ASSESSMENT OF MANDIBULAR FLEXURE FOR SEXUAL DIMORPHISM: A RETROSPECTIVE STUDY

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BACKGROUND: In forensic medicine, distinguishing proof of age and sexual orientation is vital, furthermore, it plays a fundamental part in deciding one's personality. The skeletal parts frequently explored for sexual dimorphism are the pelvis and skull, with the mandible being a reasonable component to investigate sexual dimorphism in the divided bones.

MATERIALS AND METHODS: The current study will be conducted in the Department of Oral Medicine and Radiology of our college using the orthopantomogram taken in our department for various treatment aspects for the analysis of mandibular ramus flexure of both males and females. The included OPGs will be evaluated based on Loth and Hennerberg (1996). The analysis will be carried out by the software for the measurement of the radiographs.

RESULTS: Among the 452 individuals included in the study, 244 females and 208 males among them 26.8% and 14.2% were misdiagnosed respectively. The sensitivity and specificity of the study turned out to be 73.2% and 85.8% respectively.

CONCLUSION: The present study's sensitivity and specificity whose predictive accuracy is 67%. The mandible alone can be used as a separate entity for sexual dimorphism when they are measured with other parameters for attaining a better accuracy in gender determination.

KEYWORDS: mandibular ramus flexure, sexual dimorphism, orthopantomogram, forensic odontology, disaster victim identification.

INTRODUCTION:

According to GI-TOC 2021, India ranks 64 with a crime index of 5.53 value also enlisting itself as one among the 57 countries in the category of High criminality with low resilience. Also in World Risk Index, India ranks 89th out of 181 countries with a score of 6.62 which lies in the medium-risk category. In the current scenario where crime rates and disasters occur on large scales, forensic medicine comes into play to properly identify the person. Forensic medicine improves clinical measurable pathology and clinical statute and whether the term utilized accentuates the connection between medication and the law and legal frameworks. The improvement of legal medication has a long history of returning millennia. It is for the most part thought to be that the structure of the field started in China[1]. The principal composed record of utilizing medication and entomology to address criminal cases is credited to the book of Xi Yuan Lu (deciphered as Washing Away of Wrongs), written in China by Song Ci (宋慈, 1186–1249) in 1248, who was a director of justice, jail and supervision, during the Song dynasty. Song Ci ruled regulations about autopsy reports for court, how to protect the evidence in the examining process, and the reason why workers must show examination to public impartiality[1].

The advancement of forensic medicine has helped the crime and jurisdiction department in solving many cases. In forensic dentistry, the gender of an obscure individual can be resolved in light of the information from the morphology and metric elements of the skull and the mandible, delicate tissues, dental records, and DNA analysis of teeth. Apart from this, dentists also have a role in 1) the Identification of unknown dead bodies, human remains and living individuals, 2) Age and sex determination, 3) Mass disaster victim analysis, 4) Bite mark and lip print evidence, 5) Child abuse and civil litigations report.

Forensic odontology's primary utility is in identifying human remains based on the individualistic characteristics present in the remains of different individuals using dental evidence. This branch assumes a critical part in the distinguishing proof of human remaining parts in occurrences, for example, torrents, seismic tremors, land-slides, bomb impacts and psychological oppressor assaults, plane accidents, train and street mishaps, and so on where profoundly ravaged and dismantled dead bodies are recuperated which are to the point of being unrecognizable. This course of recognizable proof of the debacle casualties is known as Disaster Victim Identification (DVI).

The skeletal parts frequently explored for sex determination are the pelvis and skull, with the mandible being a reasonable component to investigate sexual dimorphism in the divided bones. Mandibular ramus can be utilized to

separate among genders, and it additionally communicates solid univariate sexual dimorphism which was first quoted by Loth and Hennerberg in 1996. This study tries to see the accuracy of the mandible in male and female patients with mandibular flexure using the already taken OPG for various dental treatments.

