Measurement of Distances between Anterior Mandibular Structures in Thai Patients and Osteotomy Recommendation: A Cone Beam Computed Tomography Analysis

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Research Article

Abstract

Objective: The primary objective is to measure distances between key anatomical landmarks in the anterior mandible of Thai adults and analyze variations based on sex and skeletal classification using Cone-Beam Computed Tomography (CBCT. The secondary objective is to establish normative data for this region among the Thai population.

Materials and Methods: An observational study was conducted using CBCT scans from Thai adults with all lower anterior teeth present. Measurements focused on the distances from the inferior mandibular border to the genial tubercles and the anterior loop among others.

Results: A total of 186 CBCT scans were analyzed. No significant differences were found between left and right sides. Males showed significantly greater measurements than females (P≤0.021), except at the central incisor apex to genial tubercle (P=0.073, 0.192). No significant differences were observed among skeletal classes (P=0.099–0.987).

Conclusion: This study identified significant gender-related anatomical differences in the anterior mandible, with consistently greater measurements in males, while no significant differences were observed among skeletal classes. Based on these findings, recommended osteotomy safety margins from the inferior border are 19 mm in men and 17–17.5 mm in women for the midline and lateral incisor regions, and 15 mm in men and 13.5 mm in women for the canine region. Fixed safety margins are not recommended in the anterior loop area due to anatomical variability; therefore, individualized CBCT assessment is strongly advised. These reference values may enhance surgical safety in anterior mandibular procedures.

Keywords: Mental foramen/ Cone-Beam Computed Tomography/ Genioplasty/ Mandibular osteotomy

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Introduction

The anterior mandible, situated between the mental foramina, is also known as the interforaminal region. The chin represents the lower and most anterior portion of the mandible and is typically the most forward skeletal part of the head.[1]

The genial tubercles are distributed as right and left protuberances and as superior and inferior tubercles located at the lower lingual aspect of the anterior mandible. They serve as attachment points for the genioglossus muscle at the superior

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tubercles and the geniohyoid muscle at the inferior tubercles.[2] This region is often used for surgical procedures, such as treatment of the edentulous jaw with oral implants, as a donor site for grafting procedures, and for genioplasty.[3]

The anterior mandible is a frequent area for surgical interventions, such as implant placement, bone harvesting, or genioplasties. Consideration of and precise radiographic localization of vital anatomical structures are essential. Anatomical landmarks include the mental foramina, the mandibular incisive canal, and lingual foramina, along with their neurovascular contents. Potential risks of interference may result in neurosensory disturbances and/or hemorrhage.[4] The anterior mandible is also a common site for mandibular bone fractures, mainly located in the parasymphyseal regions.[5]

Complications from anterior mandibular procedures can occur during the surgical procedure or after treatment, which may relate to injury to the inferior alveolar nerve, mental nerve, genioglossus muscle, and roots of anterior mandibular teeth. These complications can result in discomfort, numbness, tooth root damage, and infection.[6]

Most previous recommendations suggest placing the osteotomy line about 5 mm below the mental foramen.[7-9] This guideline, however, is applied with some variation among surgeons and institutions. Lin et al.[10] reported a three-dimensional vertical distance between the inferior margin of the mental foramen and the lowest point of the inferior alveolar nerve canal differed between groups and demonstrated that even when applying this 5 mm margin, the risk of nerve injury remained substantial, with reported incidences of 6.4%, 5.0%, 10.6%, 16.0% and 9.9% in skeletal Classes I, II, III, cleft lip/palate groups and overall cohorts, respectively. To mitigate this risk, they recommended safe distance zones for osteotomy at 7.06, 8.01, and 9.12 mm below the mental foramen, corresponding to risk probabilities of 2.5%, 0.5%, and 0.0005%, respectively.[10] In contrast, Park et al. reported that, in the American population, the mean horizontal distances from midline and mean vertical distances from the inferior border of the mandible to the mental foramina was 22.11±1.92 mm and 15.15±1.77 mm, respectively.[11] Such findings highlight that a universal safety margin may not adequately account for anatomical diversity, and that risk can vary depending on skeletal type and patient population.

