(Jurnal Plastik Rekonstruksi, 2024; Vol 11, No 2, 74-78) RECONSTRUCTIVE

Article

MORPHOMETRIC VARIATION OF MAXILLA IN MOHAMMAD HOESIN GENERAL HOSPITAL

Mufida Muzakkie[1], Lawrencia Toline[1], Ratna Sari Devi[2], & Ziske Maritska[3]

1. Plastic Reconstructive and Aesthetic Surgery Division, Mohammad Hoesin Central General Hospital - Faculty of Medicine, Sriwijaya University, Palembang, Indonesia.
2. Department of Radiology, Mohammad Hoesin General Hospital, Palembang, Indonesia.
3. Departement of Medical Biology, Faculty of Medicine Sriwijaya University, Palembang, Indonesia

ABSTRACT

Background: *Morphometry* is a quantitative approach to finding information about variations in the shape of organisms. The maxilla has a central position and plays a vital role in supporting the *viscerocranium*. Morphometric variations are beneficial in reconstructive procedures and are an essential reference in plastic surgery. However, this study is currently limited. This study aims to determine variations in the maxillary morphometry of patients at Mohammad Hoesin General Hospital that may become a reference for maxillary reconstruction.
Method: This descriptive observational study with a cross-sectional approach aims to identify variations in maxillary morphometry in patients treated at RSUP Mohammad Hoesin Palembang. The study is directed at describing a community or society to create an objective picture or description of a condition. It continues by analyzing and comparing maxillary morphometry based on gender.
Results: In this study, the results were obtained from as many as 96 samples (male, n = 60, female, n = 36). Variable of male and female were assessed, namely intercanine width (3.58 ± 0.27cm; 3.44 ± 0.18cm), intermolar width (5.64 ± 0.43cm; 5.47 ± 0.27cm), arch length (3.31 ± 0.38cm; 3.32 ± 0.31cm, and palate height (2.46 ± 0.28cm; 2.35 ± 0.22cm) significant results were obtained that the dimensions of the male maxilla were more significant than those of females.
Conclusion: There are variations in maxillary morphometry based on gender. Males have larger inter canine width, intermolar width, and palate height morphometry than females.

Key words: *Morphometric variation, Maxilla Morphometric, Reconstruction*

Latar Belakang: Morfometri adalah pendekatan kuantitatif untuk memperoleh informasi tentang variasi bentuk organisme. Maksila memiliki posisi sentral dan berperan penting dalam mendukung viscerocranium. Variasi morfometri maksila berguna dalam prosedur rekonstruksi dan menjadi referensi penting dalam bedah plastik. Namun, penelitian terkait hal ini masih terbatas. Penelitian ini bertujuan untuk menentukan variasi morfometri maksila pada pasien di RSUP Mohammad Hoesin yang dapat menjadi referensi untuk rekonstruksi maksila.
Metodologi: Penelitian observasional deskriptif dengan pendekatan cross-sectional ini bertujuan untuk mengidentifikasi variasi morfometri maksila pada pasien yang dirawat di RSUP Mohammad Hoesin Palembang. Penelitian ini diarahkan untuk menggambarkan suatu komunitas atau masyarakat guna menciptakan gambaran atau deskripsi obyektif tentang suatu kondisi. Analisis dilakukan dengan membandingkan morfometri maksila berdasarkan jenis kelamin.
Hasil: Penelitian ini melibatkan 96 sampel (laki-laki, n = 60, perempuan, n = 36). Variabel yang dinilai pada laki-laki dan perempuan meliputi lebar interkaninus (3,58 ± 0,27 cm; 3,44 ± 0,18 cm), lebar intermolar (5,64 ± 0,43 cm; 5,47 ± 0,27 cm), panjang lengkung (3,31 ± 0,38 cm; 3,32 ± 0,31 cm), dan tinggi palatum (2,46 ± 0,28 cm; 2,35 ± 0,22 cm). Hasil signifikan menunjukkan bahwa dimensi maksila pada laki-laki lebih besar dibandingkan perempuan.
Kesimpulan: Terdapat variasi morfometri maksila berdasarkan jenis kelamin. Laki-laki memiliki morfometri yang lebih besar pada lebar interkaninus, lebar intermolar, dan tinggi palatum dibandingkan perempuan.