MATERIALS AND METHODS:

The present study was conducted in the Department of Oral Medicine and Radiology of our college using the orthopantomogram taken in our department for various treatment aspects for the analysis of mandibular ramus flexure of both males and females (SRMU/M&HS/SRMDC/2021/PG/018).

The inclusion criteria are 1. Age: 18-60 years. 2. OPG without much distortion or artefacts and the exclusion criteria are 1. Age below 18 years. 2. Multiple posterior missing teeth and supra erupted posteriors. 3. Fracture lines evident or any developmental disturbances. 4. Systemic conditions affecting jawbone like hyperparathyroidism. 5. Restoration or prosthesis in the posterior teeth. 6. Bone loss in maxilla and mandible.

1089 OPGs were taken for assessment in January 21-June'21 out of which 416 were selected for the study, the details of the OPGs were concealed. The OPGs were given a number and were assessed. The observer was blinded and analysis was carried out. Each side of the ramus is scored either by -1, 0, or +. Finally, the scores from each side are added. **Total score = Score of Right Mandibular Ramus + Score of Left Mandibular Ramus.**

The total scores of -1, and -2 are to be females and 0,1,2 are to be males. The results were sent in for statistical analysis. A score of (+1) was given when the posterior margin flexure of one side ramus coincided with the occlusal plane height at that side(FIG-1). A score of (0) was given to a ramus in which the posterior margin was neither flexed nor straight(FIG – 2). A score of (−1) is given to a straight posterior margin ramus and also to a ramus in which the flexure of its posterior margin did not coincide with the height of the occlusal plane but is located either above or below the occlusal plane level, i.e., near the condyle or the mandibular angle (FIG – 3).

RESULTS:

Among the 452 individuals included in the study, 244 were females and 208 were males. Table 1 shows the distribution of age among the ramus shape score. The number of individuals was higher in the age group of 18-30 years of age. Ramus shape score of 2.00 was found to be higher in the age group of 31-40 years, followed by ramus shape -2.00 in the same age group The least sore was seen in ramus score of -1 and 1 in the group of 41-60 years of age. Table 2, shows the distribution of gender of the cohort among the ramus shape score. Among the females, the ramus score of 2 was found to be higher in 31- 40 years of age and 41-

50 years of age and the least in score of 1 was found in the age group of 31- 40 years. Among the males, the ramus score of 2 was found to be higher in 31- 40 years of age and least in the score of 1 was found in the age group of 31-40 years and no study individuals in the age group of 51-60 had a score of -2 and -1 in males and 1 in females. Graph 3 shows the overall distribution of ramus shape scores which clearly shows that higher individuals' ramus shape score of -2 at 28.4% followed by a ramus score of 2 at wiat4.8% and the least ramus score of 1 was seen among the study groups with 9.1% distribution. Table 3 shows the gender difference among the ramus shape score. P-value <0.05 was found to be statistically significant. While assessing the gender difference, P-value was found to be <0.01 which shows a highly statistically significant difference was found, which showed much difference among males and females in about ramus shape score.

DISCUSSION:

Forensic odontology is the utilization of dental information to give proof in the law enforcement framework. Measurable dental specialists are engaged with helping insightful offices to distinguish recuperated human remaining parts and recognize entire or divided bodies. Criminological dental specialists may likewise be approached to help with deciding the age, race, occupation, past dental history and financial status of unidentified casualties.

Since teeth are normally utilized as a weapon either to go after a casualty or as a demonstration of safeguard, dentistry assumes a key part in police examinations. In situations where indentations are tracked down on the body of a casualty or thought culprit (or even in food or different articles), the scientific odontologist utilizes a similar methodology to attempt to decide or reject likely wellsprings of the indentations. Dental tissues are extraordinarily impervious to fire and frequently stay in one piece even after an entombment - to this end they are seen as a significant piece of the proof[4].

