e-ISSN: 2722-3558

Sriwijaya Journal of Surgery

[SJS]

https://sriwijayasurgery.com

Maxillary Intercanine Width in a South Sumatran Population: Implications for Maxillofacial Reconstruction

Mufida Muzakkie[1], Lawrencia Toline[2*], SNA Ratna Sari Devi[3], Ziske Maritska[4]

[1]Department of Plastic Surgery, Aesthetic and Reconstruction, Faculty of Medicine, Universitas Sriwijaya, Palembang, Indonesia

[2]Specialized Residency Training, Department of Surgery, Dr. Mohammad Hoesin General Hospital, Palembang, Indonesia

[3]Department of Radiology, Dr. Mohammad Hoesin General Hospital, Palembang, Indonesia

[4]Department of Medical Biology, Faculty of Medicine, Universitas Sriwijaya, Palembang, Indonesia

ARTICLE INFO

Keywords:
Intercanine width
Maxilla
Maxillofacial reconstruction
Morphometry
Sexual dimorphism

***Corresponding author:**
Lawrencia Toline

E-mail address:
tolinelawrencia@gmail.com

All authors have reviewed and approved the final version of the manuscript.

https://doi.org/10.37275/sjs.v7i2.113

A B S T R A C T

Introduction: The maxilla is a crucial bone in the facial skeleton, contributing significantly to both aesthetics and function. Understanding the morphometric variations of the maxilla, particularly the intercanine width (ICW), is vital for successful maxillofacial reconstruction procedures. This study aimed to investigate the ICW in a South Sumatran population, considering its implications for reconstructive surgeries. **Methods:** This retrospective study analyzed computed tomography (CT) scans of 96 adult patients (60 males, 36 females) from South Sumatra. The ICW was measured using 3D reconstruction software, and the data were analyzed for gender-based differences. The findings were compared with existing literature to understand regional variations in maxillary morphology. **Results:** The mean ICW for males was 3.58 ± 0.27 cm and for females was 3.44 ± 0.18 cm. Males exhibited a significantly larger ICW than females (p < 0.05). These findings are consistent with previous studies indicating sexual dimorphism in maxillary morphology. **Conclusion:** This study provides valuable data on maxillary intercanine width in a South Sumatran population. The observed gender-based differences highlight the importance of considering patient demographics in maxillofacial reconstruction. This information can aid surgeons in achieving optimal functional and aesthetic outcomes.

1. Introduction

The human face, a tapestry of intricate structures, is a testament to the delicate balance between form and function. At the heart of this facial framework lies the maxilla, a keystone bone that plays a pivotal role in defining facial aesthetics, ensuring proper function, and maintaining overall harmony. The maxilla, a paired bone that fuses at the midline, contributes significantly to the middle third of the face. It forms the foundation of the upper jaw, houses the maxillary sinuses, and supports the orbital floor, nasal cavity, and hard palate. Its strategic position and multifaceted role make it a critical player in various physiological functions, including mastication, speech, and respiration.[1-3]

The morphology of the maxilla exhibits remarkable variations among individuals and populations, influenced by a complex interplay of genetic, environmental, and hormonal factors. Understanding these variations is essential for clinicians and researchers, particularly in the realm of maxillofacial surgery and reconstructive procedures. Intercanine width (ICW), the distance between the tips of the maxillary canines, is a key parameter in assessing maxillary morphology. It reflects the transverse dimension of the dental arch and provides insights into the overall shape and size of the maxilla. ICW is not only crucial for dental occlusion and alignment but also influences facial aesthetics and proportions.[4-6]

Maxillofacial reconstruction, a specialized branch of surgery, aims to restore the form and function of the facial skeleton following trauma, congenital defects, or tumor resection. The maxilla, being a prominent and functionally significant bone, often requires meticulous reconstruction to ensure optimal outcomes. Precise reconstruction of the maxilla is vital for achieving both aesthetic and functional goals. Aesthetically, the maxilla contributes to the overall balance and harmony of the face. Its proper reconstruction ensures that the facial proportions are restored, maintaining a natural and pleasing appearance. Functionally, the maxilla plays a crucial role in mastication, speech, and respiration. Its proper reconstruction ensures that these functions are not compromised, allowing patients to regain their quality of life. Several studies have investigated maxillary morphology and ICW in various populations, providing valuable insights into regional and ethnic variations. However, data on the South Sumatran population remains limited.[7-10] This study aims to address this gap by investigating the ICW in a South Sumatran population, considering its implications for maxillofacial reconstruction.

2. Methods

This research employed a retrospective study design, capitalizing on the wealth of information contained in pre-existing computed tomography (CT) scans. The study population comprised adult patients from South Sumatra who had undergone CT scans for various clinical indications. The CT scans were obtained from the archives of the Radiology Department of a major tertiary care hospital in South Sumatra. This hospital serves as a major referral center for the region, catering to a diverse patient population. The extensive database of CT scans provided a rich source of information for this retrospective study. To ensure the integrity and homogeneity of the study population, strict inclusion and exclusion criteria were applied. Patients were included in the study if they met the following criteria; Age: Adult patients aged 20 years or older were included in the study. This age criterion ensured that the subjects had reached skeletal maturity, minimizing the potential influence of growth and development on maxillary morphology; Intact Maxilla: Patients with a history of facial trauma, maxillofacial surgery, or congenital anomalies were excluded from the study. This exclusion criterion ensured that the measurements were taken from individuals with no prior alterations to their maxillary structure.

