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Proposal for Standardized Terminology and Defining Criteria for Craniometric Points Used in the Diagnosis of Mandibular Asymmetry *(Condylion, Gonion, Gnathion* and *Menton*)

Propuesta de Terminología Estandarizada y Criterios de Definición para Puntos Craneométricos Utilizados en el Diagnóstico de Asimetría Mandibular (*Condylion, Gonion, Gnathion* y *Menton*)

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SUMMARY: The craniometric points *Condylion*, *Gonion*, *Gnathion*, and *Menton* are essential references in mandibular analysis used in orthodontics, maxillofacial surgery, and morphometric studies. However, their clinical use shows significant variability in definitions and localization, both in two-dimensional and three-dimensional imaging, which affects diagnostic accuracy in conditions such as mandibular asymmetry. The objective of the study is to propose standardized definitions and abbreviations for the points *Condylion*, *Gonion*, *Gnathion*, and *Menton*, integrating anatomical and clinical criteria to ensure consistent application in cranio-mandibular studies *in vivo* and through two-and three-dimensional imaging. A descriptive observational study was conducted in three stages. First, a narrative review revealed wide heterogeneity and a lack of terminological consensus. Based on this, preliminary consensus definitions were generated by four experts in anatomy and orthodontics. In the second stage, a single-blind survey was administered to members of the Chilean Orthodontic Society (SORTCH) and the Pan American Association of Anatomy (APA), who selected definitions from various sources and the proposed definitions. Finally, survey results and a systematic review of current clinical usage were integrated and contrasted with Anatomical Terminology (TA2) to develop the final proposal. Data were analyzed using descriptive statistics and the Chi-square test ($p < 0.05$). A total of 103 responses were obtained (36 orthodontists, 67 anatomists). No significant association between groups was found for any of the evaluated terms. Preferences varied widely, with no clear trend toward classical definitions or consistency across diagnostic imaging modalities. The lack of intergroup congruence confirmed the need for standardization. An anatomical and operational definition is proposed for each point: *Condylion*, the most superior and central point of the mandibular condyle; *Gonion*, the midpoint of the contour of the mandibular angle; *Gnathion*, the point at the anteroinferior margin of the mandibular symphysis; and *Menton* as its homolog in the soft tissues (skin). The proposed definitions provide clear and clinically applicable anatomical criteria, promoting coherence among anatomy, orthodontics, and imaging, and thereby contributing to a future update of anatomical and clinical terminology.

KEY WORDS: *Condylion*; *Gonion*; *Gnathion*; *Menton*; **Terminology; Mandibular asymmetry.**

INTRODUCTION

Craniometric points are reference landmarks in cranial and mandibular anatomy that, across different biomedical fields, allow measurements to be performed and structures to be localized (Vigo *et al*., 2020; Jacquesson, 2021; Simon *et al*., 2021), thereby facilitating evaluation and diagnosis both in normal conditions and in variations or pathological alterations of human morphology.

In medical and dental disciplines that focus on the head and neck region, such as orthodontics and maxillofacial surgery, accurate localization of craniometric points is essential, particularly in anomalies such as mandibular asymmetry, which has significant clinical implications for orofacial function and aesthetics.

There are four craniometric points, or points that in dental terminology are considered cephalometric

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landmarks, that have been crucial in the diagnosis of mandibular asymmetries: *Condylion*, *Gonion*, *Gnathion*, and *Menton*. However, there are considerable variations and contradictions both in their definitions and in their localization, which can directly affect the accuracy and reproducibility of measurements, consequently leading to errors in the diagnosis and planning of orthodontic and surgical treatments for mandibular asymmetries and deformities (Cevidanes *et al*., 2006; Proffit *et al*., 2013).

Variability in definitions and localization

The main discrepancies observed usually arise from divergences between *in vivo* anatomy and its reconstruction through imaging techniques, whether in two-dimensional (2D) or three-dimensional (3D) formats. The literature presents multiple definitions and abbreviations for each term, which are outlined below.

Condylion

From an etymological perspective, the term *Condylion* derives from the Greek κονδυλιον (kondylion), a diminutive of κονδυλος (kondyloς), meaning "knuckle" or "condyle" (Liddell *et al*., 1940). This term lacks a clear historical reference and gradually appeared in cephalometric analyses such as those by Harvold (1974), and later by McNamara Jr. (1984).

In panoramic radiographs, Kjellberg *et al*. (1994), defined *Condylion* (Co) as the most superior point on the condylar head, while Grayson *et al*. (1983), used it in lateral cephalometric measurements and defined *Condylion* (Cd) as the most superior point on the curvature of the condyle. However, a commonly cited definition for lateral cephalograms by Melnik (1992), Ludlow *et al*. (2009), and D'Antò *et al*. (2019), and for CBCT by Thiesen *et al*. (2018), and Cavagnetto *et al*. (2021), describes it as the most superior and posterior point of the mandibular condyle. Stratemann *et al*. (2010), defined it in CBCT as the most superior point of the mandibular condylar head, centered mediolaterally and anteroposteriorly, while Lin *et al*. (2018), defined it as the midpoint between the medial and lateral condylar poles on the margin of the most posterior superior surface. Variations in nomenclature include Condilion (Co) (La Rosa *et al*., 2021) and the abbreviation *Condylion* (C) (Ramirez-Yañez *et al*., 2011).

It should be emphasized that *Condylion* is not a formally recognized anatomical point and is not included in the International Anatomical Terminology, which is the official standard for naming anatomical structures.

Gonion

The term *Gonion* derives from the classical Greek γωνια (gonía), meaning angle or corner (Liddell *et al*., 1940). In the Anatomical Terminology (TA2) (Federative International Programme for Anatomical Terminology, 2019), it is numbered 862 and is considered an anatomical reference point. In cephalometry, it first appeared in the studies of Broadbent (1931), who applied measurements used by physical anthropologists to orthodontics to provide more scientific and standardized solutions to orthodontic problems. Most authors abbreviate it as "Go"; however, depending on its localization, various definitions can be found.

In 2D imaging, on panoramic radiographs, it is geometrically defined as the intersection of the ramus line and the mandibular line at the mandibular margin (Kjellberg, 1994). In frontal cephalograms, Legrell *et al*. (2000), defined it as the most inferolateral point of the ramus contour at the mandibular angle. Grayson (1983), in lateral cephalograms, defined it as the midpoint at the mandibular angle. Araki *et al*. (2015), in a study on dry skulls using panoramic and lateral cephalometric radiographs, defined *Gonion* based on the "gonial angle," as the midpoint, that is, the bisector of the angle formed by the intersection of the ramus plane and the mandibular plane.