Building on this, previous studies have demonstrated that anterior mandibular anatomy varies across populations. Park et al., using CBCT in an American population, reported that the superior border of the genial tubercle was located 15.63±2.75 mm and the inferior border 6.87±3.29 mm from the inferior border of the mandible.[11] While Voon et al. examined a Chinese-Malaysian population and advised the mean safe zone measured at the crestal level from the genial tubercle site on the left side of the mandible was 21.12 mm and 21.67 mm on the right side with a statistically significant difference without sex-related differences.[12] Kolsuz et al. investigated the Turkish population and found mean values between inferior border of the mandible and inferior margin of the tubercle to be 8.3-10.1 mm and recommended the use of CBCT to avoid possible complications.[13] Rai et al. reported midline anatomical variations in an Indian population[14], further highlighting the need to account for ethnic and population differences. Wang et al. also noted variability in genial tubercle position and dimensions in a Taiwanese sample and reported inferior border of the mandible and inferior margin of the tubercle distance of 6.4-8.4 mm.[15] Collectively, these findings emphasize that mandibular anatomy differs among races and populations, underlining the importance of population-specific reference data.

Several of the above studies also highlight the value of CBCT in preoperative planning. Park et al., Voon et al., and Wang et al. demonstrated its utility in accurately assessing mandibular structures, while Rai et al. specifically recommended CBCT to identify potential risks of hemorrhagic or neurosensory complications.[11,12,14,15] Thus, CBCT is strongly recommended before performing osteotomies in the anterior mandible to ensure individualized assessment and minimize surgical risks.

As mentioned above, the anatomical structures in the anterior mandibular region are complex and vary in their location, which may lead to surgical complications. However, to our knowledge, no similar studies have been conducted among the Thai population. This study aims to measure the distances between key anatomical structures in the anterior mandible, including the inferior border to root apices of lower anterior teeth, anterior loop, genial tubercle, anterior loop to the inner aspect of the buccal cortex at the mandibular midline, and root apices of the central incisor to the superior border of the genial tubercle. Additionally, we seek to analyze whether these distances vary based on patient factors such as sex and skeletal classification.

Materials and Methods

This retrospective study analyzed cone-beam computed tomography (CBCT) images to assess specific anatomical structures in the anterior mandible among Thai adults.

Inclusion Criteria

- Thai adults aged 18 years and older.
- Presence of all lower anterior teeth.
- Availability of CBCT images encompassing the inferior border of the mandible and interforaminal region, along with lateral cephalometric images.

Exclusion Criteria

- History of mandibular trauma or surgery.
- Presence of pathological lesions in the anterior mandible.
- Congenital craniofacial anomalies.
- CBCT or lateral cephalometric images of inadequate quality, such as those affected by blurring or severe artifacts.

Data Collection

The sample size was determined using purposive sampling via G*Power software[16], referencing the study by Wang et al.[15] The research protocol received approval from the Ethical Review Board of the Faculty of Dentistry and Faculty of Pharmacy, Mahidol University (Protocol No. MU-DT/PY-IRB 2022/010.2103).

CBCT data were sourced from Kodak 9500 Cone Beam 3D system (Carestream Health, Inc., USA) and Planmeca Promax 3D mid (Planmeca Group, Finland) at the Oral and Maxillofacial Radiology department of the Faculty of Dentistry, Mahidol University, covering January 2017 to June 2021. The field of view (FOV) for the Kodak system was 18.4 cmx20.6 cm with a voxel size of 0.3 mm, and for the Planmeca system, 17 cmx20 cm with a voxel size of 0.2 mm. Images were analyzed using CS 3D imaging software, allowing adjustments in contrast, brightness, and magnification. Skeletal classification was determined by cephalometric analysis. The FH-SN angle was assessed first; if within the gender-specific norm (2.73–7.99° males, 3.59–9.33° females), classification was based on the ANB angle (Class I: 1.64–5.74° males, 2.26–5.66° females; higher=Class II, lower=Class III), while cases outside the FH-SN norm were classified using Wits appraisal (–5.61 to –0.87

mm males, −5.72 to −0.92 mm females).[17-19] Images were assessed in multiplanar views with a slice thickness of 0.3 mm. Patient information, including age and sex, was recorded. All measurements were initially performed by the main author (4^{th}-year oral and maxillofacial surgery resident). To assess reliability, both intraobserver and interobserver evaluations were conducted. Intraobserver reliability was tested by re-evaluating 10% of the subjects after a two-week interval. For interobserver reliability, an oral and maxillofacial radiologist (with more than ten years of experience) independently assessed the same subset of cases. The intraclass correlation coefficient (ICC) was used to determine the level of agreement, and any discrepancies were