The sample size for this study was determined based on a power analysis, considering the desired level of statistical significance and the expected effect size. A total of 96 CT scans (60 males and 36 females) met the inclusion criteria and were included in the final analysis. The intercanine width (ICW) was measured using state-of-the-art 3D reconstruction software. This software allowed for precise identification and measurement of anatomical landmarks on the maxillary arch. The software's advanced capabilities enabled accurate visualization and manipulation of the 3D models reconstructed from the CT scans. The ICW was defined as the linear distance between the tips of the maxillary canines. The tips of the canines were identified based on their anatomical characteristics, and the distance between them was measured using the software's measurement tools. All measurements were performed by a highly trained and experienced radiologist with expertise in maxillofacial imaging. The radiologist underwent a rigorous training session to ensure consistency and accuracy in identifying the anatomical landmarks and performing the measurements. The collected data were meticulously organized and entered into a secure database. Statistical analysis was performed using SPSS software (version 27), a powerful tool widely used in medical research. Descriptive statistics were used to summarize the data, providing measures of central tendency (mean, median) and dispersion (standard deviation, range). Independent t-tests were used to compare the ICW between males and females, assessing the statistical significance of any observed differences. A p-value of less than 0.05 was considered

statistically significant. This retrospective study utilized de-identified patient data, ensuring the protection of patient privacy and confidentiality. The study protocol was reviewed and approved by the Institutional Review Board of the hospital, ensuring adherence to ethical guidelines and regulations.

3. Results

Table 1 provides a detailed overview of the sample characteristics in this study investigating maxillary intercanine width (ICW) in a South Sumatran population. The sample consisted of 96 adults, with a higher proportion of males (60 individuals, 62.5%) compared to females (36 individuals, 37.5%). This indicates a slight male bias in the sample, which should be considered when generalizing the findings to the broader population. The mean age of the overall sample was 42.3 years (± 12.5 years), suggesting a relatively wide age range among the participants. The mean age for males (43.1 ± 13.2 years) was slightly higher than that of females (41.8 ± 11.9 years), although this difference is likely not statistically significant. All participants (100%) identified as South Sumatran, reflecting the study's focus on a specific regional population. Within this group, the majority (75%) were of Malay ethnicity, followed by Javanese (12.5%) and other ethnicities (12.5%). This distribution provides insights into the ethnic composition of the sample and may have implications for understanding potential variations in ICW within the South Sumatran population. The average BMI for the overall sample was 24.5 kg/m² (± 3.8), falling within the normal weight range. Males had a slightly higher mean BMI (25.1 ± 4.2) compared to females (23.8 ± 3.3), which aligns with general trends in body composition between sexes. A quarter of the participants (25%) were smokers, while the majority (75%) were non-smokers. This information is relevant as smoking has been linked to various oral health issues and could potentially influence maxillary morphology. The vast majority of participants (87.5%) were dentate (having teeth), while 12.5% were partially edentulous (missing some teeth). This is important as the presence of teeth is essential for accurate measurement of ICW.

Table 1. Sample characteristics.

Variable	Characteristics	Frequency/Mean (SD)	Percentage
Gender	Male	60	62.5%
	Female	36	37.5%
Age (years)	Overall	42.3 ± 12.5	-
	Male	43.1 ± 13.2	-
	Female	41.8 ± 11.9	-
Ethnicity	South Sumatran	96	100%
	Malay	72	75%
	Javanese	12	12.5%
	Other	12	12.5%
BMI (kg/m²)	Overall	24.5 ± 3.8	-
	Male	25.1 ± 4.2	-
	Female	23.8 ± 3.3	-
Smoking status	Smoker	24	25%
	Non-Smoker	72	75%
Dental status	Dentate	84	87.5%
	Partially Edentulous	12	12.5%

Table 2 presents the key findings of this study, focusing on the intercanine width (ICW) measurements in the South Sumatran population. The mean ICW for the entire sample (including both males and females) was 3.53 cm with a standard deviation (SD) of 0.25 cm. This provides a general overview of the average ICW in this population. The standard deviation indicates a moderate degree of variability in the measurements, suggesting that individual ICW values can deviate from the mean by approximately 0.25 cm. The mean ICW for males was 3.58 cm (± 0.27 cm). This value is slightly higher than the overall mean, indicating that males tend to have wider intercanine distances compared to the sample average. The standard deviation for males is similar to the overall SD, suggesting a comparable degree of variability within the male group. The mean ICW for females was 3.44 cm (± 0.18 cm). This value is notably lower than both the overall mean and the male mean, highlighting a clear difference in ICW between sexes. Additionally, the standard deviation for females is smaller than that of males, indicating less variability in ICW among females.

Table 2. Intercanine width.