In vivo or in 3D imaging analyses of soft tissues, *Gonion* (Go) is defined as the most lateral point of the mandibular angle, near the osseous *Gonion* (Jagadish Chandra *et al*., 2012; Rongo *et al*., 2014). In 3D diagnostic imaging, Yonemitsu *et al*. (2025), defined *Gonion* as the most external point of the transition between the posterior ramus and the inferior margin of the mandible. Williams & Richtsmeier (2003), in the anatomical-anthropological field, defined it as the junction of the ramus and the inferior margin of the mandibular body, while Toneva *et al*. (2023), in the forensic field from the perspective of sexual dimorphism, defined it as the point at the mandibular angle where the mandibular contour intersects the line that bisects the angle formed by the tangent to the posterior margin of the ramus and the tangent to the inferior margin of the mandibular body. Thiesen *et al*. (2018), defined it as the most inferior and posterior point on the contour of the gonial angle, whereas Kim *et al*. (2022), defined it as the point where the ascending ramus transitions into the body of the mandible.

Gnathion

Gnathion is a term derived from the Greek γναθιον (gnáthion), the diminutive of γναθος (gnáthos), meaning "jaw" (Liddell *et al*., 1940), and is abbreviated as "Gn." This term first appears classified in the Anatomical Terminology

(TA2) (Federative International Programme for Anatomical Terminology, 2019) under number 839, together with Symphysis mandibulae (838) within the Corpus mandibulae (836). This reference is relatively recent, as it did not appear in the earlier Terminologia Anatomica (Federative Committee on Anatomical Terminology, 1998).

In cephalometric studies, Broadbent mentioned it as early as 1931, and it has since been used as a craniometric reference for the assessment of mandibular morphology and growth. Proffit *et al.* (2013), defined it as the most anterior and inferior point of the mandibular symphysis, located on the midline of the chin. In 2D imaging and lateral cephalometric analyses, Jacobson & Jacobson (2006) referred to it as the midpoint between *Pogonion* and *Menton* along the mandibular midline. In 3D imaging, Thiesen *et al*. (2018), defined it as the most anteroinferior point of the contour of the chin bone or the mandibular symphysis (Williams & Richtsmeier, 2003; Kim *et al*., 2022). In soft tissues, it is abbreviated as Gn¢ and differs only by its location on the skin or soft tissue of the chin (Storms *et al*., 2017; Ho *et al*., 2019).

Menton

Unlike the previously discussed terms, *Menton* derives from the Latin mentum, meaning chin, beard, or chin prominence (Mir, 1986), and is generally abbreviated as "Me." It should be noted, however, that this point is not registered in TA2 (2019) as an anatomical reference.

With respect to hard-tissue definitions, *Menton* shows many similarities with the previously described point *Gnathion*. For example, in three-dimensional assessment studies it has been defined as the most inferior midpoint of the chin on the contour of the mandibular symphysis (Swennen *et al*., 2006; Leung & Leung, 2018). Ongkosuwito *et al*. (2009), in a comparative study of measurements between orthopantomographs (panoramic radiographs) and lateral cephalograms, used the definition proposed by Athanasiou (1995), describing *Menton* as the most inferior point on the midline of the mandibular symphysis, that is, the lowest point of the symphyseal shadow of the mandible visible on a lateral cephalogram.

In soft tissues, *Menton* (Me¢) is used as an aesthetic and functional reference point in the evaluation of the facial profile and mandibular contour, and is identified as the lowest point on the contour of the chin at the level of the facial midline (Proffit *et al*., 2013), or as the most inferior midpoint of the symphysis or chin in the soft tissue or skin (Storm *et al*., 2017; Ho *et al*., 2019; Zhao *et al*., 2023).

Standardizing the identification of anatomo-cephalometric points such as *Condylion*, *Gonion*, *Gnathion*, and *Menton* is essential to minimize errors and improve the reproducibility of mandibular analyses, both in the diagnosis of asymmetries and in other morphometric study methods. Therefore, the aim of this study is to propose a definition and abbreviation that integrate anatomical and clinical criteria for *Condylion*, *Gonion*, and *Gnathion* on the mandibular bone, and for *Menton* in the soft tissues, allowing broad and standardized diagnostic applicability both *in vivo* and in two- and three-dimensional cephalometric measurements.

MATERIAL AND METHOD

A descriptive observational study was conducted and subdivided into three stages. In the first stage, a narrative review was carried out, which revealed a lack of consensus, poor delimitation, and variability in definitions and abbreviations, as well as their interchangeable use in, *in vivo* studies and/or in two- or three-dimensional imaging, within medical fields involved in craniofacial diagnosis. Consequently, a transitory and experimental definition was generated for each term (*Condylion*, *Gonion*, *Gnathion*), considering their applicability to the mandibular bone. This common definition and its corresponding abbreviation were established by consensus and validated by four experts: two Anatomy professors from the Faculty of Medicine of the Universidad de La Frontera and two orthodontists, one a doctoral student in Morphological Sciences, and the other affiliated with the Postgraduate Program in Orthodontics and Dentomaxillofacial Orthopedics at the Universidad de La Frontera, in Temuco, Chile.

In the second stage, a survey was designed and administered for professionals who regularly use these terms. In the clinical field, collaboration was obtained from the Chilean Orthodontic Society (SORTCH), and in the academic field from the Pan American Association of Anatomy (APA). The surveys were distributed via message through a response link using the Google Forms platform. A single-blind survey design was used, in which respondents were asked to select the most accurate definition and abbreviation of the points in question, applicable to a panoramic radiograph (OPG). However, among the four alternatives provided for each term, definitions commonly used for lateral cephalograms (CL) and 3D imaging such as CBCT were also included (without citing authors in the survey options). For the terms *Condylion* and *Gonion*, definitions from Grayson *et al*. (1983; CL), Kjellberg (1994; OPG), and Thiesen *et al*. (2018; CBCT) were used, in addition to the definition and

abbreviation proposed by the four experts involved in this study. For the term *Gnathion*, Kjellberg was not included; instead, the definition by Núñez Martínez & Núñez Vázquez (2019) related to soft tissues was used. To assess respondents' experience, participants were asked to indicate their professional role or category. For SORTCH members, three categories were included: (a) Student member (residents or students in orthodontic training); (b) Full member (orthodontic specialists and general members of the Society); and (c) Active member (members approved by the Board who have demonstrated professional competence to their peers). For APA members, four categories were recorded according to their role in anatomy: (a) Professor; (b) Undergraduate student; (c) Postgraduate Graduate student; and (d) Technician.