There are various aspects of forensic dentistry analysis, starting from basic personal identification to DNA analysis. This study concentrated on the anthropology aspect of the mandibular flexure present in the ramus of the mandible. There were a few investigations performed on sexual dimorphism from various skeletal parts, which utilised different osteometric and morphological methodologies. The pelvis is the best skeletal marker for any sex assurance, while the skull is the second-best pointer because of its better conservation. The dimorphic highlights of the skull have preferred strength and toughness over other hard leftovers. The strategies utilized for sex assurance are grouped into atomic and morphological techniques. A

grown-up skull is like a sub-grown-up skull in sex assurance because of hormonal control on its development and bone improvement in the grown-up skull. The distinction in sexual orientation in the skull happens because of its changeability in bone turn of events and its powers. Subsequently, bone improvement in females is sooner than in guys, and there is an uncommon change in the presence of the female skull at the hour of pubescence. In this way, the morphological distinction among sexual orientations shows all the more promptly in the grown-up skeletons[6].

The use of the mandible as a tool for sexual dimorphism was followed by various authors after the use of pelvic advanced, dimorphism of the grown-up current human facial skeleton and the mandible has been noted in different populaces by various authors who examined the various aspects of the mandible (Ascadi and Nemeskery, 1970; Loth and Henneberg, 1996, 1998; Vidarsdottir and O'Higgins, 2001; Rosas and Bastir, 2002; Thayer and Dobson, 2010)[5]. This concept brought in a revolution in the usage of mandibles for sexual dimorphism other than the pelvis.

Here in this retrospective study, we analysed the mandibular ramus flexure of various OPGs to determine sexual dimorphism. This was first done by Loth and Henneberg in the year of 1996 when they concluded that there are the existence of flexure in males and an absence in females[7]. However, Koski et.al., also in the year 1996 contraindicated the statement produced by the former group with their report stating the opposite results by the presence of flexure in females and the absence in males[11].

Followed by which various authors pursued this concept to re-examine the hypothesis put forward by these two authors, and to date, there are two schools of thought concerning the concept of which gender has the presence of flexure in it. The authors who backed up Loth and Henneberg (Saini et al. 2011 and Shivaprakash and Vijaykumar 2014) or challenged (Oettlé et al., 2005; Hu et al., 2006). Also, another entity is still in discussion is that which gender has more sensitivity, one group claims for the males(Donnelly et al.; Haun; Hill; Kemkes-Grottenthaler et al., 2002; Balci et al.; Oettlé et al.; Shivaprakash and Vijaykumar) and the latter for females (James et al.; Suazo et al.; Tamer, 2012). But there was one concept everyone accepted was that only adult mandibles can be used for the identification of the presence of flexure and not the sub-adults[6].

There are likewise debates regarding the exactness of the ramus flexure as a mark of orientation in light of obsessive circumstances like Paget's sickness, acromegaly, and other foundational illnesses. The powers of rumination follow up on the muscles of

rumination particularly hoisting muscles and these powers are engaged with the renovating of the ramus.

Our study backed up Loth and Henneberg's stating that the presence of flexure in males and the vice-verse in females, also the sensitivity has more in males.

CONCLUSION:

Mandibular Ramus Flexure can be used in gender identification. The present study has sought after sensitivity and specificity which shows a moderately acceptable predictive accuracy, i.e., 67%. The mandible alone can be used as a separate entity for sexual dimorphism when they are measured with mandibular ramus flexure and other parameters for attaining a better accuracy in gender determination.

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TABLE 1: DISTRIBUTION OF AGE AMONG THE RAMUS SHAPE SCORE

AGE	18-30 YEARS		31-40 YEARS		41-50 YEARS		51-60 YEARS	
	N (241)	%	N (113)	%	N (51)	%	N (11)	%
-2.00	68	28.2	34	30.1	14	27.5	2	18.2
-1.00	46	19.1	12	10.6	8	15.7	1	9.1
.00	51	21.2	24	21.2	12	23.5	3	27.3
1.00	25	10.4	8	7.1	3	5.9	2	18.2
2.00	51	21.2	35	31.0	14	27.5	3	27.3