Variable	Characteristics	Mean (SD)
Intercanine width (cm)	Overall	3.53 ± 0.25
	Male	3.58 ± 0.27
	Female	3.44 ± 0.18

4. Discussion

This study's primary discovery is the presence of sexual dimorphism in ICW within the South Sumatran population. Males exhibit a significantly wider ICW compared to females, a finding that aligns with previous research in other populations. This difference underscores the importance of considering the patient's gender when planning maxillofacial reconstructive procedures. The mean ICW for males in this study was 3.58 cm (± 0.27 cm), while for females, it was 3.44 cm (± 0.18 cm). This difference, though seemingly small, can have significant implications for the functional and aesthetic outcomes of reconstructive surgeries. The presence of sexual dimorphism in intercanine width (ICW) has significant implications for treatment planning in maxillofacial reconstruction. Surgeons should not rely on population averages but instead, consider the patient's gender when determining the appropriate dimensions for reconstruction. Maxillofacial reconstruction is a highly specialized area of surgery that aims to restore the form and function of the facial skeleton following trauma, congenital defects, or tumor resection. The maxilla, a central bone in the facial structure, often requires meticulous reconstruction to ensure optimal outcomes. Intercanine width (ICW), the distance between the tips of the maxillary canines, is a key parameter in assessing maxillary morphology. It reflects the transverse dimension of the dental arch and provides insights into the overall shape and size of the maxilla. ICW is not only crucial for dental occlusion and alignment but also influences facial aesthetics and proportions. Sexual dimorphism in ICW refers to the difference in ICW between males and females. This study found that males exhibit a significantly wider ICW compared to females, a finding consistent with previous research in other populations. Individualized treatment planning is essential in maxillofacial reconstruction because it takes into account the unique characteristics of each patient. This includes factors such as sex, age, ethnicity, and the nature of the defect or injury. In cases involving maxillary defects, the surgeon can utilize the sex-specific normative ICW data to guide the reconstruction. This precision can aid in selecting the appropriate size and shape of implants or grafts,

ensuring the proper restoration of the maxillary arch and dental occlusion. Achieving optimal aesthetic outcomes in maxillofacial reconstruction relies heavily on restoring proper facial proportions. By considering the patient's gender and the corresponding ICW data, surgeons can ensure that the reconstructed maxilla harmonizes with the rest of the face, creating a natural and balanced appearance. The maxilla plays a crucial role in various functions, including mastication, speech, and respiration. Its proper reconstruction is essential for restoring these functions. By considering the patient's gender and the corresponding ICW data, surgeons can ensure that the reconstructed maxilla supports proper function, improving the patient's quality of life. The findings of this study can contribute to enhancing surgical outcomes in maxillofacial reconstruction. By utilizing the sex-specific normative ICW data, surgeons can improve the accuracy and precision of their reconstructive procedures, leading to better functional and aesthetic results for their patients. In cases involving maxillary defects, the surgeon can utilize the sex-specific normative ICW data to guide the reconstruction. This precision can aid in selecting the appropriate size and shape of implants or grafts, ensuring the proper restoration of the maxillary arch and dental occlusion. Accuracy in reconstruction is paramount in maxillofacial surgery. It directly impacts the functional and aesthetic outcomes of the procedure. Inaccurate reconstruction can lead to complications such as malocclusion, impaired mastication, speech difficulties, and facial asymmetry. Sex-specific normative ICW data refers to the average ICW measurements for males and females in a specific population. This study found that males exhibit a significantly wider ICW compared to females, a finding consistent with previous research in other populations. Thorough preoperative planning is essential for achieving accuracy in reconstruction. This includes obtaining detailed imaging studies, such as CT scans, to assess the extent of the defect and plan the surgical approach. The surgeon can utilize the sex-specific normative ICW data to guide the selection of the appropriate size and shape of implants or grafts. This ensures that the reconstructed maxilla matches the patient's natural anatomy and supports proper dental occlusion. The surgeon's skill and experience play a crucial role in achieving accuracy in reconstruction. Meticulous surgical technique is essential for precise placement of implants or grafts and for ensuring proper alignment of the maxillary arch. Postoperative monitoring is essential for identifying and managing any complications that may arise. This includes regular follow-up appointments and imaging studies to assess the healing process and ensure the long-term success of the reconstruction. Accurate reconstruction of the maxilla can lead to improved functional outcomes, such as proper mastication, speech, and respiration. Achieving accuracy in reconstruction can also enhance aesthetic outcomes by restoring proper facial proportions and creating a natural and balanced appearance. Patients who undergo accurate maxillofacial reconstruction are more likely to be satisfied with the results of their procedure. This can lead to improved self-esteem and quality of life. Achieving optimal aesthetic outcomes in maxillofacial reconstruction relies heavily on restoring proper facial proportions. By considering the patient's gender and the corresponding ICW data, surgeons can ensure that the reconstructed maxilla harmonizes with the rest of the face, creating a natural and balanced appearance. Aesthetics play a crucial role in maxillofacial reconstruction. The face is a defining feature of an individual's identity, and any disfigurement can have a significant impact on self-esteem and quality of life. Facial proportions are a key determinant of facial aesthetics. The human face is naturally divided into thirds, and the maxilla contributes significantly to the middle third. Any alteration in the size or shape of the maxilla can disrupt these proportions and affect overall facial harmony. Thorough preoperative planning is essential for optimizing aesthetics in reconstruction. This includes obtaining detailed imaging studies, such as CT scans, to assess the extent of the defect and plan the surgical approach. The surgeon can utilize the sex-specific normative ICW data to guide the

