GENDER BASED VARIATIONS IN MORPHOLOGICAL FEATURES OF MANDIBLE IN DIGITAL PANORAMIC RADIOGRAPHS - A COMPARATIVE STUDY

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CERTIFICATE BY HEAD OF THE DEPARTMENT / HEAD OF THE INSTITUTION

This is to certify that the Dissertation entitled "**GENDER BASED VARIATIONS IN MORPHOLOGICAL FEATURES OF MANDIBLE IN DIGITAL PANORAMIC RADIOGRAPHS - A COMPARATIVE STUDY"** is a bonafide work done by **Dr. S.ARULEENA SHAMINEY,** Post Graduate student (2014-2017) in the Department of Oral Medicine and radiology under the guidance of **Prof. Dr. G.V. MURALI GOPIKA MANOHARAN, M.D.S.** Professor, Department of Oral Medicine and Radiology, Tamil Nadu Government Dental College and Hospital, Chennai – 600 003.

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I, **Dr .S .Aruleena Shaminey** hereby declare that no part of the dissertation will be utilized for gaining financial assistance/any promotion without obtaining prior permission of the Principal, Tamilnadu Government Dental College and Hospital, Chennai 600003. In addition, I declare that no part of this work will be published either in print or in electronic media without the guide who has been actively involved in the dissertation. The author reserves the right to publish the work with the prior permission of the Principal and Guide, Tamilnadu Government Dental College & Hospital, Chennai 600003.

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LIST OF ABBREVIATIONS

DL	Disto Lingual
MB	Mesio Buccal
DB	Disto Buccal
ML	Mesio Lingual
PCR	Polymerase Chain Reaction
DNA	Deoxyribo Nucleic Acid
SM	Superior Margin
MF	Mental Foramen
IM	Inferior Margin
AC	Alveolar Crest
OPG	Orthopantomograph
AMEL gene	Amelogenin gene
CD- ROM	Compact Disc Read Only Memory
SPSS	Statistical Package for the Social Sciences

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ABSTRACT:

Background:

Identification of skeletal remains is of paramount importance in medico- legal investigations. Skeletal components which are often investigated for gender determination are the skull and pelvis with the mandible being a practical element to analyze gender variation in the fragmented bones. Presence of a dense layer of compact bone makes it very durable and well preserved than any other bone. When skeleton sex determination is considered, metric analyses on the radiographs are often found to be of superior value owing to their objectivity, accuracy and reproducibility.

Aims and objectives:

1. To measure the various morphometric parameters of the mandible in digital panoramic radiographs, determine variations in the morphometric parameters of the mandible, based on gender.

2. To correlate these findings in gender determination.

3. To find out which are the most reliable parameters in gender determination.

Materials and methods:

A retrospective study was conducted using panoramic radiographs of 100 males and100 females, which were taken using Orthophos XG machine 64 KV, 8mA and 14.1 seconds). Twelve parameters such as maximum ramus breadth, minimum ramus breadth, condylar height, projective height of ramus, coronoid height, height of mandible, superior margin of mental foramen to inferior border, inferior margin of mental foramen to inferior border, superior margin

of mental foramen to alveolar crest, gonial angle, antegonial angle and antegonial depth were measured on both sides on digital panoramic radiographs .Measurements were made using mouse driven methods and anatomical landmarks. Statistical analysis was done.

Results:

There was significant difference in these parameters with p value < 0.05

Conclusion:

This study shows strong evidence that mandibular measurements using panoramic radiographs were reliable for gender determination and the projective height of the ramus is the most significant of all the parameters, which may be used for gender determination using the mandible.

Key words:

Mandible, Sexual dimorphism, Panoramic radiographs.

INTRODUCTION:

Forensic odontology is that branch of dentistry which deals with the proper handling and examination of dental evidence and with the proper evaluation and presentation of dental findings in the interest of justice[1]. This branch has been utilized for many years for the identification of victims and suspects in mass disasters, abuse and organized crimes[2]. Forensic odontology embraces all dental specialities and forensic dental field work requires an interdisciplinary knowledge of all dental specialities. The widely accepted classification of forensic odontology is based on the major fields of activity i.e. civil, criminal and research by Avon[3].

Determination of sex using skeletal remains presents a great problem for forensic experts especially when only fragments of the body are recovered [4].

The identification of human skeletal remains is considered an initial step in forensic investigations and is crucial for further analysis[5]. In the adult skeleton, sex determination is usually first step of the identification process subsequent methods for age and stature estimation are sex dependent. The reliability of sex determination depends on the completeness of the remains and the degree of sexual dimorphism inherent in the population[5.] When the entire adult skeleton is available for analysis, sex can be determined up to 100% accuracy, but in cases of mass disasters where usually fragmented bones are found, sex determination with 100% accuracy is not possible and it depends largely on the available parts of skeleton.

The relative development (size, strength, and angulation) of the muscles of mastication is known to influence the expression of mandibular dimorphism as masticatory forces exerted are different for males and females[6]. Humphrey *et al* . showed that the sites associated with the greatest morphological changes in size and remodeling during growth, mandibular condyle, and ramus in tend to show higher sexual dimorphism, and differences between the sexes are generally more marked in the mandibular ramus than in the mandibular body[7].