Measurement of Anterior Mandibular Structures

Measurements were conducted using CS 3D imaging software, with images oriented such that the Frankfort plane was horizontal and the midsagittal plane was perpendicular. The following distances were measured:

1. From the inferior border of the mandible to the superior border of the genial tubercle (IBM-SGT). (Figure 1A).
2. From the apex of the central incisor to the superior border of the genial tubercle (CIA-SGT). (Figure 1B).
3. From the inferior border of the mandible to the root apices of the lateral incisor and canine (IBM-LIA and IBM-CA). (Figure 1C, D).
4. From the inferior border of the mandible to the anterior aspect of the anterior loop (IBM-AL). (Figure 1E).
5. From the most mesial part of the anterior loop to the inner aspect of the buccal cortex at the mandibular midline (MAL-ML), with the midline defined by an imaginary line passing through the lingual foramen. (Figure 1F).

Data Analysis

Descriptive statistics summarized the distances of anterior mandibular structures. The Kolmogorov-Smirnov test assessed data normality. For normally distributed data, independent t-tests compared distances between sexes, and one-way ANOVA compared distances among skeletal classifications I, II, and III. For non-parametric data, the Mann-Whitney U test and Kruskal-Wallis test were utilized accordingly.

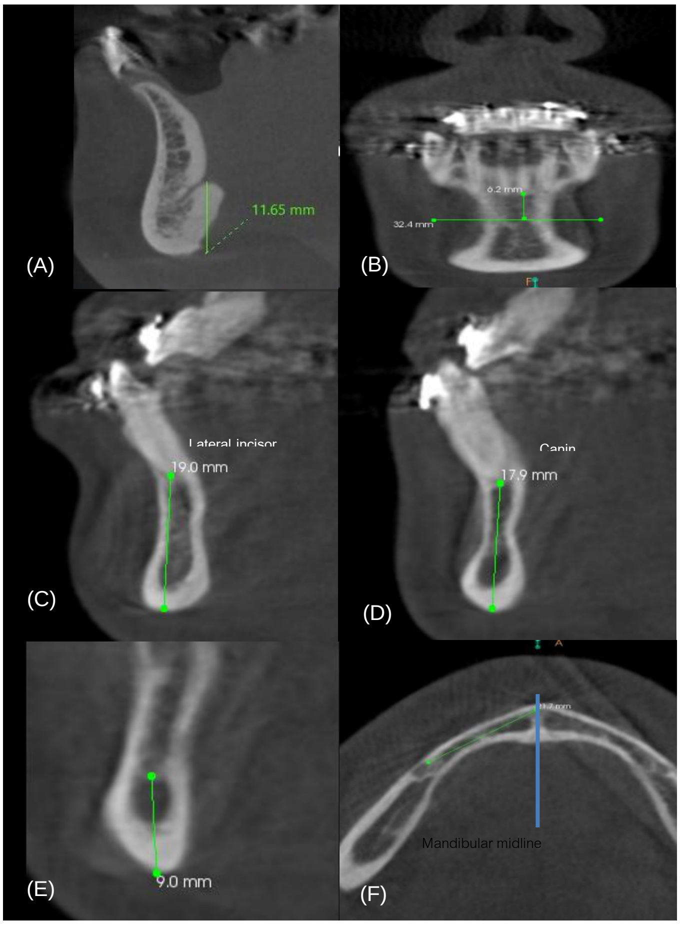

Figure 1 Distances measured in the study. (A) Sagittal oblique CBCT shows distance from IBM-SGT as inferior border of the mandible to superior border of genial tubercle, (B) Coronal CBCT shows CIA-SGT as distance from apex of central incisor to genial tubercle superior border, (C) Sagittal oblique CBCT shows IBM-LIA as distance from apex of lateral incisor to inferior border of the mandible, (D) Sagittal oblique CBCT shows IBM-CA as distance from apex of canine to inferior border of the mandible, (E) Sagittal oblique CBCT shows IBM-AL as distance from anterior aspect of anterior loop to inferior border of the mandible, (F) Axial CBCT shows MAL-ML as distance from the most mesial part of anterior loop to inner aspect of buccal cortex at mandibular midline.