reconstruction. This ensures that the reconstructed maxilla matches the patient's natural anatomy and facial proportions. The surgeon can select implants or grafts that are appropriate for the patient's gender and facial structure. This can help to create a natural and balanced appearance. The surgeon's skill and experience play a crucial role in optimizing aesthetics in reconstruction. Meticulous surgical technique is essential for creating smooth contours and minimizing scarring. Proper postoperative care is essential for optimizing aesthetics. This includes measures to reduce swelling and bruising, as well as instructions on how to care for the surgical site. Patients who undergo aesthetically successful maxillofacial reconstruction are more likely to have improved self-esteem and confidence. Optimizing aesthetics can also enhance the patient's overall quality of life by reducing social anxiety and improving social interactions. Aesthetics and function are often intertwined in maxillofacial reconstruction. Optimizing aesthetics can also lead to better functional outcomes, such as improved mastication and speech. The maxilla plays a crucial role in various functions, including mastication, speech, and respiration. Its proper reconstruction is essential for restoring these functions. By considering the patient's gender and the corresponding ICW data, surgeons can ensure that the reconstructed maxilla supports proper function, improving the patient's quality of life. Preserving function is a primary goal in maxillofacial reconstruction. The maxilla provides support for the upper teeth and is essential for proper chewing and biting. The maxilla and the hard palate are crucial for articulation and sound production during speech. The maxilla forms part of the nasal cavity and contributes to proper airflow during breathing. The maxilla and the hard palate are involved in the oral phase of swallowing, helping to propel food toward the esophagus. Impaired function due to maxillary defects can significantly impact a patient's quality of life. It can lead to difficulties with eating, speaking, breathing, and swallowing, affecting their overall health and well-being. A thorough preoperative assessment is crucial for understanding the extent of functional impairment and planning the reconstruction accordingly. This includes evaluating the patient's masticatory function, speech, and respiratory patterns. The surgeon can utilize the sex-specific normative ICW data to guide the reconstruction. This ensures that the reconstructed maxilla matches the patient's natural anatomy and supports proper dental occlusion, which is essential for effective mastication. The surgeon can select implants or grafts that are appropriate for the patient's gender and facial structure. This can help to restore the structural integrity of the maxilla and support proper function. The surgeon's skill and experience play a crucial role in preserving function in reconstruction. Meticulous surgical technique is essential for precise placement of implants or grafts and for ensuring proper alignment of the maxillary arch, which is crucial for optimal mastication and speech. Postoperative rehabilitation is often necessary to help patients regain full function. This may include speech therapy, swallowing exercises, and dietary modifications. Preserving function in maxillofacial reconstruction can significantly improve a patient's quality of life. It allows them to eat, speak, breathe, and swallow without difficulty, enhancing their overall health and well-being. Proper reconstruction of the maxilla can help to reduce the risk of complications such as malocclusion, temporomandibular joint disorders, and sleep apnea. Patients who undergo successful maxillofacial reconstruction with preserved function are more likely to be satisfied with the results of their procedure. This can lead to improved self-esteem and a more positive outlook on life. The findings of this study can contribute to enhancing surgical outcomes in maxillofacial reconstruction. By utilizing the sex-specific normative ICW data, surgeons can improve the accuracy and precision of their reconstructive procedures, leading to better functional and aesthetic results for their patients. Surgical outcomes in maxillofacial reconstruction are multifaceted and encompass both functional and aesthetic aspects. Functional outcomes relate to the

restoration of essential functions such as mastication, speech, respiration, and swallowing. Aesthetic outcomes pertain to the restoration of facial harmony and proportions, creating a natural and balanced appearance. Enhancing surgical outcomes is a continuous pursuit in maxillofacial surgery. It involves refining surgical techniques, improving preoperative planning, and utilizing the latest research findings to achieve the best possible results for patients. The findings of this study highlight the presence of sexual dimorphism in intercanine width (ICW), with males exhibiting a significantly wider ICW compared to females. By utilizing this sex-specific normative ICW data, surgeons can improve the accuracy and precision of their reconstructive procedures. In cases involving maxillary defects, the surgeon can refer to the sex-specific normative ICW data to guide the reconstruction. This can aid in selecting the appropriate size and shape of implants or grafts, ensuring the proper restoration of the maxillary arch and dental occlusion. Achieving optimal aesthetic outcomes in maxillofacial reconstruction relies heavily on restoring proper facial proportions. By considering the patient's gender and the corresponding ICW data, surgeons can ensure that the reconstructed maxilla harmonizes with the rest of the face, creating a natural and balanced appearance. The maxilla plays a crucial role in various functions, including mastication, speech, and respiration. Its proper reconstruction is essential for restoring these functions. By considering the patient's gender and the corresponding ICW data, surgeons can ensure that the reconstructed maxilla supports proper function, improving the patient's quality of life. Enhancing surgical outcomes also involves minimizing the risk of complications. By utilizing the sex-specific normative ICW data and employing meticulous surgical techniques, surgeons can reduce the likelihood of complications such as malocclusion, implant failure, and infection. Patients who undergo successful maxillofacial reconstruction with enhanced surgical outcomes are more likely to be satisfied with the results of their procedure. This can lead to improved self-esteem and a more positive outlook on life. Enhancing surgical outcomes can also lead to reduced healthcare costs by minimizing the need for revision surgeries and prolonged rehabilitation. The continuous pursuit of enhancing surgical outcomes contributes to the advancement of the field of maxillofacial surgery. It drives innovation and improves the overall quality of care for patients with maxillofacial defects.[11-14]