After the survey results were obtained, the third stage was carried out, consisting of a final consensus on the proposed terminology. This was achieved through a systematic review of the use of these terms, in mandibular asymmetry within the fields of orthodontics and maxillofacial surgery, together with an analysis of the Anatomical Terminology TA2 (Federative International Programme for Anatomical Terminology, 2019). The aim was to develop a specific definition for each term that would allow topographic and anatomical reference use and provide clinical utility in craniofacial diagnosis, as well as in cephalometric and morphometric measurements performed on two- and three-dimensional images.

Statistical Analysis

Survey data were recorded in a Microsoft Office Excel spreadsheet. Subsequently, a descriptive analysis of the data was performed, and Pearson's Chi-square test was applied to evaluate the independence or association of the variables under study. Data analysis was conducted using SPSS Statistics for Windows (version 23.0, IBM). A p-value < 0.05 was selected as the threshold for statistical significance.

RESULTS

After two invitations to respond to the survey, a total of 103 respondents were obtained, comprising 36 orthodontist members of SORTCH, among whom the highest response frequency was observed in Full Members (58.3 %), and 67 anatomist members of the APA, in whom the highest response frequency corresponded to Professors (55.2 %).

The distribution by category or professional role is shown in Figure 1.

The results of the randomized and blinded survey for each term in both groups were as follows:

Condylion

For this point, the distribution of the surveyed alternatives was:

a. *Condylion* (Cd): the most superior point on the curvature of the condyle (Grayson *et al*., 1983);

b. *Condylion* (Co): the most superior and central point of the mandibular condylar head (Proposed definition);

c. *Condylion* (Co): the most superior and medial point on the condylar head (Kjellberg, 1994); and

d. *Condylion* (Co): the most superior and posterior point of the mandibular condyle (Thiesen *et al*., 2018).

Most SORTCH orthodontists favored response "d," with n = 25, corresponding to 69.4 % of the preferences within their group. In contrast, APA anatomists selected response "b" (37.3 %) and response "d" (31.3 %) in a more balanced manner. No statistically significant associations were found between variables (p = 0.872). Detailed distributions are shown in Table I.

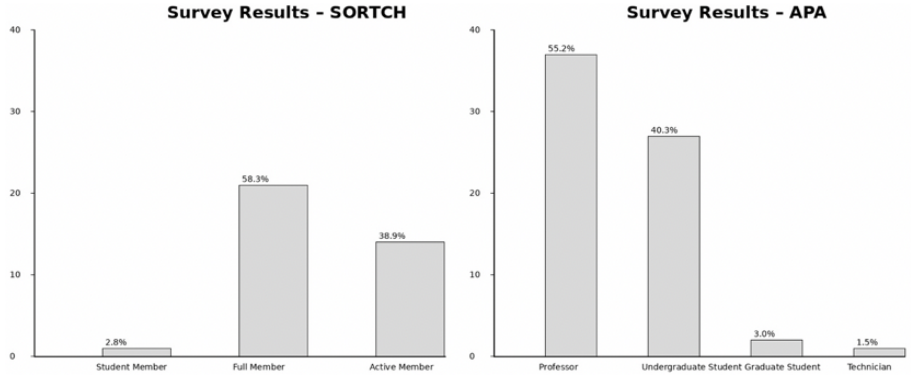


Fig. 1. Comparative graphs showing the distribution of response frequencies to the surveys from the SORTCH and APA groups according to institutional role.

Table I. Distribution of the sample by professional role and response option selected by both groups for the definition of *Condylion*.

Definition of Condylion	Anatomist role (N)	%	Orthodontist role (N)	%
a. *Condylion (Cd):* most superior point on the curvature of the condyle.	13	19.40	7	19.40
b. *Condylion (Co):* most superior and central point of the mandibular condylar head.	25	37.30	3	8.30
c. *Condylion (Co):* most superior and medial point on the condylar head.	8	11.90	1	2.80
d. *Condylion (Co):* most superior and posterior point of the mandibular condyle.	21	31.30	25	69.40
Total	**67**	**100**	**36**	**100**

When responses were analyzed according to institutional role, in the SORTCH group the predominance of response “d” was mainly attributable to Active Members, whereas in the APA group a similar distribution between responses “b” and “d” was observed among Professors and Undergraduate students (Appendix Table V).

Gonion

For this point, the distribution of the surveyed alternatives was:

a. *Gonion (Go)*: the most inferior and posterior point on the contour of the gonial angle (Thiesen *et al*., 2018);

b. *Gonion* (Go): the point of intersection between the ramus line and the mandibular margin line (Kjellberg, 1994);

c. *Gonion* (Go): the midpoint of the mandibular angle (Grayson *et al*., 1983);

d. *Gonion* (Go): the midpoint of the contour of the mandibular angle, at the intersection of the ramus and the mandibular body (Proposed definition).

Regarding *Gonion*, a higher response rate for option “a” was observed among APA anatomists (43.3 % of their group). In contrast, SORTCH orthodontists most frequently selected response “d” (39.9 %), corresponding to the proposed definition; however, no clear trend was evident, as responses “a” and “b” showed similar percentages. Response “c” was the least selected by both groups. No statistically significant associations were found between variables ($p = 0.270$). Detailed distributions are shown in Table II.

According to institutional role, in the SORTCH group the predominance of response “d” was mainly driven by Full Members, whereas in the APA group Professors predominantly selected response “a,” while Undergraduate students tended to favor response “b” (Appendix Table VI).

Gnathion

For this point, the distribution of the surveyed alternatives was:

a. *Gnathion* (Gn): the point at the anteroinferior margin of the mandible at the level of the mandibular symphysis (Proposed definition);

Table II. Distribution of the sample by professional role and response option selected by both groups for the definition of *Gonion*.