Results

This retrospective study analyzed CBCT scans from 191 patients who were treated from January 2017 to June 2021 at the Oral and Maxillofacial Radiology Department of Mahidol University, Bangkok, Thailand. After exclusions for congenital anomalies and missing teeth (5 patients with cleft lip and palate, 4 with absent mandibular lateral incisor), 186 patients remained. The sample included 45 Skeletal Class I (24.2%), 35 Skeletal Class II (18.8%), and 106 Skeletal Class III (57%) patients, with a gender distribution of 70 males (37.6%) and 116 females (62.4%).

Statistical Analysis Intraclass Correlation Coefficient (ICC) for Reliability:

- Interobserver Reliability (JT and SN): ICC ranged from 0.994 to 0.999
- Intraobserver Reliability: ICC ranged from 0.999 to 1.000

These high ICC values indicate excellent reliability in the measurements obtained from the CBCT scans.

The mean distances of all measured parameters are presented in Table 1 and illustrated (Figure 2-4). When comparing right and left sides (Table 2), no significant differences were found across all parameters ($p>0.05$).

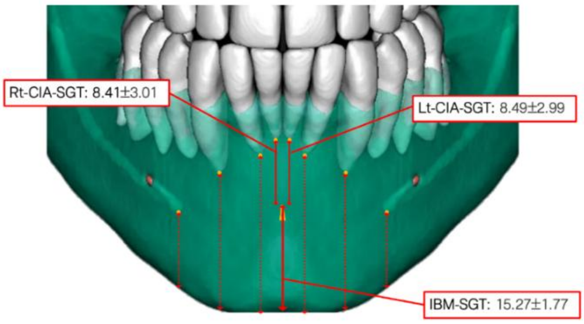

Figure 2 Measurement of IBM-SGT, Right-CIA-SGT and Left-CIA-SGT

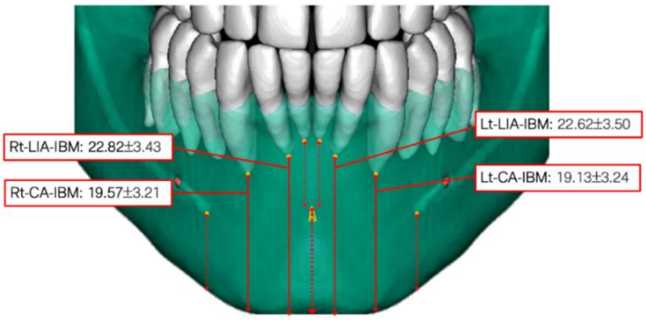

Figure 3 Measurement of Right and Left LIA-IBM and Right and Left CA-IBM

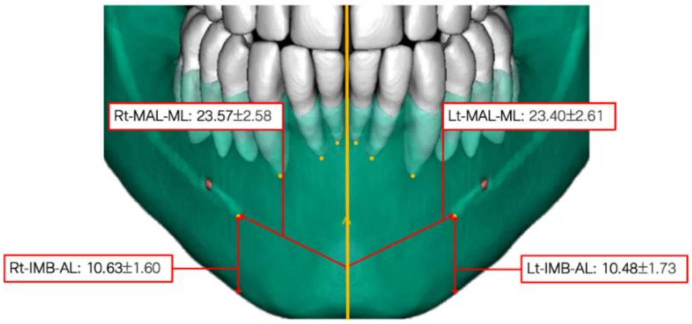

Figure 4 Measurement of Right and Left MAL-ML and Right and Left IMB-AL

Table 1 Mean distance of all parameters

Parameters	Mean (mm)		SD	Range (mm)
Inferior Border of the Mandible to Superior Border of Genial Tubercle (IBM-SGT)	15.27		1.77	6.30-19.60
Apex of Central Incisor to Superior Border of Genial Tubercle (CIA-SGT)	Rt	8.41	3.01	1.40-20.00
	Lt	8.49	2.99	1.70-20.30
Inferior Border of the Mandible to Lateral Incisor (LIA-IBM)	Rt	22.82	3.43	15.30-32.30
	Lt	22.62	3.50	14.60-32.40
Inferior Border of the Mandible to Canine (CA-IBM)	Rt	19.57	3.21	10.10-28.80
	Lt	19.13	3.24	11.40-28.70
Inferior Border of the Mandible to Anterior Aspect of Anterior Loop (IBM-AL)	Rt	10.63	1.60	6.80-15.00
	Lt	10.48	1.73	6.70-15.20
Mesial Part of Anterior Loop to Inner Aspect of Buccal Cortex at Mandibular Midline (MAL-ML)	Rt	23.57	2.58	16.40-30.20
	Lt	23.40	2.61	16.20-30.80