Kata Kunci: *Variasi morfometri, Morfometri maksila, Rekonstruksi*

Conflicts of Interest Statement:
The author(s) listed in this manuscript declare the absence of any conflict of interest on the subject matter or materials discussed

Received: 09-07-2024, Revised: 14-08-2024, Accepted: 10-09-2024

 P-ISSN 2089-6492; E-ISSN 2089-9734 | DOI: 10.14228/jprjournal.v11i2.389

INTRODUCTION

Morphometry is a quantitative method to gather data on changes and variances in organism forms that explain the correlation between diseases and the human body[1]. Morphometric measurements are frequently utilized for surgical procedures, follow-ups, and diagnosis. Knowing the locations of significant structures and reference sources is necessary to provide crucial information for surgical procedures. Additionally, a solid understanding of anatomy is the best against structural change [2].

One-third of the face is made up of the maxilla. The maxilla forms the upper jaw and is located between the orbit and the upper jaw. Maxilla is crucial in supporting the viscerocranium and occupies the central position, sustaining the midface[3].

Each maxilla has a pyramid-like shape; its base borders the nasal, its apex borders the zygomatic process, and its central part is connected to the maxillary sinus. The maxilla is connected to the surrounding structures through 4 processes: alveolar, frontal, zygomatic and palatine. The maxilla articulates with the frontal bone, the lateral side with the zygoma, the posterior side with the palatine, and the upper teeth with the inferior alveolar process. On the anterior side, it has inferior and lateral borders with the piriform aperture and articulates with the medial side of the nasal bone [4].

In general, there are four races in the world: Mongoloid, Negroid, Caucasoid, and others. Mongoloid is divided into Proto-Malay and Deutro-Malay. The Proto-Malay race consists of Batak, Nias, Mentawai, Dayak, Sasak, Toraja, and Ambon [5].

Facial morphology is unique and typical of each patient, and it has essential aspects for diagnosis, management, and prognosis. Facial morphology can be determined using parameters such as posterior and anterior facial height ratio (Jarabak's ratio), MP-SN angle, & gonial angle [6].

The dimensions of the facial arch can be determined by the length of the arch, the width of the arch and the height of the palate. Several factors affect the dimensions of the arch, such as genetics, gender, bone growth and developmental and environmental factors, such as muscle pressure and stomatognathic [7].

The study of maxillary anatomy is essential for Plastic Reconstructive and Aesthetic surgeons as a guide for maxillary reconstruction. Patients who require maxillary reconstruction such as due to tumor ablation, trauma patients such as fractures, bone loss, and others.

Maxillary defects due to tumour resection or trauma can cause severe functional and aesthetic problems. In the past, maxillary defects were covered with thick prostheses. Although the results are acceptable in many cases, patients may be dissatisfied for several reasons. Removable prostheses must be strong enough for speech, swallowing, and cosmetics. Poor durability can lead to leakage and oronasal regurgitation. Patients must maintain good hygiene in the surgical wound and around the prosthesis [8].

The goals of maxillary reconstruction are to close the defect and form the structure of the midface, restore oral and nasal function, and restore facial esthetics. To achieve these goals, maxillary reconstruction must be performed accurately to obtain two benefits. First, high accuracy is required in cases involving orbital floor reconstruction to correct the position of the eyeballs to prevent enophthalmos and diplopia. Second, high accuracy is necessary when dental implants are positioned during reconstruction to obtain proper occlusion [9].

Defects in the maxilla caused by tumour resection or trauma can cause functional and aesthetic disorders. Maxillary reconstruction with a free fibular flap has many advantages for long-term application. Some of the advantages: (1) Long vascular pedicle, (2) wider diameter of the peroneal vessel, (3) fibular bone, skin, and muscle as a flap, (4) easier transplant and lower morbidity, (5) 2 teams of surgery can work along, (6) fibula contour easier to mould, (7) suitable recipient for an implant. In a prior study, 33 patients stated that the ability to chew returned. In at least 7 months, 26 patients returned to a regular diet and seven patients on a soft diet. The speech clarity of each patient was assessed after 6 months post-surgery. The speech clarity test of the patients had a score of 93.8 to 100 percent, where the average ranged from 98.4%. The aesthetic assessment was assessed from

P-ISSN 2089-6492; E-ISSN 2089-9734 | DOI: 10.14228/jprjournal.v11i2.389

superior, reasonable, and sufficient by 22, 7, and 4 patients. The proportion of superiors was 66.87% [8].