Definition of Gonion	Anatomist role (N)	%	Orthodontist role (N)	%
a. *Gonion (Go)*: most inferior and posterior point on the contour of the gonial angle.	29	43.3	12	33.3
b. *Gonion (Go):* point of intersection between the ramus line and the mandibular border line.	21	31.3	10	27.8
c. *Gonion (Go):* midpoint of the mandibular angle.	3	4.5	0	0.0
d. *Gonion (Go):* midpoint of the contour of the mandibular angle, at the intersection of the ramus and the mandibular body.	14	20.9	14	38.9
Total	**67**	**100.0**	**36**	**100.0**

b. *Gnathion* (Gn): a virtual point corresponding to the intersection of the submental horizontal plane (mento-cervical line) with the facial plane (PMe–Pf) (Núñez Martínez & Núñez Vázquez, 2019);

c. *Gnathion* (Gn): through nasion, the most anterior and inferior point on the contour of the symphysis of the chin bone (Grayson *et al*., 1983);

d. *Gnathion* (Gn): the most anteroinferior point on the contour of the chin bone (Thiesen *et al*., 2018).

Among APA anatomists, responses showed an even distribution between option "a" (35.8 %), corresponding to the proposed definition, and option "d" (35.8 %). SORTCH orthodontists, in contrast, predominantly selected response "d" (58.3 %). However, no statistically significant associations were found when comparing responses between both groups (p = 0.152). Detailed distributions are shown in Table III.

Regarding institutional role, within the APA anatomist group, response "a" was most frequently selected by Professors, whereas response "d" showed a balanced distribution between Professors and Undergraduate students (17.9 % and 16.4 %, respectively). Among SORTCH orthodontists, response "d" was selected by 36.1 % of Full Members, followed by Active Members with 19.4 % (Appendix Table VII).

Overall, the survey results indicate that there is no clear response trend toward classical definitions that might be expected for the type of diagnostic image presented in the survey question, nor toward consistent anatomical patterns. This reflects a lack of congruence in responses across both study groups.

Terminological Proposal

In view of the lack of consensus regarding the conceptual use of the terms *Condylion*, *Gonion*, and *Gnathion*, and based on the available evidence together with the results of the survey conducted among APA anatomists and SORTCH orthodontists, we propose a standardization of terminology that allows unified criteria and ensures clear and coherent use across different diagnostic modalities. This includes both *in vivo* assessments and imaging-based analyses, whether two- or three-dimensional, currently used in clinical practice. In addition, we seek for the term *Condylion* to be recognized within the Anatomical Terminology, as well as *Menton*, with the latter being applicable solely as a reference point at the level of soft-tissue measurements. The proposed terminology and definitions for each term are detailed in Table IV.

Table III. Distribution of the sample by professional role and response option selected by both groups for the definition of *Gnathion*.

Definition of Gnathion	Anatomist role (N)	%	Orthodontist role (N)	%
a. *Gnathion (Gn):* point at the anteroinferior margin of the mandible at the level of the mandibular symphysis.	24	35.8	5	13.9
b. *Gnathion (Gn)*: a virtual point corresponding to the intersection of the submental horizontal plane (mento-cervical line) with the facial plane (PMe-Pf).	10	14.9	9	25.0
c. *Gnathion (Gn):* through nasion, the most anterior and inferior point on the contour of the symphysis of the chin bone.	9	13.4	1	2.8
d. *Gnathion (Gn):* the most anteroinferior point on the contour of the chin bone.	24	35.8	21	58.3
Total	**67**	**100.0**	**36**	**100.0**

Table IV. Terminological proposal for the points *Condylion*, *Gonion*, *Gnathion*, and *Menton* for different craniofacial diagnostic methods (*in vivo*, two-dimensional, and three-dimensional imaging).

Term	Abbreviation	TA2 ID Number	Definition	Tissue of localization
Condylion	Co	–	most superior and central point of the mandibular condylar head	Hard – Bone – Mandible
Gonion	Go	862	midpoint of the contour of the mandibular angle, at the intersection of the ramus and the mandibular body	Hard – Bone – Mandible
Gnathion	Gn	839	point at the anteroinferior margin of the mandible at the level of the mandibular symphysis	Hard – Bone – Mandible
Menton	Me	–	point at the anteroinferior and medial margin of the mandibular skin	Soft – Skin – Mandible

Appendix. Supplementary Tables V, VII and VII Detailed analysis of survey responses according to institutional role APA Anatomists versus SORTCH Orthodontists.

Table V. Distribution of the sample according to role and the response option selected for the definition of *Condylion*. Abbreviations. UG: Undergraduate Student, PG: Postgraduate Student.

	Rol of the Anatomist										Rol of the Orthodontist							
	Professor		UG Student		PG Student		Technician		Total		Student Member		Full Member		Active Member		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
a. *Condylion* (Cd): the highest point on the curvature of the condyle.	7	10.4 %	5	7.5 %	1	1.5 %	0	0.0 %	13	19.4 %	0	0.0 %	1	2.8 %	6	16.7 %	7	19.4 %
b. *Condylion* (Co): the highest and central point of the mandibular condyle head.	14	20.9 %	9	13.4 %	1	1.5 %	1	1.5 %	25	37.3 %	0	0.0 %	1	2.8 %	2	5.6 %	3	8.3 %
c. *Condylion* (Co): the highest and medial point on the condyle head.	4	6.0 %	4	6.0 %	0	0.0 %	0	0.0 %	8	11.9 %	0	0.0 %	1	2.8 %	0	0.0 %	1	2.8 %
d. *Condylion* (Co): the highest and posterior point of the mandibular condyle.	12	17.9 %	9	13.4 %	0	0.0 %	0	0.0 %	21	31.3 %	1	2.8 %	18	50.0 %	6	16.7 %	25	69.4 %
TOTAL	37	55.2 %	27	40.3 %	2	3.0 %	1	1.5 %	67	100.0 %	1	2.8 %	21	58.3 %	14	38.9 %	36	100.0 %

Table VI. Distribution of the sample according to role and the response option selected for the definition of *Condylion*. Abbreviations. UG: Undergraduate Student, PG: Postgraduate Student.