Hormones are powerful chemical messengers that orchestrate a myriad of physiological processes, including the intricate dance of skeletal growth and development. Their influence is particularly evident in the craniofacial complex, where they sculpt the unique features that define our individual identities. Androgens, primarily testosterone, take center stage in this hormonal symphony, playing a key role in the sexual dimorphism observed in intercanine width (ICW). Androgens, with testosterone as their prominent representative, are steroid hormones that drive the development of male characteristics. During puberty, a surge in testosterone levels triggers a cascade of events that shape the male skeletal framework, including the craniofacial region. Testosterone exerts a profound influence on bone metabolism, promoting both bone formation and resorption. This dynamic process, finely tuned by hormonal signals, leads to an overall increase in bone size and density, particularly in males. The bones of the face, including the maxilla, are no exception to this testosterone-driven growth spurt. The surge in testosterone during puberty is responsible for the development of secondary sexual characteristics in males. These characteristics, which distinguish males from females, include the deepening of the voice, increased muscle mass, and the development of facial hair. In the context of craniofacial morphology, testosterone promotes the growth of the mandible, leading to a more prominent jawline, and the expansion of the maxilla, resulting in a wider ICW. The maxilla, a central bone in the facial skeleton, is particularly responsive to the effects of testosterone. This hormone acts as a growth signal, stimulating the cells within the maxilla to proliferate and differentiate,

leading to an increase in bone mass and overall size. The effect of testosterone on maxillary growth is evident in the broader and more prominent jawline typically observed in males. This increased width contributes to the overall masculine appearance of the face, creating a more angular and defined jawline. The expansion of the maxilla under the influence of testosterone directly results in a larger ICW. This increased distance between the canines is a key feature of the sexual dimorphism observed in maxillary morphology. It reflects the broader dimensions of the male maxilla and contributes to the characteristically wider smile often seen in men. While testosterone is the primary hormone driving sexual dimorphism in ICW, other hormonal factors may also play a supporting role. Growth hormone, estrogen, and thyroid hormones can all influence skeletal growth and development, potentially contributing to the subtle variations observed between males and females. Growth hormone is essential for overall skeletal growth and development. It acts as a general growth promoter, stimulating the proliferation and differentiation of bone cells throughout the body. In the craniofacial complex, growth hormone influences the size and shape of various bones, including the maxilla. Estrogen, the primary female gender hormone, also plays a role in skeletal development. While its effects are less pronounced than those of testosterone, estrogen contributes to bone maturation and the closure of growth plates, which can influence the final dimensions of the maxilla. Thyroid hormones are crucial for regulating metabolism and growth. They influence bone development and can affect the timing of growth spurts and skeletal maturation. Imbalances in thyroid hormone levels can lead to growth abnormalities, including alterations in craniofacial development. While hormones and environmental factors undoubtedly play significant roles in shaping craniofacial morphology, the underlying blueprint for skeletal development lies within our genes. Genetic factors exert a profound influence on the size and shape of the maxilla, contributing to the observed variations in intercanine width (ICW) between individuals and between sexes. Our genetic makeup, inherited from our parents, sets the stage for our physical development. Certain genes may influence the size and shape of the maxilla, contributing to the observed differences in ICW between males and females. Genes encoding growth factors and their receptors play a crucial role in bone development. These factors regulate cell proliferation, differentiation, and migration, ultimately influencing the final dimensions of the maxilla. Variations in these genes can lead to differences in ICW. Homeobox genes are a family of genes that control the body plan of an embryo along the head-tail axis. They are crucial for the proper development of the craniofacial complex. Mutations or variations in these genes can lead to craniofacial abnormalities, including alterations in ICW. The sex chromosomes, X and Y, also carry genes that influence skeletal development. The Y chromosome, present only in males, carries genes that promote the growth of the mandible and maxilla, contributing to the wider ICW observed in males. The expression of specific genes during development can affect the growth and differentiation of bone cells, ultimately influencing the final dimensions of the maxilla. Variations in gene expression patterns between males and females may contribute to the observed sexual dimorphism in ICW. Transcription factors are proteins that regulate gene expression. They bind to specific DNA sequences and control the rate at which genes are transcribed into RNA. Variations in transcription factor activity can lead to differences in gene expression patterns, potentially contributing to the observed sexual dimorphism in ICW. Epigenetics refers to changes in gene expression that do not involve alterations to the underlying DNA sequence. These changes can be influenced by environmental factors and can be passed down from one generation to the next. Epigenetic modifications may play a role in the sexual dimorphism observed in ICW. It is important to note that genetic factors do not act in isolation. They interact with environmental factors to shape craniofacial morphology. The interplay between genes and environment can lead to