Various techniques are currently available to improve reconstruction results and achieve functional and aesthetic goals. One technique that can be used is 3D printing, which involves forming a curved plate according to each patient's size. Patient-specific implant (PSI) is an approach to personalized and aesthetic reconstruction of missing body parts [10]

However, not all health facilities have 3D printing facilities as a reference for reconstruction to obtain a harmonious maxilla contour and achieve functional occlusion. So, this study is needed to assess the average size of the maxilla in Indonesia because there is no maxilla morphometry in Indonesians. In this study, maxilla morphometry can be specified in females and men in the scope of the Mohammad Hoesin General Hospital, which can guide the reconstruction of the maxilla.

METHOD

An Observational descriptive study with a cross-sectional approach from August to October 2024 included 96 samples (female 36, male 60). This study was reviewed and approved by the Institute's ethical committee

In this study, we applied the Korkhaus modification device with 4 measurement points [6]: (1). Intercanine width – from the canine cusp tip, (2). Intermolar width – from the first permanent molar buccal cusp tip, (3). Arch length – from the contact point between the permanent central incisors perpendicular to the line of intermolar width, (4). Palatal height – the perpendicular distance from palatal width (central fossa of the first permanent molar) to the deepest point of the midline.

In this study, 96 samples were collected by following the inclusion criteria (≥20 years old patient in Mohammad Hoesin General Hospital who performed head CT scan with 3D reconstruction) and exclusion criteria (patient with maxilla fracture or history of maxilla fracture, tumor in maxilla region or metastatic around maxilla region, edentulous on whole teeth or one of molar 2 or premolar). Data was collected from the Department of Radiology Mohammad Hoesin General Hospital using a Head CT scan with 3D reconstruction

RESULTS

In this study, the results were obtained as many as 96 samples [11] (male, n = 60, female, n = 36). The results of measuring the intercanine width of women with an average value (mean) of 3.4 ± 0.18 cm. The intermolar width of women with an average value (mean) of 5.47 ± 0.27 cm. The results of the measurement of the arch length of women with an average value (mean) of 3.3 ± 0.31 cm. The height of the palate of women with an average value (mean) of 2.35 ± 0.22 cm (table 1).

In this study, the results of measurements of the maxilla intercanine width of males were obtained with an average value (mean) of 3.5 ± 0.27 cm. The intermolar width of males with an average value (mean) of 5.64 ± 0.43 cm. The results of measurements of the arch length of males with an average value (mean) of 3.31 ± 0.36 cm. The height of the palate of males with an average value (mean) of 2.46 ± 0.28 cm (table 2).

From the samples obtained, it was found that the dimensions of the female maxilla had an average value of intercanine width, intermolar width, and palate height that was smaller than that of males. In contrast, the male arch length had an average value that was smaller than that of females.

Table 1. Result From Female Variables Data

Female					
		Intercanine Width	Intermolar Width	Arch Length	Palate Height
N	Valid	36	36	36	36
	Missing	0	0	0	0
Mean		3.4344	5.4797	3.3258	2.3536
Median		3.4300	5.4900	3.2550	2.3700
Std. Deviation		.18198	.27640	.31374	.22397

P-ISSN 2089-6492; E-ISSN 2089-9734 | DOI: 10.14228/jprjournal.v11i2.389

Female			
	Intercanine Width	Intermolar Width	Arch Length	Palate Height
Minimum	2.99	4.87	2.63	1.98
Maximum	3.99	6.14	3.88	2.75

Table 2. Result From Male Variables Data

Male					
		Intercanine Width	Intermolar Width	Arch Length	Palate Heigth
N	Valid	60	60	60	60
	Missing	0	0	0	0
Mean		3.5847	5.6467	3.3113	2.4683
Median		3.6050	5.6650	3.2650	2.4300
Std. Deviation		.27305	.43857	.38072	.28188
Minimum		2.74	4.09	2.40	1.92
Maximum		4.14	6.57	4.75	3.37

DISCUSSION

Measurement results of the inter canine maxilla width of females with an average value (mean) of 3.4 ± 0.18 cm. The intermolar width of female with an average value (mean) of 5.47 ± 0.27 cm. The results of the measurement of the arch length of female with an average value (mean) of 3.3 ± 0.31 cm. Palate height of female with an average value (mean) of 2.35 ± 0.22 cm.