	Rol of the Anatomist										Rol of the Orthodontist							
	Professor		UG Student		PG Student		Technician		Total		Student Member		Full Member		Active Member		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
a. *Gonion* (Go): the most inferior and posterior point on the contour of the gonial angle.	21	31.3 %	7	10.4 %	0	0.0 %	1	1.5 %	29	43.3 %	1	0.0 %	5	13.9 %	6	16.7 %	12	33.3
b. *Gonion* (Go): the point of intersection between the ramus line and the mandibular border line.	7	10.4 %	12	17.9 %	2	3.0 %	0	0.0 %	21	31.3 %	0	0.0 %	6	16.7 %	4	11.1 %	10	27.8
c. *Gonion* (Go): the midpoint of the mandibular angle.	2	3.0 %	1	1.5 %	0	0.0 %	0	0.0 %	3	4.5 %	0	0.0 %	0	0.0 %	0	0.0 %	0	0.0
d. *Gonion* (Go): the midpoint of the contour of the mandibular angle, at the intersection of the ramus and the mandibular body.	7	10.4 %	7	10.4 %	0	0.0 %	0	0.0 %	14	20.9 %	1	2.8 %	10	27.8 %	4	11.1 %	14	38.9
TOTAL	37	55.2 %	27	40.3 %	2	3.0 %	1	1.5 %	67	100.0 %	1	2.8 %	21	58.3 %	14	38.9 %	36	100.0

Table VII. Distribution of the sample according to role and the response option selected for the definition of *Gnathion*. Abbreviations. UG: Undergraduate Student, PG: Postgraduate Student.

	RoI of the Anatomist										RoI of the Orthodontist							
	Professor		UG Student		PG Student		Technician		Total		Student Member		Full Member		Active Member		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
a. *Gnathion* (Gn): the point on the anteroinferior margin of the mandible at the level of the mandibular symphysis.	18	26.9 %	5	7.5 %	1	1.5 %	0	0.0 %	24	35.8 %	0	0.0 %	3	8.3 %	2	5.6 %	5	13.9 %
b. *Gnation* (Gn): the virtual point corresponding to the intersection of the submental horizontal plane (mento-cervical line) with the facial plane (PMe–Pf).	4	6.0 %	5	7.5 %	1	1.5 %	0	0.0 %	10	14.9 %	0	0.0 %	5	13.9 %	4	11.1 %	9	25.0 %
c. *Gnathion* (Gn): through the nasion, the most anterior and inferior point on the contour of the chin bone symphysis.	3	4.5 %	6	9.0 %	0	0.0 %	0	0.0 %	9	13.4 %	0	0.0 %	0	2.8 %	1	2.8 %	1	2.8 %
d. *Gnathion* (Gn): the most anteroinferior point on the contour of the chin bone.	12	17.9 %	1 1	16.4 %	0	0.0 %	1	1.5 %	24	35.8 %	1	2.8 %	13	36.1 %	7	19.4 %	21	58.3 %
TOTAL	37	55.2 %	2 7	40.3 %	2	3.0 %	1	1.5 %	67	100.0 %	1	2.8 %	21	58.3 %	14	38.9 %	36	100.0 %

Regarding the localization of *Gnathion*, we emphasize that its marking should be determined in the sagittal plane by the line of the mandibular symphysis, a line that does not always coincide with either the median plane or the inferior dental midline.

Regarding the mandibular angle (TA-861), there is substantial interindividual variability in anatomical form, which may hinder accurate localization of the *Gonion* point. Furthermore, it is important to distinguish the gonial angle, defined as the angle whose vertex is a projected *Gonion* (not directly located on the mandibular contour), formed by the planes resulting from the intersection of tangents to the ramus and the mandibular body. This angle is widely used in orthodontics to assess mandibular divergence and growth patterns. However, we propose that this angle should instead result from the direct union of the points *Condylion–Gonion–Gnathion* (Co–Go–Gn) in any type of imaging, for the previously mentioned measurements and for the assessment of mandibular asymmetry, as previously proposed in the simplified mandibular asymmetry analysis by Agurto-Sanhueza *et al*. (2025). This approach would allow standardization and reproducibility of both linear and angular measurements.

Justification of the Proposal

The variability observed in contemporary diagnostic methods, particularly in the localization of craniometric points, largely due to the lack of standardized terminology and definitions, leads to systematic inconsistencies that may compromise clinical accuracy. This underscores the need for proposals such as the present one, which aim to reduce the semantic ambiguity of widely used terms in both diagnostic and research contexts. Likewise, in the educational and knowledge-transfer domains, anatomical teaching should reflect, within the official Anatomical Terminology, the terminological equivalents used in clinical cephalometry. This would enable the training of medical and dental students and professionals on a coherent, unified, and shared conceptual basis.

DISCUSSION

The literature provides clear evidence of terminological inconsistencies and a lack of standardization in the definitions of craniometric points used for the diagnosis of mandibular asymmetry. This may explain the results observed in the experimental survey conducted among APA anatomists and SORTCH orthodontists. It would have been expected that orthodontists, being more familiar with cephalometric diagnosis and measurements, would predominantly select the definitions proposed by

Kjellberg (1994), which are referenced in his study for *Condylion* and *Gnathion* in condylar height measurements and mandibular asymmetry on panoramic radiographs (OPG). However, this was not the case. For the *Condylion* point, orthodontists predominantly favored option "d," and among anatomists this was the second most frequently selected option; this definition describes *Condylion* as the most superior and posterior point of the mandibular condyle. It should be noted, however, that the posterior region of the mandibular condyle is not observable on a panoramic radiograph, as it is a two-dimensional image. If we adhere strictly to the Anatomical Terminology, in the case of *Gonion*, anatomists predominantly selected option "a," whose definition refers to the contour of the gonial angle, a structure that does not exist in the Anatomical Terminology, where this anatomical region is instead termed the angle of the mandible (TA-861). A similar situation occurs with the definition of *Gnathion* in options "c" and "d," which refer to the "chin bone," a structure that does not exist.

The issues outlined above may be attributed to the lack of clear and sufficiently standardized academic language guidelines. Among orthodontists, this may be due to the diversity of training backgrounds and the multiplicity of cephalometric analyses and indices currently in use, while among anatomists it may be related to the inclusion or omission of these terms in official nomenclature and the lack of clear definitions. For example, the terms *Gonion* and *Gnathion* were only recently recognized by Federative International Programme for Anatomical Terminology (FIPAT) in TA 2019, representing progress toward terminological alignment. However, *Condylion* and *Menton* are widely used in the clinical fields of orthodontics and orthognathic surgery as non-standardized terms, and their omission from the Anatomical Terminology may cause confusion in academic communication or scientific writing if their equivalents are not clearly specified.

Authors such as Chmielewski (2024), note that the current Anatomical Terminology still lacks the inclusion of basic anatomical and clinical terms and advocate for their incorporation for generalized use, in order to achieve greater coherence and completeness in scientific communication. Similarly, Caple & Stephan (2016), point out that terminological unification reduces ambiguity and measurement errors, constituting an essential element for standardizing anatomical description within human morphology.

