure is essential to minimize complications during inferior alveolar nerve blocks and orthognathic surgeries. Despite its clinical importance, existing literature lacks comprehensive analyses that assess the combined effects of multiple anatomical variables on mandibular foramen localization. The present study analyzed 62 dry human mandibles, measuring key parameters, including the mandibular angle-mental protuberance distance (MAMP), the posterior margin-foramen distance (PMRMF), and the inferior margin-foramen distance (MMF). A linear regression model was developed to predict the mandibular angle-to-foramen distance (MAMF) based on these variables. The formula worked 78.9 % of the variance in MAMF, with MMF emerging as the most influential predictor. The mean maximum ramus width was recorded at 43.0 mm, with the minimum ramus width averaging 29.5 mm. Variability was also evident in measurements such as MAMP (87.9 mm), PMRMF (14.1 mm), MMF (24.9 mm), and MAMF (20.6 mm), accompanied by standard deviations ranging from 2.03 mm to 7.90 mm. This study identifies significant morphometric variations in mandibular foramen localization across populations, emphasizing the influence of genetic and environmental factors. The findings underscore the need for population-specific standards to enhance clinical accuracy. By providing a statistical framework, this research aids surgical planning, anesthesia, and forensics. Larger, diverse samples are recommended for validation.

KEY WORDS: Mandibular foramen; Osteometric measurements; Mandibular morphology; Inferior alveolar nerve.

INTRODUCTION

The mandible is the strongest, largest and only movable bone of the skull (Kumar & Lokanadham, 2013). The presence of a dense layer of compact bone makes it very durable and therefore better preserved than many other bones. The dimorphism in the mandible is reflected in its shape and size. The shape of the mandible is created by sequential structural modeling as the size of the bone increases (Saini *et al*., 2011). It is known that skeletal characteristics differ in population groups and therefore each requires its own standards of assessment (Kharoshah *et al*., 2010). The development of mandibular implant technique, the increasing frequency of maxillofacial surgery and oral procedures add to the importance of accurate assessment of anatomical landmarks (Oguz & Bozkir, 2002). Inferior alveolar nerve (IAN) block is a local anesthetic technique commonly used in dentistry. However, it is reported that the failure rate of this technique is 20-25 %. Incorrect estimation of the localization of the mandibular foramen is the most common cause of IAN block failure (Shebi & Mohanraj, 2021). Therefore, estimation of the location of the mandibular foramen is highly valuable (Palti *et al*., 2011).

The aim of the present study was to analyze the osteometric features of the mandible and to explore the correlation between the dependent variable, specifically the distance from the mandibular foramen to the mandibular angle (MAMF), and the independent variables, namely the distance from the mandibular angle to the mental protuberance (MAMP), the minimum separation between the posterior margin of the mandibular ramus and the mandibular foramen (PMRMF), as well as the minimum distance from the inferior edges of the mandible to the mandibular foramen (MMF). Furthermore, the study sought to statistically assess the influence of these variables on the

[1]Department of Anatomy, Faculty of Medicine, Eskisehir Osmangazi University, Eskisehir, Türkiye.
[2]Department of Anatomy, Faculty of Medicine, Ankara University, Ankara, Türkiye.

Received: 2025-03-26 Accepted: 2025-06-10

MAMF. Additionally, the osteometric measurements acquired were juxtaposed with existing data in the scholarly literature to facilitate a more thorough comprehension of the structural attributes of the mandible. There exists a paucity of research within the literature that investigates the synergistic impacts of MAMP, PMRMF, and MMF on the dependent variable. This research endeavors to yield both theoretical and practical insights while establishing a reference framework for subsequent investigations through the comparison of the mandible's osteometric measurements with the extant data in literature.

MATERIAL AND METHOD

Sixty-two dry human mandibles from Ankara University Faculty of Medicine, Department of Anatomy and Eskisehir Osmangazi University, Faculty of Medicine, Department of Anatomy were included the study. Broken or damaged parts of the mandible were not included in the study. The gender and age range of the mandibles is unknown. Measurements were made in the presence of an observer researcher. We measured the mandible with a digital caliper (precision: ± 0.2 mm / ± %1).