In this study, measurements result of the width of the maxilla inter canine in males with an average value (mean) of 3.5 ± 0.27 cm. Intermolar width in males with an average value (mean) of 5.64 ± 0.43 cm. arch lenth in males with an average value (mean) of 3.31 ± 0.36 cm. Palate height in males with an average value (mean) of 2.46 ± 0.28 cm.

Previous studies that discuss the overall facial dimensions have significant results from 3 assessments. Except for the arch length, the dimensions of the male face are more significant than the overall facial dimensions of women. This difference in facial dimensions is likely due to genetics, hormones, and the environment, such as nutrition and masticatory muscles. It can be concluded that the results of the dimensions of the male and female maxilla, which are larger, can also be influenced by the consistency of food consumed by patients, which makes the masticatory muscles stronger and the dimensions of the maxilla become larger and vice versa, food with a soft consistency can cause a narrower maxilla [12].

CONCLUSION

Currently, not every educational centre and health care has 3D printing facilities as a guidance for maxillary reconstruction defect closure. Good maxillary reconstruction can obtain a harmonious maxillary contour and achieve functional occlusion. The research data on the average maxillary dimensions in men and women obtained are expected to be a reference size that helps perform maxillary reconstruction according to gender, which will be beneficial for patients and the Plastic, Reconstructive, and Aesthetic Surgery team in Indonesia.

Correspondence regarding this article should be addressed to:
Lawrencia Toline, Division of Plastic Surgery, Faculty of Medicine Sriwijaya University, Palembang, Indonesia; E-mail: tolinelawrencia@gmail.com

ACKNOWLEDGEMENT

N/A

REFERENCES

1. Utkualp N, Ercan I. Anthropometric measurements usage in medical sciences. Biomed Res Int. 2015;2015.

P-ISSN 2089-6492; E-ISSN 2089-9734 | DOI: 10.14228/jprjournal.v11i2.389

2. Chrcanovic BR, Abreu MHNG, Custódio ALN. A morphometric analysis of supraorbital and infraorbital foramina relative to surgical landmarks. Surgical and Radiologic Anatomy. 2011;33(4):329–35.
3. Soriano RM, M Das J. Anatomy, Head and Neck, Maxilla [Internet]. PubMed. Treasure Island (FL): StatPearls Publishing; 2023 [cited 2023 Aug 3]. Available from: https://pubmed.ncbi.nlm.nih.gov/30860762/#:~:text=Excerpt
4. Soriano RM, Das JM. Anatomy, Head and Neck, Maxilla [Internet]. Nih.gov. StatPearls Publishing; 2019. Available from: https://www.ncbi.nlm.nih.gov/books/NBK538527/
5. Lubis H, Lubis M, Sutan C. The relationship of maxillary arch dimension with vertical facial morphology in proto-malay race. journal of orthodontic science. 2022;11(1):17.
6. Farooq A, Mahmood A, Jabbar A. Correlation of inter canine width with vertical facial morphology in patients seeking orthodontic treatment. Pakistan Oral Dent J 2015;35:213-15.
7. Saeed HK, Mageet AO. Dental arch dimensions and form in a Sudanese sample. J Contemp Dent Pract 2018;19:1235-41.
8. Peng X, Mao C, Yu G, Guo C, Huang M, Zhang Y. Maxillary Reconstruction with the Free Fibula Flap. Plastic and Reconstructive Surgery. 2005 May;115(6):1562–9.
9. Morotomi T, Iuchi T, Hirano N, Fujita M, Niwa K. Usefulness of customized titanium plates for midface contouring surgery. International Journal of Surgery Case Reports [Internet]. 2022 Jul 1 [cited 2023 Aug 6];96:107324. Available from: https://www.sciencedirect.com/science/article/pii/S2210261222005703
10. Yousof K, Darwich MA, Darwich K, Alassah G, Imran A, Nazha HM. A Case Report of Zygomatic Fracture Reconstruction: Evaluation with Orbital Measurements and Models Registration. Applied Sciences [Internet]. 2023 Jan 1 [cited 2023 Jul 22];13(10):6154. Available from: https://www.mdpi.com/2076-3417/13/10/6154
11. Lemeshow, S. & David W.H.Jr, 1997. Besar Sampel dalam Penelitian Kesehatan (terjemahan), Gadjahmada University Press, Yogyakarta
12. Rat Maxillary and Mandibular Growth within Three Generations — A Longitudinal CBCT Study. 2023;

P-ISSN 2089-6492; E-ISSN 2089-9734 | DOI: 10.14228/jprjournal.v11i2.389