a wide range of variations in ICW, even within the same sex. The forces generated during chewing and biting can influence the expression of genes involved in bone development. Individuals who engage in activities that require strong masticatory forces may exhibit differences in gene expression patterns, potentially leading to variations in ICW. Dietary habits can also influence gene expression. Diets that are rich in nutrients essential for bone development may promote the expression of genes involved in maxillary growth, potentially leading to a wider ICW. Certain cultural practices, such as the use of pacifiers or thumb sucking, can also influence gene expression. These practices can alter the forces acting on the maxilla during development, potentially affecting gene expression patterns and ultimately, ICW. While our genetic makeup lays the foundation for craniofacial development, the environment we interact with plays a crucial role in shaping the final outcome. Environmental factors, including masticatory forces, dietary habits, and cultural practices, can influence the development and final dimensions of the maxilla, contributing to the variations observed in intercanine width (ICW). The human face is a dynamic structure, constantly adapting to the forces it encounters. Among these forces, masticatory forces, generated during chewing and biting, play a significant role in shaping the maxilla and influencing intercanine width (ICW). Mastication, the process of chewing food, involves a complex interplay of muscles, teeth, and bones. The muscles of mastication, including the masseter, temporalis, and medial and lateral pterygoids, generate powerful forces that are transmitted to the maxilla through the teeth. These forces stimulate bone remodeling, a dynamic process that involves the removal of old bone tissue and the formation of new bone tissue. This process is essential for maintaining bone health and adapting to mechanical demands. Strong masticatory forces can promote maxillary expansion, leading to a wider ICW. This is because the forces exerted during chewing and biting stimulate bone formation in the maxilla, particularly in the alveolar ridges where the teeth are embedded. The repeated stress and strain on the maxilla trigger a cascade of cellular events that promote bone deposition and growth. The concept of bone adaptation to mechanical forces is encapsulated in Wolff's Law, which states that bone in a healthy person or animal will adapt to the loads under which it is placed. In the context of mastication, this means that the maxilla will respond to the forces generated during chewing by increasing its density and expanding its dimensions, including ICW. The alveolar bone, which surrounds and supports the teeth, is particularly responsive to masticatory forces. The pressure and tension exerted on the alveolar bone during chewing stimulate bone remodeling, leading to changes in its shape and density. This remodeling process can contribute to maxillary expansion and a wider ICW. Individuals who consume diets rich in hard and fibrous foods, such as raw vegetables and nuts, tend to generate stronger masticatory forces compared to those who consume primarily soft and processed foods. This can lead to differences in ICW. Certain cultural practices, such as chewing betel nuts or using chewing tobacco, can also influence masticatory forces and potentially affect ICW. Genetic factors can influence the responsiveness of the maxilla to masticatory forces. Some individuals may be genetically predisposed to develop a wider maxilla in response to strong masticatory forces, while others may not. Dietary habits can also influence ICW independently of masticatory forces. Diets that are rich in hard and fibrous foods may promote the development of a wider maxilla, while diets that are primarily soft and processed may not provide the necessary stimulus for maxillary growth. Adequate intake of nutrients essential for bone development, such as calcium, vitamin D, and protein, is crucial for maxillary growth. Diets that are deficient in these nutrients may impair maxillary development and lead to a smaller ICW. The consistency of food can also influence ICW. Hard and fibrous foods require more chewing and generate stronger masticatory forces, which can promote maxillary expansion. Soft and processed foods, on the other hand, require less chewing and generate weaker forces, potentially

leading to a smaller ICW. Certain cultural practices can also influence the development of the maxilla and potentially affect ICW. Prolonged pacifier use can exert pressure on the developing maxilla, potentially leading to a narrower ICW. This is because the pacifier can push the upper teeth inward, restricting the growth of the maxilla. Similar to pacifier use, thumb sucking can also alter the forces acting on the maxilla during development. The pressure from the thumb can push the upper teeth inward, potentially leading to a narrower ICW.[15-17]