The following parameters were studied in 62 human mandibles (Fig 1):

- Maximum ramus width (MaxRW)
- Minimum ramus width (MinRW)
- The distance between the condylar process and mandibular foramen (CPMF)
- The distance between the condylar process and mental spina (CPMS)
- The distance between the mandibular angle and mental protuberentia (MAMP)
- The minimum distance between the anterior margins of the mandibular ramus and mandibular foramen (AMRMF)
- The minimum distance between the posterior margins of the mandibular ramus and mandibular foramen (PMRMF)
- The minimum distance between the mandibular incisure and mandibular foramen (MIMF)
- The minimum distance between the inferior margins of the mandibula and mandibular foramen (MMF)
- The distance between the mandibular foramen and the mandibular angle (MAMF)

The data were analyzed to determine the mean, standard deviation, minimum, and maximum values using Jamovi 2.3.28. The normality of the data distribution was confirmed by examining skewness and kurtosis values and applying the Kolmogorov-Smirnov test. Measurements were compared with similar data in the literature using a one-sample t-test. Additionally, a linear regression analysis was performed to predict the dependent variable MAMF using the independent variables MAMP, PMRMF, and MMF. The regression analysis aimed to explain the variance in the dependent variable. Model fit was evaluated using the R^2 value, and the effects of the independent variables were tested using their regression coefficients and p-values. Model significance was assessed with an F-test. Statistical analyses were performed using Jamovi 2.3.28, and results were considered significant at $p<0.05$.

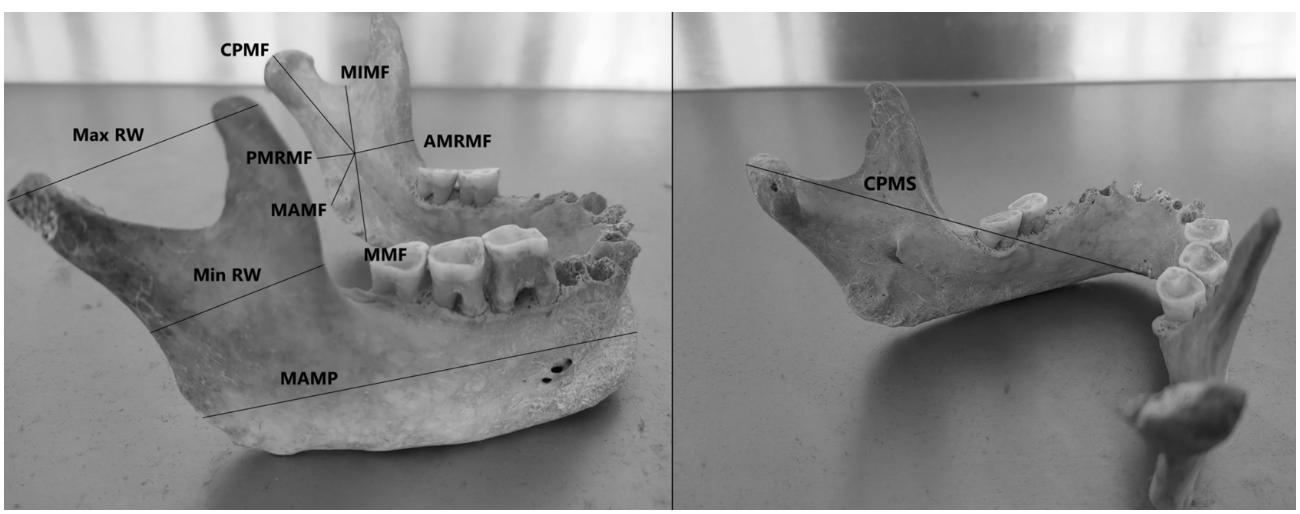

Fig. 1. Osteometric parameters measured in the human mandible. MaxRW: Maximum ramus width, MinRW: Minimum ramus width, CPMF: The distance between the condylar process and mandibular foramen, CPMS: The distance between the condylar process and mental spina, MAMP: The distance between the mandibular angle and mental protuberance, AMRMF: The minimum distance between the anterior margins of the mandibular ramus and mandibular foramen, PMRMF: The minimum distance between the posterior margins of the mandibular ramus and mandibular foramen, MIMF: The minimum distance between the mandibular incisure and mandibular foramen, MMF: The minimum distance between the inferior margins of the mandibula and mandibular foramen, MAMF: The distance between the mandibular foramen and the mandibular angle.