From a clinical and imaging perspective, the inherent limitations associated with two-dimensional cephalometry, both in panoramic radiographs and in posteroanterior and lateral projections, such as structural superimposition and magnification, have long been recognized as problematic for linear measurements. With the incorporation of three-dimensional technologies such as cone-beam computed tomography (CBCT), which provides multiplanar views, a broader range and more precise localization of anatomical structures were expected. Nevertheless, there remains conceptual ambiguity in the traditional definitions of reference points or landmarks within a three-dimensional coordinate system (Ludlow *et al*., 2009; Gribel *et al*., 2011; Liu *et al*., 2025). This consistently confirms that difficulties in locating craniometric points are intrinsically linked to the lack of standardization of their anatomical and operational definitions (Albarakati *et al*., 2012).

In mandibular asymmetry, the accurate identification of *Condylion*, *Gonion*, and *Gnathion* is essential to distinguish a true difference in the length of the mandibular ramus or body (true skeletal asymmetry) from a functional asymmetry (caused by adaptive displacement of the condyle due to occlusal interferences). However, substantial variability in localization, along with low levels of reliability and reproducibility of these points, particularly bilateral ones such as *Condylion* and *Gonion*, has been reported (Lisboa *et al*., 2015; Neelapu *et al*., 2018; Sam *et al*., 2019; Kim *et al*., 2022; Panesar *et al*., 2023).

Regarding the use of *Gnathion* in hard tissues and *Menton* in soft tissues, the former is already formally recognized in TA 2019 and is widely used in orthodontics for measurements of the mandibular plane and facial divergence, yet it still lacks clear definitions. For example, Durão *et al*. (2015), compared variability in the identification of 17 common cephalometric points by orthodontists and dentomaxillofacial radiologists and found that *Gnathion* was the most inconsistently identified point by orthodontists (standard deviation ~5.9 mm). However, landmark definitions were not specified in their article, and *Gnathion* appears to have been geometrically inferred between Po*Gonion* and *Menton*, which were analyzed. While this is not a direct critique of that study's methodology, such patterns are systematically observed across multiple measurements and may lead to confusion in both manual and automated localization. This further supports the proposal to consider a single anatomical reference point in the anteroinferior region of the mandible. Similarly, although *Menton* is also widely used in cephalometric measurements, its use may generate confusion; therefore, we consider it should be restricted to an external facial and mandibular evaluation point (skin), in accordance with its etymological, semantic, and terminological origin Mentum (chin), TA-122.

Among the limitations of our study, we note the low response rate among orthodontic professionals, which may

in part be due to time constraints or limited interest in participating in scientific studies. A more balanced number of responses between anatomists and orthodontists would have allowed for a better comparison of concordance levels between both groups. Additionally, the deeply rooted use of these terms within certain educational traditions in orthodontics may hinder their widespread adoption.

Finally, we consider it important to evaluate in the future the incorporation of reference points that are more objective and reproducible from an anatomical standpoint, such as foramina and tubercles present in the skull and mandible, particularly given advances in three-dimensional cephalometric measurements and the subsequent progressive incorporation of artificial intelligence.

CONCLUSIONS

The findings demonstrate a clear need to move toward terminological harmonization that integrates the relationship between clinically used points and their equivalents in the official Anatomical Terminology. The incorporation of standardized definitions for the terms *Condylion*, *Gonion*, *Gnathion*, and *Menton* would strengthen coherence between anatomy and clinical practice, improve the methodological quality of craniofacial studies, and promote global consistency in scientific language. Taken together, the arguments presented strongly support a future revision of Anatomical Terminology to more faithfully reflect the diagnostic and morphological realities of contemporary practice.

AGURTO-SANHUEZA, P.; SANDOVAL-VIDAL, P.; DEL SOL, M. & OTTONE, N. E. Propuesta de terminología estandarizada y criterios de definición para puntos craneométricos utilizados en el diagnóstico de asimetría mandibular (*Condylion*, *Gonion*, *Gnathion* y *Menton*). *Int. J. Morphol., 44(4)*:1481-1491, 2026.

RESUMEN: Los puntos craneométricos *Condylion*, *Gonion*, *Gnathion* y *Menton* son referencias esenciales en el análisis mandibular utilizado en ortodoncia, cirugía maxilofacial y estudios morfométricos. Sin embargo, su uso clínico presenta una variabilidad significativa en cuanto a definiciones y localización, tanto en imágenes bidimensionales como tridimensionales, lo que afecta la precisión diagnóstica en condiciones como la asimetría mandibular. El objetivo de este estudio es proponer definiciones y abreviaturas estandarizadas para los puntos *Condylion*, *Gonion*, *Gnathion* y *Menton*, integrando criterios anatómicos y clínicos para asegurar una aplicación consistente en estudios craneomandibulares *in vivo* y mediante imágenes bidimensionales y tridimensionales. Se realizó un estudio observacional descriptivo en tres etapas. En primer lugar, una revisión narrativa reveló una amplia heterogeneidad y falta de consenso terminológico. Sobre esta base, cuatro expertos en anatomía y ortodoncia elaboraron definiciones preliminares consensuadas. En la segunda etapa, se aplicó una encuesta de ciego simple a miembros de la Sociedad de Ortodoncia de Chile (SORTCH) y de la Asociación Panamericana de Anatomía (APA), quienes seleccionaron entre definiciones provenientes de diversas fuentes y las definiciones propuestas. Finalmente, se integraron y contrastaron los resultados de la encuesta y una revisión sistemática del uso clínico actual con la *Terminologia Anatomica* (TA2) para desarrollar la propuesta definitiva. Los datos se analizaron mediante estadística descriptiva y la prueba de Chi-cuadrado ($p < 0,05$). Se obtuvieron 103 respuestas en total (36 ortodoncistas, 67 anatomistas). No se encontró una asociación significativa entre los grupos para ninguno de los términos evaluados. Las preferencias variaron ampliamente, sin una tendencia clara hacia las definiciones clásicas ni consistencia entre las modalidades de diagnóstico por imagen. La falta de congruencia entre grupos confirmó la necesidad de estandarización. Se propone una definición anatómica y operativa para cada punto: *Condylion*, el punto más superior y central del cóndilo mandibular; *Gonion*, el punto medio del contorno del ángulo mandibular; *Gnathion*, el punto en el margen anteroinferior de la sínfisis mandibular; y *Menton*, como su homólogo en los tejidos blandos (piel). Las definiciones propuestas aportan criterios anatómicos claros y clínicamente aplicables, fomentando la coherencia entre la anatomía, la ortodoncia y el diagnóstico por imagen, y contribuyendo así a una futura actualización de la terminología anatómica y clínica.