Table 2 Bilateral Comparison of research parameters between the left and right sides

Parameters		Mean (mm)	SD (mm)	P-value
CIA-SGT	Rt	8.50	3.90	0.094
	Lt	8.30	3.70	
LIA-IBM	Rt	22.82	3.43	0.176
	Lt	22.62	3.50	
CA-IBM	Rt	19.02	4.30	0.057
	Lt	19.00	4.10	
IBM-AL	Rt	10.63	1.60	0.068
	Lt	10.48	1.73	
MAF-ML	Rt	23.57	2.58	0.147
	Lt	23.40	2.61	

Note: P-value from Wilcoxon Signed Ranks Test for non-parametric data and Paired T-test for parametric data.

Gender comparisons (Table 3) demonstrated that males consistently exhibited greater mean distances than females. Significant differences were observed for IBM-SGT (p<0.001), LIA-IBM (Rt and Lt, both p<0.001), CA-IBM (Rt p=0.017, Lt p=0.021), IBM-AL (Rt and Lt, both p<0.001), and MAL-ML (Rt p=0.035, Lt p=0.010). However, CIA-SGT did not differ significantly between sexes (Rt p=0.073, Lt p=0.192). The results are also illustrated (Figure 5-7).

Comparison among skeletal classes (Table 4) showed no statistically significant differences for any parameter (all p>0.05).

Table 3 Comparison of parameters between genders

Parameters	Side	Gender	Mean (mm)	SD (mm)	P-value
IBM-SGT	-	Male	15.75	2.43	<0.001
		Female	14.65	1.78	
CIA-SGT	Rt	Male	8.85	2.98	0.073
		Female	8.10	4.15	
	Lt	Male	8.86	2.97	0.192
		Female	8.27	2.99	
LIA-IBM	Rt	Male	24.32	3.13	<0.001
		Female	21.92	3.30	
	Lt	Male	24.01	3.34	<0.001
		Female	21.79	3.34	
CA-IBM	Rt	Male	20.29	3.24	0.017
		Female	19.13	3.12	
	Lt	Male	19.83	3.11	0.021
		Female	18.70	3.25	
IBM-AL	Rt	Male	11.38	1.62	<0.001
		Female	10.19	1.41	
	Lt	Male	11.29	1.79	<0.001
		Female	9.99	1.50	
MAL-ML	Rt	Male	24.08	2.45	0.035
		Female	23.26	2.62	
	Lt	Male	24.03	2.42	0.010
		Female	23.02	2,66	

Note: p-value from Mann-Whitney U test for non-parametric data and Independent T-test for parametric data.

Table 4 Comparison of parameters between skeletal class

Parameters	Side	Skeletal class	Mean (mm)	SD (mm)	P-value
IBM-SGT	-	1	15.10	2.15	0.987
		2	15.10	2.00	
		3	15.10	2.63	
CIA-SGT	Rt	1	8.09	3.49	0.323
		2	9.07	2.73	
		3	8.33	2.88	
	Lt	1	8.19	3.36	0.361
		2	9.11	2.89	
		3	8.41	2.85	
LIA-IBM	Rt	1	22.80	4.50	0.385
		2	22.80	5.20	
		3	22.20	5.08	
	Lt	1	22.40	5.40	0.533
		2	22.50	5.10	
		3	22.10	5.00	
CA-IBM	Rt	1	19.70	4.25	0.805
		2	18.80	5.30	
		3	19.15	4.03	
	Lt	1	19.40	4.70	0.713
		2	17.90	4.20	
		3	18.70	3.93	
IBM-AL	Rt	1	11.02	1.64	0.099
		2	10.77	1.38	
		3	10.43	1.62	
	Lt	1	10.94	1.90	0.117
		2	10.32	1.50	
		3	10.34	1.71	
MAL-ML	Rt	1	23.54	2.34	0.560
		2	23.17	2.96	
		3	23.71	2.56	
	Lt	1	23.18	2.65	0.496
		2	23.09	2.14	
		3	23.60	2.74	

Note: P-value from Kruskal-Wallis test for non-parametric data and ANOVA for parametric data.