Linear regression model:

- MAMF = ß0 + ß1.MAMP + ß2.PMRMF + ß3.MMF + ε
- MAMF: dependent variable
- MAMP, PMRMF, MMF: independent variables
- ß0: stable term (intercept)
- ß1, ß2, ß3: regression coefficients of each independent variable
- ε: error term (residual)

Ethical Approval. According to the current regulations in our country, studies involving cadavers and animal tissues are not subject to ethics committee approval.

RESULTS

The morphological measurements of 62 dry human mandibles revealed significant variability across the assessed parameters. The mean maximum ramus width (MaxRW) was 43.0 mm, while the minimum ramus width (MinRW) averaged 29.5 mm. The distances between key anatomical landmarks, such as the condylar process and mandibular foramen (CPMF) and the condylar process and mental spina (CPMS), were 42.7 mm and 111 mm, respectively. Measurements like MAMP (87.9 mm), AMRMF (16.5 mm), PMRMF (14.1 mm), MIMF (23.1 mm), MMF (24.9 mm), and MAMF (20.6 mm) also demonstrated variability, with standard deviations ranging from 2.03 mm to 7.90 mm. The data provides a comprehensive baseline for understanding mandibular morphology, crucial for clinical and anatomical applications (Table I). The measurements of the left and right sides are given separately in Table II.

In this study, the relationship between the dependent variable MAMF and the independent variables MAMP, PMRMF and MMF were analyzed. In the linear regression analysis, the following regression model was obtained:

MAMF = 5.080 – 0.150.MAMP + 0.547.PMRMF + 0.844.MMF

The general fit and significance of the model are supported by the following statistics:

The R^2 value was calculated as 0.789, indicating that the independent variables explained 78.9 % of the variance of the dependent variable.

The F statistic calculated for the overall significance test of the model was 144 and this value was found to be $p < 0.001$. This result shows that the model is statistically significant.

The obtained model explains most of the variance of MAMF as the dependent variable (78.9 %) and shows that each of the independent variables has a significant effect on the dependent variable. In particular, MMF stands out as the variable with the largest effect on the dependent variable (ß3 = 0.844). On the other hand, MAMP has a negative effect on the dependent variable (ß1 = - 0.150).

DISCUSSION

The localization of the mandibular foramen often shows variation. IAN injury is caused by inaccurate localization of the mandibular foramen (Shenoy *et al*., 2012). Various mandibular osteotomy techniques have been described in orthognathic surgery (Bell, 2018). Most common of these are intraoral vertical ramus osteotomy (IVRO) and sagittal split osteotomy (SSO) (Yoshioka *et al*., 2008). Since the IAN is located within the osteotomy area, there is a potential for nerve injury during Bilateral Sagittal Split Osteotomy Surgery (Alolayan & Leung, 2014). One of the most critical issues among the most common complications associated with SSO is damage to the IAN (de Santana Santos *et al*., 2012). In the literature, IAN injury was noted between 11.54 % and 90 % in the SSO group and

Table I. Morphological measurements of dry human mandibles.