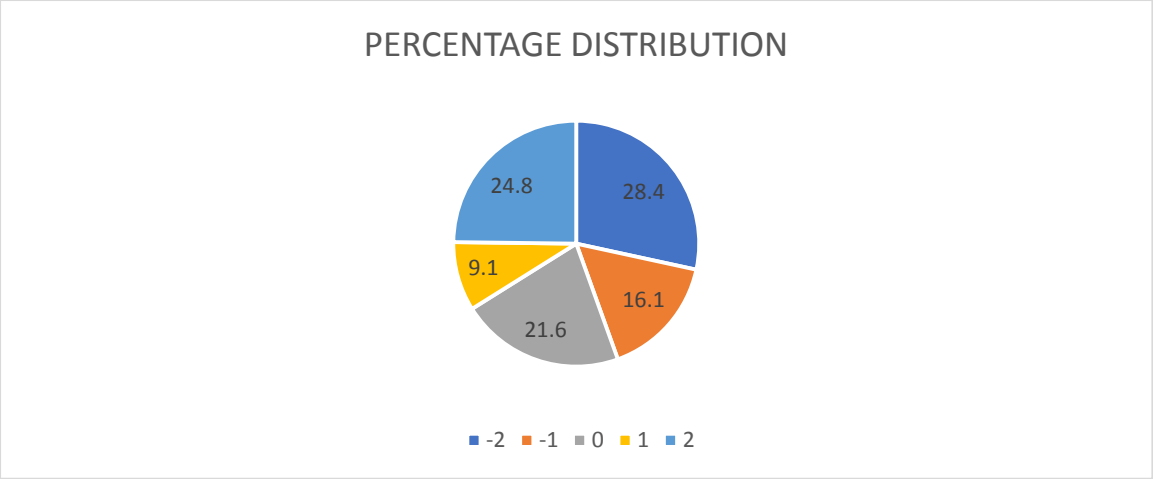
TABLE 2: DISTRIBUTION OF GENDER OF COHORT AMONG THE RAMUS SHAPE SCORE

AGE	FEMALES								MALES							
	18-30 YEARS		31-40 YEARS		41-50 YEARS		51-60 YEARS		18-30 YEARS		31-40 YEARS		41-50 YEARS		51-60 YEARS	
	N (126)	%	N (56)	%	N (51)	%	N (11)	%	N (115)	%	N (57)	%	N (25)	%	N (11)	%
-2.00	50	39.7	28	50.0	13	50.0	2	50.0	18	15.7	6	10.5	1	4.0	0	0
-1.00	42	33.3	11	19.6	8	30.8	1	25.0	4	3.5	1	1.8	11	44.0	0	0
.00	17	13.5	8	14.3	1	3.8	1	25.0	34	29.6	16	28.1	3	12.0	2	28.6
1.00	4	3.2	2	3.6	0	0	0	0	21	18.3	6	10.5	10	40.0	2	28.6
2.00	13	10.3	7	12.5	4	15.4	0	0	38	33.0	28	49.1	1	4.0	3	42.9

TABLE 3: GENDER DIFFERENCE AMONG THE RAMUS SHAPE SCOR

GENDER DIFFERENCE	VARIABLES					t	df	P-value
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
FEMALES -MALES	-1.56373	1.84654	.12928	-1.81864	-1.30881	-12.095	203	<0.01*