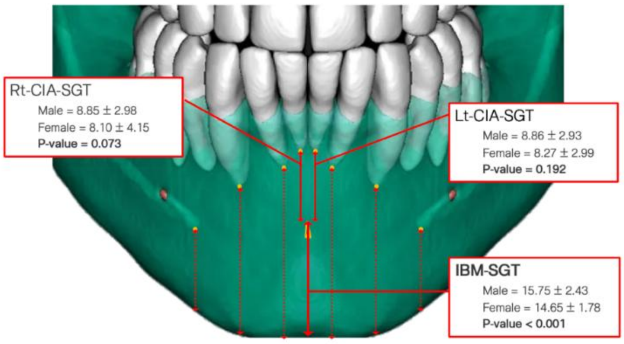

Figure 5 Measurement of IBM-SGT, Right and Left CIA-SGT and gender comparison

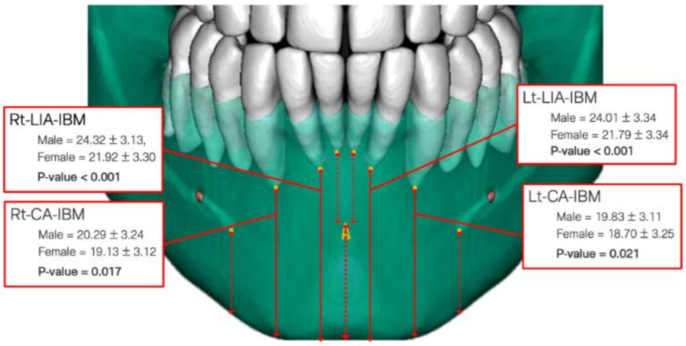

Figure 6 Measurement of Right and Left LIA-SGT, CA-IBM and gender comparison

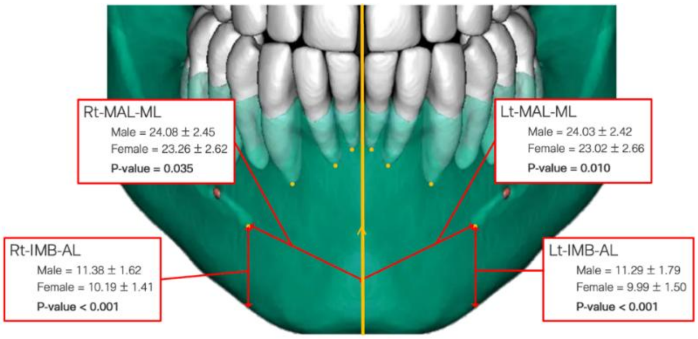

Figure 7 Measurement of Right and Left MAL-ML and gender comparison

Discussion

Complications associated with genioplasty, such as long-term neurosensory deficits, occur in up to 20% of isolated genioplasty cases and up to 70% when combined with bilateral sagittal split osteotomy.[20] A thorough understanding of the inferior alveolar nerve's trajectory and danger zones is crucial for safe osteotomy. However, consensus on the safest osteotomy location in the anterior mandible remains lacking.

For IBM-SGT (the inferior border of the mandible to the superior border of the genial tubercle), Park et al. reported that, the superior border of the genial tubercle was located 15.63±2.75 mm and the inferior border 6.87±3.29 mm from the inferior border of the mandible.[11] Our study found mean distances of IBM-SGT 15.27±1.77 mm and supports osteotomy heights of 19 mm in males and 17.5 mm in females above the inferior mandibular border, providing a safe margin to minimize root injury and nerve damage in the genial region.

For CIA-SGT (Central incisor apex to genial tubercle), Silverstein et al. measured the distance between central incisor apices and the superior genial tubercle, reporting a mean of 11.8 mm.[21] Mintz et al. also found a mean vertical distance of 6.45 mm from the incisor apex in dry skulls.[22] In comparison, our study demonstrated shorter distances (8.41–8.49 mm), which may reflect anatomical variations in Thai patients or methodological differences. Yin et al. reported greater distances in males than females, consistent with our findings.[23] Since there is no universally accepted safety margin measured directly from the genial tubercle, the findings in this study highlight the need for population-specific guidelines in osteotomy planning.

For IBM-LIA (Lateral incisor apex to inferior mandibular border), Park et al. recommended a safety margin of 15.5 mm from the lateral incisor apex to avoid root damage.[11] Our findings suggest slightly greater values, with osteotomy heights of 19 mm for males and 17 mm for females. This provides additional support for individualized planning based on gender and population-specific anatomy.