	MaxRW	MinRW	CPMF	CPMS	MAMP	AMRMF	PMRMF	MIMF	MMF	MAMF
n	114	121	118	119	121	121	121	121	121	120
Mean	43.0	29.5	42.7	111	87.9	16.5	14.1	23.1	24.9	20.6
SD	3.76	3.09	4.47	7.90	5.93	2.05	2.03	3.57	4.11	3.78
Minimum	31.5	21.6	26.8	87.4	69.7	11.0	8.20	15.4	16.3	12.5
Maximum	50.3	37.2	51.5	125	100	22.0	18.9	31.0	33.5	29.8

All values are given in millimeters. MaxRW: Maximum ramus width, MinRW: Minimum ramus width, CPMF: The distance between the condylar process and mandibular foramen, CPMS: The distance between the condylar process and mental spina, MAMP: The distance between the mandibular angle and mental protuberance, AMRMF: The minimum distance between the anterior margins of the mandibular ramus and mandibular foramen, PMRMF: The minimum distance between the posterior margins of the mandibular ramus and mandibular foramen, MIMF: The minimum distance between the mandibular incisure and mandibular foramen, MMF: The minimum distance between the inferior margins of the mandibula and mandibular foramen, MAMF: The distance between the mandibular foramen and the mandibular angle.

Table II. Morphological measurements of left and right sided human mandibles.

	n	Mean	Median	SD	SE
MaxRW Left	53	42.9	42.8	3.78	0.519
MaxRW Right	53	43.2	43.5	3.64	0.501
MinRW Left	59	29.8	29.4	3.20	0.417
MinRW Right	59	29.3	29.3	3.07	0.399
CPMF Left	56	42.4	43.0	4.55	0.608
CPMF Right	56	43.0	43.7	4.47	0.597
CPMS Left	57	111.0	111.9	7.96	1.054
CPMS Right	57	110.7	112.0	8.14	1.078
MAMP Left	59	87.4	88.2	6.25	0.814
MAMP Right	59	88.6	89.3	5.58	0.727
AMRMF Left	59	16.6	16.2	2.13	0.278
AMRMF Right	59	16.3	16.2	1.97	0.257
PMRMF Left	59	14.0	14.1	2.00	0.261
PMRMF Right	59	14.2	14.3	2.08	0.271
MIMF Left	59	22.9	22.8	3.91	0.509
MIMF Right	59	23.4	23.3	3.29	0.428
MMF Left	59	24.8	25.0	3.95	0.515
MMF Right	59	24.8	25.4	4.22	0.549
MAMF Left	58	20.5	20.7	3.68	0.484
MAMF Right	58	20.4	20.2	3.87	0.508

All values are given in millimeters. MaxRW: Maximum ramus width, MinRW: Minimum ramus width, CPMF: The distance between the condylar process and mandibular foramen, CPMS: The distance between the condylar process and mental spina, MAMP: The distance between the mandibular angle and mental protuberance, AMRMF: The minimum distance between the anterior margins of the mandibular ramus and mandibular foramen, PMRMF: The minimum distance between the posterior margins of the mandibular ramus and mandibular foramen, MIMF: The minimum distance between the mandibular incisure and mandibular foramen, MMF: The minimum distance between the inferior margins of the mandibula and mandibular foramen, MAMF: The distance between the mandibular foramen and the mandibular angle.

between 5.08 % and 35 % in the IVRO group (Al-Bishri *et al*., 2005; Peleg *et al*., 2022). After orthognathic surgery, sensory loss can reach approximately 90 % and nerve injury can reach approximately 20 % (Agbaje *et al*., 2015). Modified techniques to prevent nerve damage during mandibular osteotomy are described in the literature. The efficacy of the technique now needs to be evaluated in a randomized controlled clinical trial (Manisali & Naini, 2016). The data from this study can be used as a reference for future clinical trials.

In the present investigation, osteometric measurements of the mandible were meticulously examined, and the correlation between the dependent variable MAMF and the independent variables MAMP, PMRMF, and MMF was systematically assessed. The resulting model elucidated 78.9 % of the variance in MAMF and demonstrated that all independent variables exerted a statistically significant influence. Notably, the MMF variable emerged as the most potent predictor amongthe variables assessed. These results enhance the predictive capacity regarding mandibular functions through the established regression model derived from osteometric assessments of the mandible, thereby offering a vital contribution to research endeavors that concurrently evaluate the MAMP, PMRMF, and MMF variables, which are scant in the existing literature. Furthermore, the juxtaposition of the acquired osteometric data with earlier studies in the scholarly corpus facilitated a more nuanced comprehension of the structural characteristics of the mandible and provided a foundational reference for subsequent investigations.