The findings of this study have significant implications for maxillofacial reconstruction procedures. Surgeons should consider the patient's gender and the corresponding normative ICW data when planning reconstructive surgeries involving the maxilla. In cases involving maxillary defects, achieving accuracy in reconstruction is paramount for restoring both form and function. The surgeon can utilize normative data on intercanine width (ICW) for the South Sumatran population to guide the reconstruction. This precision can aid in selecting the appropriate size and shape of implants or grafts, ensuring the proper restoration of the maxillary arch and dental occlusion. Thorough preoperative planning is the cornerstone of accurate maxillofacial reconstruction. It involves a comprehensive assessment of the patient's condition and meticulous planning of the surgical approach. The surgeon should carefully evaluate the patient's preoperative imaging studies, such as CT scans, to assess the extent of the maxillary defect. This includes determining the size and shape of the defect, its relationship to surrounding structures, and the quality of the remaining bone. In complex cases, virtual surgical planning (VSP) can be employed. VSP utilizes computer-aided design and manufacturing (CAD/CAM) technology to create a virtual model of the patient's skull and the planned reconstruction. This allows the surgeon to simulate the surgery and optimize the placement of implants or grafts before entering the operating room. Advances in 3D printing technology have revolutionized maxillofacial reconstruction. Surgeons can now use 3D printed models of the patient's skull and the planned reconstruction to guide the surgery. This enhances precision and reduces the risk of errors. The surgeon should consider the patient's gender and the corresponding normative ICW data when selecting implants or grafts. This will help ensure that the reconstructed maxilla matches the patient's natural anatomy and supports proper dental occlusion. The study highlighted the presence of sexual dimorphism in ICW, with males exhibiting a significantly wider ICW compared to females. This difference should be taken into account when selecting implants or grafts to ensure that the reconstructed maxilla matches the patient's natural anatomy. In some cases, custom implants may be necessary to achieve optimal accuracy. These implants are designed based on the patient's specific anatomy and the normative ICW data for their sex. The surgeon should employ meticulous surgical techniques to ensure precise placement of implants or grafts and proper alignment of the maxillary arch. This will help optimize both functional and aesthetic outcomes. Careful planning of incision placement is essential to minimize scarring and optimize aesthetic outcomes. Gentle handling of soft tissues is crucial to minimize trauma and promote healing. Secure fixation of implants or grafts is essential to prevent movement and ensure long-term stability. In cases where there is insufficient bone for implant placement, bone grafting may be necessary. The surgeon should carefully select the appropriate bone graft material and technique to ensure optimal bone regeneration and implant stability. Achieving optimal aesthetic outcomes in maxillofacial reconstruction relies heavily on restoring proper facial proportions. By considering the patient's gender and the corresponding ICW data, surgeons can ensure that the reconstructed maxilla harmonizes with the rest of the face, creating a natural and balanced appearance. The surgeon should perform a thorough facial analysis to assess the patient's facial proportions and identify any asymmetries or disharmonies. The face is naturally divided into thirds—the upper third

(forehead to eyebrows), middle third (eyebrows to base of the nose), and lower third (base of the nose to chin). The maxilla contributes significantly to the middle third, and its proper reconstruction is essential for maintaining facial harmony. The width of the face can be assessed by measuring the bizygomatic distance (the distance between the cheekbones) and the bigonial distance (the distance between the angles of the mandible). The height of the face can be assessed by measuring the distance from the hairline to the chin. The relationship between the upper and lower teeth should be evaluated to ensure proper alignment and function. The surgeon should consider the patient's gender and the corresponding normative ICW data when planning the reconstruction. This will help ensure that the reconstructed maxilla complements the patient's overall facial features. Male and female faces have distinct characteristics. Male faces tend to be wider and more angular, while female faces tend to be narrower and more rounded. The surgeon should take these differences into account when planning the reconstruction. ICW is closely related to facial width. Males generally have a wider ICW and a wider face, while females have a narrower ICW and a narrower face. The surgeon should use the normative ICW data to guide the reconstruction and ensure that the reconstructed maxilla matches the patient's natural facial width. The surgeon should also consider the soft tissue envelope when planning the reconstruction. Adequate soft tissue coverage is essential for achieving optimal aesthetic outcomes. The skin and muscles of the face play a crucial role in facial aesthetics. The surgeon should ensure that there is sufficient soft tissue to cover the reconstructed maxilla and create a natural appearance. In some cases, fat grafting may be necessary to augment the soft tissue envelope and achieve optimal aesthetic outcomes. The maxilla plays a crucial role in various functions, including mastication, speech, and respiration. Its proper reconstruction is essential for restoring these functions. By considering the patient's gender and the corresponding ICW data, surgeons can ensure that the reconstructed maxilla supports proper function, improving the patient's quality of life. The surgeon should aim to restore proper dental occlusion and masticatory function. This will allow the patient to chew and bite effectively, improving their nutritional intake and overall quality of life. The surgeon should consider the impact of the reconstruction on speech. Proper reconstruction of the maxilla and hard palate can help restore clear articulation and speech patterns. The surgeon should ensure that the reconstruction does not compromise the patient's respiratory function. Proper reconstruction of the nasal cavity and airway can help maintain adequate airflow and prevent respiratory complications.[18-20]

5. Conclusion

This study confirms the presence of sexual dimorphism in maxillary intercanine width (ICW) within the South Sumatran population. Males exhibit a significantly wider ICW compared to females. This finding underscores the importance of considering the patient's gender when planning maxillofacial reconstructive procedures. Surgeons should utilize sex-specific normative ICW data to guide reconstruction, ensuring the selection of appropriately sized implants or grafts for optimal functional and aesthetic outcomes. This precision contributes to restoring proper maxillary arch dimensions and dental occlusion, improving mastication, speech, and respiration. The study's findings have significant implications for enhancing surgical outcomes in maxillofacial reconstruction. By considering the patient's gender and utilizing normative ICW data, surgeons can improve the accuracy and precision of their reconstructive procedures, leading to better functional and aesthetic results for their patients.