For IBM-CA (Canine apex to inferior mandibular border), Previous research has been limited regarding the distance from the canine apex to the mandibular inferior border. Our results provide new reference values, recommending osteotomy heights of 15 mm for males and 13.5 mm for females. These guidelines highlight the importance of considering canine root proximity when planning osteotomies in the anterior mandible.

For IBM-AL (Anterior loop to inferior mandibular border), the anterior loop of the mental nerve shows considerable variability, with prevalence ranging from 13.3% to 100% and mean extensions up to 7 mm.[10,24] Filo et al. reported loops in >75% of patients[25,26], while Apostolakis and Brown found them in 48%, with 95% measuring <3 mm.[25] Wei et al. reported a mean loop length of 3.3 mm in Southern Chinese patients, suggesting that the commonly cited 5 mm safety margin may be insufficient.[27] For the Thai population, Phraisukwisarn et al. reported an anterior loop prevalence of 64.4% in Thai patients, with mean vertical and horizontal extensions of 3.88±1.52 mm and 2.16±1.20 mm, respectively.[28] There was no statistically significant difference across groups, except for horizontal length, which differed between genders.[28] In our study, we recommend osteotomy distances >6 mm for males and >5 mm for females from the anterior loop's anterior edge to the inferior mandibular border, reducing the risk of nerve injury.

For MAL-ML (Mesial anterior loop to buccal cortex at midline), Lin et al. observed larger vertical distances in Class III and cleft lip/palate patients, emphasizing the variability in anterior mandibular anatomy.[10] The results in this study differed slightly, showing significant differences depending on genders but not on skeletal classes, possibly due to different population (Figure 8).

This study has several limitations that should be considered. First, the reliance on CBCT for anatomical measurements introduces potential inaccuracies due to image resolution constraints and possible distortion artifacts, which may affect the precision of the data. Second, the sample size, while adequate, may not fully capture the variability within the broader Thai population. For example, there was an uneven distribution among skeletal classes, with Class III patients outnumbering Classes I and II. However, this imbalance did not result in statistically significant differences across skeletal classes in our analysis. Third, while efforts were made to standardize measurement techniques, inherent methodological differences compared to previous studies could contribute to variations in reported distances, underscoring the need for standardized protocols in future research. Finally, our study focused on anatomical measurements without direct correlation to surgical outcomes. Clinical validation of the proposed safety margins in actual procedures will therefore be an important direction for future studies.

Despite these limitations, a major strength of this study is that it provides population-specific reference data for the Thai population using CBCT, which has not been previously reported. These findings offer clinically relevant guidelines that may help improve the safety of anterior mandibular osteotomies. Future research should aim to validate these recommendations with prospective clinical data and larger, more diverse samples, as well as to explore the integration of advanced imaging and surgical navigation systems to further enhance precision and patient safety.

Overall, this study provides a comprehensive, evidence-based framework for genioplasty osteotomies, integrating gender, skeletal classification, and anatomical variations. By establishing precise safety margins and highlighting population-specific differences, our findings enable surgeons to plan procedures with greater accuracy, reducing the risk of complications such as neurosensory deficits. This is particularly critical in the anterior mandible, where functional and aesthetic outcomes are equally vital. Our research bridges gaps in existing literature, offering practical guidelines that enhance surgical safety and patient outcomes.

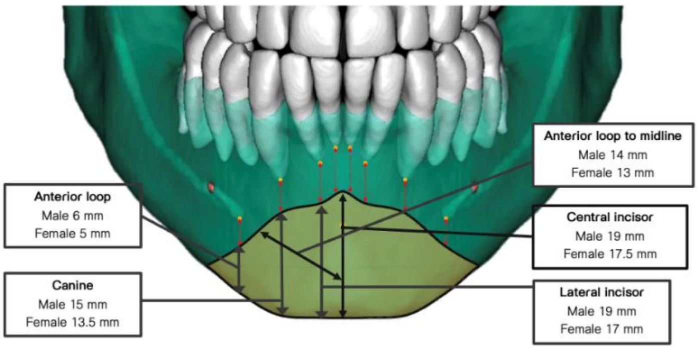

Figure 8 Recommended safety margins for osteotomies in the anterior mandible

Conclusion

This study demonstrated significant gender-related anatomical differences in the anterior mandible, with males exhibiting consistently greater measurements, while no significant variations were observed among skeletal classes. Consequently, recommended osteotomy safety margins from the inferior border are 19 mm in men and 17–17.5 mm in women for the midline and lateral incisor regions, and 15 mm in men and 13.5 mm in women for the canine region. Fixed safety margins are not advisable in the anterior loop area due to anatomical variability, and individualized CBCT assessment is strongly recommended These guidelines provide practical reference values to enhance surgical safety in anterior mandibular procedures.