In our study, the mandibular foramen was located 1.2 mm posterior and 0.9 mm superior to the midpoints of anterior-posterior and superior-inferior distances of mandibular ramus, respectively. This positioning is consistent with the findings of Kumar & Lokanadham (2013), in India, who reported the foramen in the third anterior-posterior quadrant (62.5 %) and at the junction of the second and third superior-inferior quadrants (50.41 %). While the dimensions of the minimum and maximum ramus width in our study (29.5 mm and 43 mm) were broader than Kumar & Lokanadham (2013) values (30.50 mm and 39.21 mm), significant differences were identified ($p < .001$).

When comparing the distances of the mandibular foramen to the anterior, posterior, superior, and inferior margins, our findings (16.5 mm, 14.1 mm, 23.1 mm, and 24.9 mm) aligned closely with those reported by Shenoy *et al*. (2012), in India. However, significant differences were noted in the distances of the mandibular foramen to the posterior and inferior margin of the mandible ($p < .001$). Unlike Shenoy *et al*. (2012) who found no right-left asymmetry, our study observed small but significant differences in minimum ramus width, condylar process-to-mandibular foramen distance, and mandibular angle-to-mental protuberance distance. The difference in minimum ramus width was 0.5 mm, the difference between condylar process and mandibular foramen was 0.4 mm and the difference between mandibular angle and mental protuberance was 1.2 mm; however, the effect sizes were small according to Cohen's d classification.

Similarly, our results were comparable to those of Ozkan *et al*. (2002), in Turkey for distance of the mandibular foramen to the anterior and posterior margins of the mandibular ramus, but differences in inferior margin and mandibular incisura measurements were noted, potentially due to sample or methodological variations (Oguz & Bozkir, 2002). In contrast, Lima *et al*. (2016), in Brazil reported significant differences in all measured parameters compared to our findings, highlighting regional variability. Saini *et al*. (2011), in India also observed similarities in maximum ramus widths but significant differences in minimum widths, reflecting potential sex or population-based morphological differences.

Studies by Kharoshah *et al*. (2010), in Egypt and Monnazzi *et al*. (2012), in Brazil similarly highlighted discrepancies with our data. While Monnazzi *et al*. (2012) findings aligned with ours for the distances of the mandibular foramen to the anterior, superior and inferior margins diverged significantly. Kharoshah *et al*. (2010) after desexing their data, reported significant differences across all parameters. Additionally, the findings of Chenna *et al*. (2015), and Jerolimov *et al*. (1998), further underscore population-specific variations, as they reported significant differences in the distances of the mandibular foramen to the anterior, posterior and superior margins measurements compared to our study.

CONCLUSION

The study highlights the significance of osteometric parameters in understanding mandibular morphology and their clinical relevance. Through a comprehensive analysis of mandibular measurements, the research established a robust regression model predicting the MAMF with significant contributions from MAMP, PMRMF, and MMF, particularly emphasizing MMF as the most influential variable. These findings offer valuable insights for clinical practices, including mandibular surgeries and nerve localization techniques, while also serving as a comparative reference for future research. The study underscores the need for further investigations involving larger, diverse populations and advanced imaging modalities to refine the applicability of these measurements.

LIMITATIONS

The primary limitation of this study is the lack of demographic information, such as the gender and age of the mandibles analyzed. These factors are critical in osteometric studies, as they significantly influence mandibular morphology due to sexual dimorphism and age-related changes. Without this information, the findings cannot be generalized across different population groups or used to derive conclusions about specific demographic variations. Furthermore, the absence of these details restricts comparative analysis with studies that incorporate such demographic stratifications, potentially limiting the scope of the study's applicability in clinical and anatomical research.

ACKNOWLEDGEMENTS. All authors thanks to Hilmi Özden for contributions.

KÜÇÜK, B.; ORTADEVECI, A.; BALCI, A.; AKBAS, A. & KARAHAN, T. Una fórmula novedosa para la localización precisa del foramen mandibular basada en mediciones osteométricas. *Int. J. Morphol., 43(4)*:1307-1312, 2025.