PALABRAS CLAVE: *Condylion*; *Gonion*; *Gnathion*; *Menton*; Terminología; Asimetría mandibular.

REFERENCES

Agurto-Sanhueza, P.; Roco, K.; Navarro, P.; Neyem, A.; Sumonte, N. I. & Ottone, N. E. Simplified diagnosis of mandibular asymmetry in panoramic radiographs through digital processing and its prospective integration with artificial intelligence: a pilot study. *Appl. Sci., 15(19)*:10802, 2025.

Albarakati, S. F.; Kula, K. S. & Ghoneima, A. A. The reliability and reproducibility of cephalometric measurements: a comparison of conventional and digital methods. *Dentomaxillofac. Radiol., 41(1)*:11-7, 2012.

Araki, M.; Kiyosaki, T.; Sato, M.; Kohinata, K.; Matsumoto, K. & Honda, K. Comparative analysis of the gonial angle on lateral cephalometric radiographs and panoramic radiographs. *J. Oral Sci., 57(4)*:373-8, 2015.

Athanasiou, A. E. *Orthodontic Cephalometry.* London, Mosby-Wolfe, 1995.

Broadbent, B. H. A new X-ray technique and its application to orthodontia. *Angle Orthod., 1(2)*:45-66, 1931.

Caple, J. & Stephan, C. N. A standardized nomenclature for craniofacial and facial anthropometry. *Int. J. Legal Med., 130(3)*:863-79, 2016.

Cavagnetto, D.; Abate, A.; Caprioglio, A.; Cressoni, P. & Maspero, C. Three-dimensional volumetric evaluation of the different mandibular segments using CBCT in patients affected by juvenile idiopathic arthritis: a cross-sectional study. *Prog. Orthod., 22*:32, 2021.

Cevidanes, L. H.; Styner, M. A. & Proffit, W. R. Image analysis and superimposition of 3-dimensional cone-beam computed tomography models. *Am. J. Orthod. Dentofacial Orthop., 129(5)*:611-8, 2006.

Chmielewski, P. P. Exploring the uncharted: missing anatomical names in the Terminologia Anatomica. *Clin. Anat., 37(2)*:193-200, 2024.

D'Antò, V.; Pango Madariaga, A. C.; Rongo, R.; Bucci, R.; Simeon, V.; Franchi, L. & Valletta, R. Distribution of the *Condylion-Gonion-Menton* (CoGoMe^) angle in a population of patients from Southern Italy. *Dent. J. (Basel), 7(4)*:104, 2019.

Durão, A. P.; Morosolli, A.; Pittayapat, P.; Bolstad, N.; Ferreira, A. & Jacobs, R. Cephalometric landmark variability among orthodontists and dentomaxillofacial radiologists: a comparative study. *Imaging Sci. Dent., 45(4)*:213-20, 2015.

Federative Committee on Anatomical Terminology (FCAT). *Terminologia Anatomica: International Anatomical Terminology.* Stuttgart, Georg Thieme Verlag, 1998.

Federative International Programme for Anatomical Terminology (FIPAT). *Terminologia Anatomica*. 2nd ed. Halifax, Federative International Programme for Anatomical Terminology, 2019. Disponible en: https://fipat.library.dal.ca

Grayson, B. H.; Boral, S.; Eisig, S.; Kolber, A. & McCarthy, J. G. Unilateral craniofacial microsomia. Part I. Mandibular analysis. *Am. J. Orthod., 84(3)*:225-30, 1983.

Gribel, B. F.; Gribel, M. N.; Frazão, D. C.; McNamara, J. A. Jr. & Manzi, F. R. Accuracy and reliability of craniometric measurements on lateral cephalometry and 3D measurements on CBCT scans. *Angle Orthod., 81(1)*:26-35, 2011.

Harvold, E. P. The Activator in Interceptive Orthodontics. St. Louis, C. V. Mosby Co., 1974.

Ho, C. T.; Denadai, R.; Lai, H. C.; Lo, L. J. & Lin, H. H. Computer-aided planning in orthognathic surgery: a comparative study with the establishment of Burstone analysis-derived 3D norms. *J. Clin. Med., 8(12)*:2106, 2019.

Jacobson, A. & Jacobson, R. L. *Radiographic Cephalometry: From Basics to 3-D Imaging.* 2nd ed. Chicago, Quintessence Publishing Co., 2006.

Jacquesson, T. Craniometric points in neurosurgery: when anatomy is the best imaging guidance system. *Morphologie, 105(350)*:S44, 2021.

Jagadish Chandra, H.; Ravi, M. S.; Sharma, S. M. & Rajendra Prasad, B. Standards of facial esthetics: an anthropometric study. *J. Maxillofac. Oral Surg., 11(4)*:384-9, 2012.

Kim, J. H.; An, S. & Hwang, D. M. Reliability of cephalometric landmark identification on three-dimensional computed tomographic images. *Br. J. Oral Maxillofac. Surg., 60(3)*:320-5, 2022.

Kjellberg, H.; Ekestubbe, A.; Kiliaridis, S. & Thilander, B. Condylar height on panoramic radiographs. A methodologic study with a clinical application. *Acta Odontol. Scand., 52(1)*:43-50, 1994.

La Rosa, J.; Restrepo, M.; Torres, E. A. & Rodríguez, M. J. Asimetría mandibular en radiografías de niños no sindrómicos con y sin hendidura labio palatina en Bucaramanga, Colombia. *Rev. Estomatol. Herediana, 31(2)*:73-80, 2021.

Legrell, P. E.; Nyquist, H. & Isberg, A. Validity of identification of *Gonion* and ante*Gonion* in frontal cephalograms. *Angle Orthod., 70(2)*:157-64, 2000.

Leung, M. Y. & Leung, Y. Y. Three-dimensional evaluation of mandibular asymmetry: a new classification and three-dimensional cephalometric analysis. *Int. J. Oral Maxillofac. Surg., 47(8)*:1043-51, 2018.

Liddell, H. G.; Scott, R. & Jones, H. S. *A Greek-English Lexicon.* 9th ed. Oxford, Clarendon Press, 1940.