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การวัดระยะทางระหว่างโครงสร้างกระดูกขากรรไกรล่างส่วนหน้าของผู้ป่วยไทยและแนะนำตำแหน่งการตัดกระดูก: การศึกษาโดยใช้ภาพรังสีส่วนตัดอาศัยคอมพิวเตอร์ลำรังสีรูปกรวย

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บทความวิจัย

บทคัดย่อ

วัตถุประสงค์: เป้าหมายหลักเพื่อเพื่อวัดระยะห่างระหว่างจุดอ้างอิงทางกายวิภาคบริเวณหน้ากระดูกขากรรไกรล่างในผู้ใหญ่ไทย และวิเคราะห์ความแตกต่างตามเพศและโครงสร้างกระดูกขากรรไกร โดยใช้ภาพรังสีส่วนตัดอาศัยคอมพิวเตอร์ลำรังสีรูปกรวย เป้าหมายรอง เพื่อกำหนดค่ามาตรฐานของบริเวณนี้ในประชากรไทย
วัสดุอุปกรณ์และวิธีการ: ศึกษาเชิงสังเกตจากภาพรังสีส่วนตัดอาศัยคอมพิวเตอร์ลำรังสีรูปกรวย ของผู้ใหญ่ไทยที่มีฟันหน้าล่างครบ วัดระยะห่างจากขอบล่างของกระดูกขากล่างไปยังจุดต่าง ๆ เช่น ปุ่มกระดูกแนวประสานคางและแอนทีเรียลูป
ผล: จากการวิเคราะห์ภาพรังสีส่วนตัดอาศัยคอมพิวเตอร์ลำรังสีรูปกรวย จำนวน 186 ราย ไม่พบความแตกต่างระหว่างด้านซ้ายและขวาอย่างมีนัยสำคัญ พบว่าผู้ชายมีค่าการวัดสูงกว่าผู้หญิงอย่างมีนัยสำคัญ ยกเว้นบริเวณปลายรากฟันหน้ากลางล่างถึงปุ่มกระดูกแนวประสานคาง ไม่พบความแตกต่างตามโครงสร้างกระดูกขากรรไกร
บทสรุป: การศึกษานี้พบความแตกต่างทางกายวิภาคของขากรรไกรล่างส่วนหน้าอย่างมีนัยสำคัญระหว่างเพศ โดยเพศชายมีค่าการวัดมากกว่าเพศหญิงอย่างสม่ำเสมอ ขณะที่ไม่พบความแตกต่างอย่างมีนัยสำคัญระหว่างกลุ่มโครงสร้างขากรรไกร (Skeletal classes) จากผลการศึกษา สามารถแนะนำระยะความปลอดภัยของแนวตัดกระดูกจากขอบล่างของขากรรไกรล่างได้ดังนี้ ได้แก่ บริเวณกึ่งกลางและฟันตัดข้าง ควรมีระยะ 19 มม. ในเพศชาย และ 17–17.5 มม. ในเพศหญิง และบริเวณเขี้ยว ควรมีระยะ 15 มม. ในเพศชาย และ 13.5 มม. ในเพศหญิง สำหรับบริเวณ anterior loop ไม่แนะนำให้ใช้ระยะความปลอดภัยแบบคงที่ เนื่องจากความแปรผันทางกายวิภาค จึงควรประเมินเป็นรายบุคคลด้วยภาพถ่าย CBCT แนวทางดังกล่าวสามารถใช้เป็นค่าอ้างอิงเชิงปฏิบัติเพื่อเพิ่มความปลอดภัยในการผ่าตัดบริเวณขากรรไกรล่างส่วนหน้า

คำไขรหัส: รูเปิดข้างคาง/ ภาพรังสีส่วนตัดอาศัยคอมพิวเตอร์ลำรังสีรูปกรวย/ การผ่าตัดกระดูกบริเวณคาง/ การผ่าตัดกระดูกบริเวณขากรรไกรล่าง

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