RESUMEN: Este estudio examina las características osteométricas de la mandíbula humana, con especial atención a la localización del foramen mandibular, un punto de referencia anatómico crucial para procedimientos quirúrgicos y anestésicos. La identificación precisa de esta estructura es esencial para minimizar las complicaciones durante los bloqueos del nervio alveolar inferior y las cirugías ortognáticas. A pesar de su importancia clínica, la literatura existente carece de análisis exhaustivos que evalúen los efectos combinados de múltiples variables anatómicas en la localización del foramen mandibular. El presente estudio analizó 62 mandíbulas humanas secas, midiendo parámetros clave, como la distancia del ángulo mandibular a la sínfisis mental (DPM), la distancia del margen posterior al foramen (DMP) y la distancia del margen inferior al foramen (DMM). Se desarrolló un modelo de regresión lineal para predecir la distancia del ángulo mandibular al foramen mandibular (MAMF) con base en estas variables. La fórmula abordó el 78,9 % de la varianza en MAMF, siendo MMF el predictor más influyente. La media del ancho máximo de la rama de la mandíbula se registró en 43,0 mm, con un promedio del ancho mínimo de 29,5 mm. También se evidenció variabilidad en mediciones como MAMP (87,9 mm), PMRMF (14,1 mm), MMF (24,9 mm) y MAMF (20,6 mm), acompañada de desviaciones estándar que oscilaron entre 2,03 mm y 7,90 mm. Este estudio identificó variaciones morfométricas significativas en la localización del foramen mandibular en distintas poblaciones, destacando la influencia de factores genéticos y ambientales. Los hallazgos subrayan la necesidad de estándares poblacionales específicos para mejorar la precisión clínica. Al proporcionar un marco estadístico, esta investigación facilita la planificación quirúrgica, la anestesia y la medicina forense. Se recomiendan muestras más grandes y diversas para la validación.

PALABRAS CLAVE: Foramen mandibular; Medidas osteométricas; Morfología mandibular; Nervio alveolar inferior.

REFERENCES

Agbaje, J. O.; Salem, A. S.; Lambrichts, I.; Jacobs, R. & Politis, C. Systematic review of the incidence of inferior alveolar nerve injury in bilateral sagittal split osteotomy and the assessment of neurosensory disturbances. *Int. J. Oral Maxillofac. Surg., 44(4)*:447-51, 2015.

Al-Bishri, A.; Barghash, Z.; Rosenquist, J. & Sunzel, B. Neurosensory disturbance after sagittal split and intraoral vertical ramus osteotomy: as reported in questionnaires and patients' records. *Int. J. Oral Maxillofac. Surg., 34(3)*:247-51, 2005.

Alolayan, A. B. & Leung, Y. Y. Risk factors of neurosensory disturbance following orthognathic surgery. *PLoS One, 9(3)*:e91055, 2014.

Bell, R. B. A history of orthognathic surgery in North America. *J. Oral Maxillofac. Surg., 76(12)*:2466-81, 2018.

Chenna, D.; Hosapatna, M.; D´Souza, A. S.; Gadicherla, S. & Pentapati, K. C. Lingula and antilingula as anatomic reference points for ramus osteotomies. *Int. J. Dent. Sci. Res., 3(1)*:1-3, 2015.

de Santana Santos, T.; Albuquerque, K. M.; Santos, M. E. S. M. & Laureano Filho, J. R. Survey on complications of orthognathic surgery among oral and maxillofacial surgeons. *J. Craniofac. Surg., 23(5)*:e423-30, 2012.

Jerolimov, V.; Kobler, P.; Keros, J.; Stanicic´, T. & Bagic´, I. Assessment of position of foramen mandibulae in recent adult population. *Coll. Antropol., 22(1)*:169-77, 1998.

Kharoshah, M. A. A.; Almadani, O.; Ghaleb, S. S.; Zaki, M. K. & Fattah, Y. A. A. Sexual dimorphism of the mandible in a modern Egyptian population. *J. Forensic Leg. Med., 17(4)*:213-5, 2010.