Lin, C. W.; Wang, Y. C.; Chen, Y. H. & Ko, E. W. Dentoskeletal parameters related to visual perception of facial asymmetry in patients with skeletal class III malocclusion after orthognathic surgery. *Int. J. Oral Maxillofac. Surg., 47(1)*:48-56, 2018.

Lisboa, C. O.; Masterson, D.; da Motta, A. F. & Motta, A. T. Reliability and reproducibility of three-dimensional cephalometric landmarks using CBCT: a systematic review. *J. Appl. Oral Sci., 23(2)*:112-9, 2015.

Liu, B.; Liu, C.; Xiong, Y.; Zhu, H.; Zeng, W.; Chen, J.; Guo, J.; Liu, W. & Tang, W. Accuracy and reliability of 3D cephalometric landmark detection with deep learning. *Eur. J. Med. Res., 30(1)*:1000, 2025.

Ludlow, J. B.; Gubler, M.; Cevidanes, L. & Mol, A. Precision of cephalometric landmark identification: cone-beam computed tomography vs conventional cephalometric views. *Am. J. Orthod. Dentofacial Orthop., 136(3)*:312.e1-10, 2009.

McNamara Jr., J. A. A method of cephalometric evaluation. *Am. J. Orthod., 86(6)*:449-69, 1984.

Melnik, A. K. A cephalometric study of mandibular asymmetry in a longitudinally followed sample of growing children. *Am. J. Orthod. Dentofacial Orthop., 101(4)*:355-66, 1992.

Mir, J. M. *Diccionario ilustrado latín: latino-español, español-latino*. Barcelona, Vox, Bibliograf, 1986.

Neelapu, B. C.; Kharbanda, O. P.; Sardana, V.; Gupta, A.; Vasamsetti, S.; Balachandran, R. & Sardana, H. K. Automatic localization of three-dimensional cephalometric landmarks on CBCT images by extracting symmetry features of the skull. *Dentomaxillofac. Radiol., 47(2)*:20170054, 2018.

Núñez Martínez, G. & Núñez Vázquez, J. G. Perfilografía áurea: estética de las proporciones nasales y faciales. *Cir. Plást. Ibero-Latinoam., 45(2)*:127-38, 2019.

Ongkosuwito, E. M.; Dieleman, M. M.; Kuijpers-Jagtman, A. M.; Mulder, P. G. & van Neck, J. W. Linear mandibular measurements: comparison between orthopantomograms and lateral cephalograms. *Cleft Palate Craniofac. J., 46(2)*:147-53, 2009.

Panesar, S.; Zhao, A.; Hollensbe, E.; Wong, A.; Bhamidipalli, S. S.; Eckert, G.; Dutra, V. & Turkkahraman, H. Precision and accuracy assessment of cephalometric analyses performed by deep learning artificial intelligence with and without human augmentation. *Appl. Sci., 13(12)*:6921, 2023.

Proffit, W. R.; Fields, H. W. & Sarver, D. M. *Contemporary Orthodontics*. 5th ed. St. Louis, Elsevier, 2013.

Ramirez-Yañez, G. O.; Stewart, A.; Franken, E. & Campos, K. Prevalence of mandibular asymmetries in growing patients. *Eur. J. Orthod., 33(3)*:236-42, 2011.

Rongo, R.; Antoun, J. S.; Lim, Y. X.; Dias, G.; Valletta, R. & Farella, M. Three-dimensional evaluation of the relationship between jaw divergence and facial soft tissue dimensions. *Angle Orthod., 84(5)*:788-94, 2014.

Sam, A.; Currie, K.; Oh, H.; Flores-Mir, C. & Lagravère-Vich, M. Reliability of different three-dimensional cephalometric landmarks in cone-beam computed tomography: a systematic review. *Angle Orthod., 89(2)*:317-32, 2019.

Simon, É.; Beuriat, P.; Delabar, V.; Jouanneau, E.; Fernandez-Miranda, J. & Jacquesson, T. Cranial and cerebral anatomic key points for neurosurgery: a new educational insight. *Oper. Neurosurg., 22*:e18-27, 2021.

Storms, A. S.; Miclotte, A.; Grosjean, L.; Cadenas De Llano-Pérula, M.; Alqerban, A.; Fieuws, S.; Sun, Y.; Politis, C.; Verdonck, A. & Willems, G. Short-term hard and soft tissue changes after mandibular advancement surgery in Class II patients: a retrospective cephalometric study. *Eur. J. Orthod., 39(5)*:567-76, 2017.

Stratemann, S. A.; Huang, J. C.; Maki, K.; Hatcher, D. C. & Miller, A. J. Evaluating the mandible with cone-beam computed tomography. *Am. J. Orthod. Dentofacial Orthop., 137(4 Suppl.)*:S58-70, 2010.

Swennen, G. R.; Schutyser, F.; Barth, E. L.; De Groeve, P. & De Mey, A. A new method of 3-D cephalometry. Part I: the anatomic Cartesian 3-D reference system. *J. Craniofac. Surg., 17(2)*:314-25, 2006.

Thiesen, G.; Freitas, M. P. M.; Araújo, E. A.; Gribel, B. F. & Kim, K. B. Three-dimensional evaluation of craniofacial characteristics related to mandibular asymmetries in skeletal Class I patients. *Am. J. Orthod. Dentofacial Orthop., 154(1)*:91-8, 2018.

Toneva, D. H.; Nikolova, S. Y.; Fileva, N. F. & Zlatareva, D. K. Size and shape of human mandible: sex differences and influence of age on sex estimation accuracy. *Leg. Med., 65*:102322, 2023.

Vigo, V.; Cornejo, K.; Nunez, L.; Abla, A. & Rodriguez Rubio, R. Immersive surgical anatomy of the craniometric points. *Cureus, 12(6)*:e8643, 2020.

Williams, F. L. & Richtsmeier, J. T. Comparison of mandibular landmarks from computed tomography and 3D digitizer data. *Clin. Anat., 16(6)*:494-500, 2003.

Yonemitsu, Y.; Uezono, M.; Ogasawara, T.; Rathnayake, R. M. M. H. B.; Nakajima, Y. & Moriyama, K. Development of automatic landmark identification for mandible using curvature-based registration. *Dentomaxillofac. Radiol., 54(4)*:294-301, 2025.

Zhao, J.; Xu, Y.; Wang, J.; Lu, Z. & Qi, K. 3-dimensional analysis of hard- and soft-tissue symmetry in a Chinese population. *BMC Oral Health, 23(1)*:432, 2023.

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