6. References

1. Zhang R, Zhang W, Ren Y, Yu J, Li L, Zhang Y. Recent developments in delirium after oral and maxillofacial free-flap reconstruction. J Stomatol Oral Maxillofac Surg. 2024; (102045): 102045.

2. Yousefi-Koma A-A, Baniameri S, Yousefi-Koma H, Mashhadiabbas F. Comparative evaluations of different surgical and non-surgical treatment methods for early invasive and micro invasive squamous cell carcinoma in the oral and maxillofacial regions: a systematic review. J Stomatol Oral Maxillofac Surg. 2024; (102034): 102034.
3. A modified palatoplasty for palate cleft: a case report and literature review. J Dent Maxillofacial Res. 2024; 7(2).
4. Sivaranjani S, Mohan VK, Nimoshini G, Divya B, Vasanthi V, Ramadoss R. Morphogenic correlation between facial form and intercanine width - An aid in forensic dentistry. SRM J Res Dent Sci. 2021; 12(1): 22–6.
5. Hartmann CR, Hanson PR, Pincsak JJ. Mandibular intercanine width increase without intervention in children with slipped contacts. Pediatr Dent. 2001; 23(6): 469–75.
6. Abdul Rehman S, Rizwan S, Faisal SS, Hussain SS. Association between intercanine width and mandibular dental arch forms. J Coll Physicians Surg Pak. 2021; 31(4): 478–80.
7. Singhal P, Jaswal O, Thakur S. Mandibular interincisor and Intercanine Width at Three Different Stages of dentition: a cross-sectional study. Int J Clin Pediatr Dent. 2024; 17(4): 417–24.
8. Krishnan RP, Srivatchava S, Yuvaraj A, Pandiar D. Gender determination using mandibular intercanine distance and mesiodistal width of right mandibular molar. J Oral Maxillofac Pathol. 2024; 28(2): 347–50.
9. Balaraman C, Asokan S, GeethaPriya PR, YogeshKumar TD, Viswanath S. Mandibular intercanine width at three stages of mixed dentition in children at Namakkal District: a cross-sectional study. Int J Clin Pediatr Dent. 2024; 17(7): 737–41.
10. Heiser W, Richter M, Niederwanger A, Neunteufel N, Kulmer S. Association of the canine guidance angle with maxillary and mandibular intercanine widths and anterior alignment relapse: Extraction vs nonextraction treatment. Am J Orthod Dentofacial Orthop. 2008; 133(5): 669–80.
11. Yang D-H, Lee J-Y, Ban J-S, Oh G-J, Park S-W. Position of maxillary central incisor and intercanine width in Korean adults. J Korean Acad Prosthodont. 2013; 51(3): 147.
12. Deogade SC, Mantri SS, Sumathi K, Rajoriya S. The relationship between innercanthal dimension and interalar width to the intercanine width of maxillary anterior teeth in central Indian population. J Indian Prosthodont Soc. 2015; 15(2): 91–7.
13. Banker AM, Pillai JP, Patel KD. Determination of normal maxillary transverse dimension by using intercanine width and interpalatal first molar width. Indian J Dent Res. 2016; 27(5): 468–72.
14. Deshmukh M, Maiti S, Ganapathy D. Correlation of width of anterior maxillary teeth with the intercanine distance, distance from inner to outer canthus of right eye and width of first three fingers of right hand for teeth selection. Int J Dent Oral Sci. 2020; 39–45.
15. Thakur A, Thakur S, Singhal P, Chauhan D. Maxillary intercanine width at three stages of dentition – A cross-sectional study. Int J Forensic Odontol. 2021; 6(2): 123.
16. Aggarwal I, Kharel AD, Mittal S, Bhullar MK, Palkit T. Evaluation of treatment changes in the maxillary intercanine and intermolar width in patients with various malocclusions: a study model analysis. Dent J Adv Stud. 2021; 9(01): 43–7.
17. Dinakaran J, Vadhana SR, Ravikumar SS, Kumar D, Kalaichelvan V, Manikandan S. Stature prediction by comparing maxillary and mandibular intercanine width and intermolar width among Tamil Nadu

population. J Pharm Bioallied Sci. 2022; 14(Suppl 1): S706–11.

18. Ayub N, Sartaj Khan M, Chughtai MA. Correlation of interalar width and maxillary Intercanine width in dentate subjects of Gandhara University, Peshawar. J Khyber Coll Dent. 2022; 12(03): 34–7.
19. Wankhede MP, Tamgdge A, Anjali AK, Vidhale RG, Pereira T, Lalai MN. Assessment of sexual dimorphism in Maharashtrian young adults using maxillary intercanine, interpremolar, and intermolar widths: a morphometric study. J Oral Maxillofac Pathol. 2023; 27(1): 121–9.
20. Jassim A, Rp S, K N, Radhakrishnan L, Mc J, Mohamed Ali Kp A. The evaluation of the relationship between intercondylar and intercanine distances, maxillary central incisor width, and various facial forms: a comparative study. Cureus. 2023; 15(8): e43551.