Kumar, M. P. & Lokanadham, S. Sex determination & morphometric parameters of human mandible. *Int. J. Res. Med. Sci., 1(2)*:93-6, 2013.

Lima, F. J. C.; Oliveira-Neto, O. B.; Barbosa, F. T. & Sousa-Rodrigues, C. F. Location, shape and anatomic relations of the mandibular foramen and the mandibular lingula: a contribution to surgical procedures in the ramus of the mandible. *Oral Maxillofac. Surg., 20(2)*:177-82, 2016.

Manisali, M. & Naini, F. B. Mandibular sagittal split osteotomy - A modified technique to reduce postoperative labiomental paraesthesia. *Ann. R. Coll. Surg. Engl., 98(8)*:594-5, 2016.

Monnazzi, M. S.; Passeri, L. A.; Gabrielli, M. F. R.; Bolini, P. D. A.; de Carvalho, W. R. S. & da Costa Machado, H. Anatomic study of the mandibular foramen, lingula and antilingula in dry mandibles, and its statistical relationship between the true lingula and the antilingula. *Int. J. Oral Maxillofac. Surg., 41(1)*:74-8, 2012.

Oguz, Ö. & Bozkir, M. Evaluation of location of mandibular and mental foramina in dry, young, adult human male, dentulous mandibles. *West Indian Med. J., 51(1)*:14-6, 2002.

Palti, D. G.; de Almeida, C. M.; Rodrigues, A. C.; Andreo, J. C. & Lima, J. E. O. Anesthetic technique for inferior alveolar nerve block: a new approach. *J. Appl. Oral Sci., 19(1)*:11-5, 2011.

Peleg, O.; Mahmoud, R.; Shuster, A.; Arbel, S.; Kleinman, S.; Mijiritsky, E. & Ianculovici, C. Vertical ramus osteotomy, is it still a valid tool in orthognathic surgery? *Int. J. Environ. Res. Public Health, 19(16)*:10171, 2022.

Saini, V.; Srivastava, R.; Rai, R. K.; Shamal, S. N.; Singh, T. B. & Tripathi, S. K. Mandibular ramus: an indicator for sex in fragmentary mandible. *J. Forensic Sci., 56 Suppl. 1*:S13-6, 2011.

Shenoy, V.; Vijayalakshmi, S. & Saraswathi, P. Osteometric analysis of the mandibular foramen in dry human mandibles. *J. Clin. Diagn. Res., 6(4)*:557-60, 2012.

Shebi, S. & Mohanraj, K. G. Morphometric localization of mandibular foramen with reference to various anatomical landmarks in dry human mandibles and its clinical implications. *J. Res. Med. Dent. Sci., 9(2)*:234-8, 2021.

Yoshioka, I.; Khanal, A.; Tominaga, K.; Horie, A.; Furuta, N. & Fukuda, J. Vertical ramus versus sagittal split osteotomies: Comparison of stability after mandibular setback. *J. Oral Maxillofac. Surg., 66(6)*:1138-44, 2008.

Corresponding author:
Abdullah Ortadeveci
Department of Anatomy
Medical School of Eskisehir Osmangazi University
Meselik Campus, 26040
Eskisehir
TÜRKIYE

E-mail:aortadeveci@ogu.edu.tr
abdullahortadeveci@gmail.com

Orcid: 0000-0001-6575-5699

Burak Küçük
E-mail: burak.kucuk@ogu.edu.tr
Orcid: 0000-0002-0162-4742

Abdullah Ortadeveci
E-mail: aortadeveci@ogu.edu.tr
Orcid: 0000-0001-6575-5699

Aybegum Balci, MD
E-mail: aybegumakin@ankara.edu.tr
Orcid: 0000-0002-6345-1082

Yadigar Akbas, MD
E-mail: yakbas@ogu.edu.tr
Orcid: 0000-0002-2771-8712

Tuna Karahan, MD
Orcid: 0000-0001-5599-7459