GRAPH 3: TOTAL DISTRIBUTION OF RAMUS SHAPE SCORE



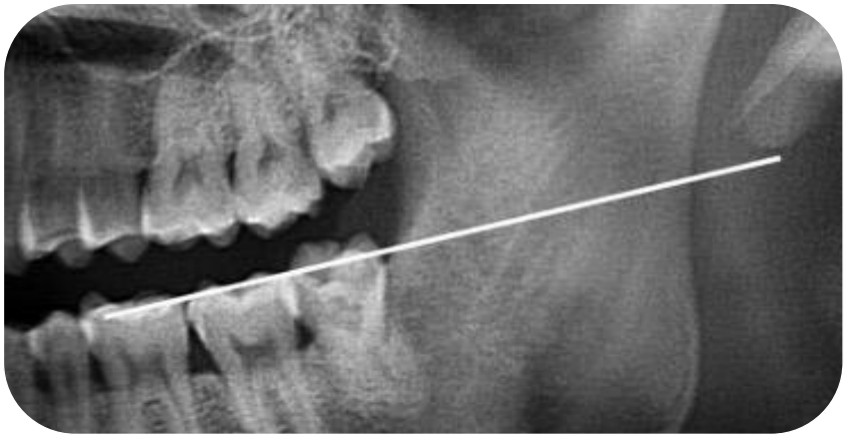


FIG-1: A score of (+1) was given when a posterior margin flexure of one side ramus coincided with the occlusal plane height at that side.

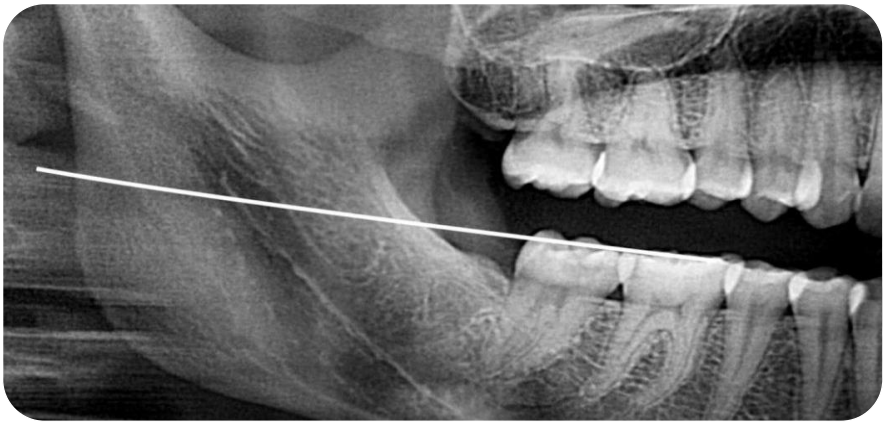


FIG – 2: A score of (0) was given to a ramus in which the posterior margin was neither flexed nor straight.

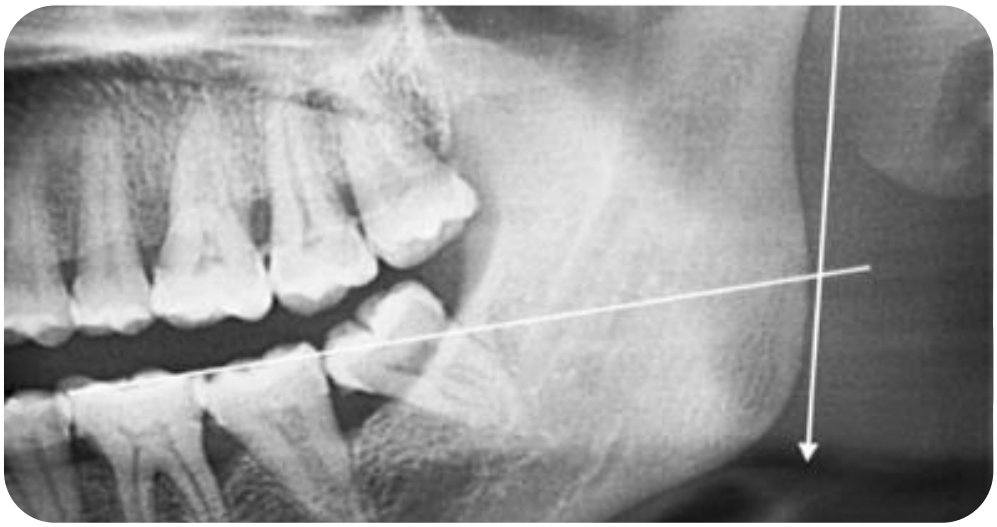


FIG – 3: A score of (−1) is given to a straight posterior margin ramus and also to a ramus in which the flexure of its posterior margin did not coincide with the height of the occlusal plane but is located either above or below the occlusal plane level, i.e., near the condyle or the mandibular angle.