In case of a dead person, postmortem changes such as decomposition, mutilation or skeletonization may make identification progressively more difficult almost to the point of impossibility[8]. Dry skull's orthopantomography (OPG) are frequently used on scientific research or forensic investigations. Dental methods are considered to be a reliable tool when other identification methods fail[9]. Sex determination analysis can be done either by morphological analysis or by molecular analysis. Morphological analysis can be done on hard tissues (odontometric, orthometric, and miscellaneous) of oral and paraoral regions or soft tissue (lip prints- Cheiloscopy, palatal rugae pattern- Rugoscopy).A number of identification techniques are used by forensic dentists, including rugoscopy, cheiloscopy (lip prints), the obtainment of imprints, or the use of molecular techniques such as polymerase chain reaction (PCR) for analyzing the DNA contained in dental pulp tissue[10]. Typical antemortem dental records may include radiographs, dental charts (odontograms), both intraoral and/or extra oral photographs, dental casts, and notes.

Dentofacial radiography has become a routine procedure in the dental, medical, and hospital clinics. The radiographs are taken at different periods during the lifetime of large segments of the population[11].In forensic anthropology, comparison of ante mortem and postmortem radiographs is one of the cornerstones of positive identification of human remains. Ante mortem orthopantomograms may be of great value in the identification of human remains[12].

Mandible is the largest, strongest and movable part of the skull. Mandible identification is important in medico-legal and anthropological work[13]. But in cases where intact skull is not found, mandible may play a vital role in sex determination as it is the most dimorphic, largest, and strongest bone of skull [4,5 6,14]. The morphological features of mandible are commonly used by anthropologists and forensic dentists in the determination of sex[15].

The mental foramen is fairly well depicted in panoramic radiographs[16].It provides the ability to view the entire body of the mandible and allows a more accurate location of the mental foramen in both horizontal as well as in vertical dimensions. Digital panoramic radiographs can be used to determine vertical height measurements of the mandible[17].Measurements of the mandibular ramus tend to show higher sexual dimorphism and differences between the sexes are more marked in the mandibular ramus than mandibular body[7].Methods based on measurements and morphometric are accurate and can be used in determination of sex [18].

This study measures various parameters like maximum ramus breadth, minimum ramus breadth, condylar height, projective height of ramus, coronoid height, height of mandible, distance between the superior margin of mental foramen to inferior border, inferior

margin of mental foramen to inferior border, superior margin of mental foramen to alveolar bone, gonial angle, antegonial angle and antegonial depth and to find out which of these parameters is more accurate in gender determination. Hence this study aims to evaluate the usefulness of morphological features of the mandible as seen in digital panoramic radiographs in sex determination and propose the use of the same in forensic analysis.

Aim:

To study the various morphometric variations in the mandible using digital panoramic radiographs in male and female subjects and its application in gender determination.

Objectives:

1. To measure the various morphometric parameters of the mandible in digital panoramic radiographs, determine variations in the morphometric parameters of the mandible, based on gender.

2. To correlate these findings in gender determination.

3. To find out which are the most reliable parameters in gender determination.

REVIEW OF LITERATURE

DEFINITION:

Forensic odontology is an interdisciplinary field between forensic medicine and dentistry. It is that branch of dentistry which is concerned with the practice of the law and administration of justice[19].

It involves the correct collection, management, interpretation, evaluation, and o presentation of dental evidence for criminal or civil legal proceedings: a combination of various aspects of the dental, scientific, and legal professions[20].

Forensic Odontology is an important component of modern day investigations for the identification of people in mass disasters, accidents, or where the victim's bodies cannot be recognized by visual methods. The natural teeth are the most durable organs in the bodies of vertebrates, and humankind's understanding of their own past and evolution relies heavily upon remnant dental evidence found as fossils. Methods of human identification that are radiographs clinical photographs, study models results of specific tests, prescriptions[21.]

HISTORY:

Earliest dental identification; Dental findings for identification have been used for more than 2000 years. The first recorded case was made in 66 A.D when Nero's mistress Sabina got his wife killed by soldiers and demanded to see the head of the victim in a dish. She recognised the head by a black anterior tooth.

First dental identification by a dentist; Luntz L and Luntz P presented a case of 1775 in 1972.The first forensic odontologist in the United States was Dr.Paul Revere who

identified the extreme body of Dr. Joseph Warren, a revolutionary the British in 1775 through the bridge of silver and ivory that he had constructed.

First dental identification reported in India: M. Raja Jayachandra Rathore of Canouj, died on the battle field in 1191.His body was identified by his false anterior teeth. This was the first case identified in India and reported by Sansore K and Dayal PK in 1995.

First dental identification accepted by law: It was admitted in United States court system which took place in Boston in 1849[3].

Dr. Oscar Amoeda, Professor at a Dental School in Paris presented a paper entitled 'The role of the dentists in the identification of the victims of the catastrophe of the Bazaar de la Chartie, Paris, 4th May 1897'' at the International Medical Congress of Moscow, he included many of the concepts of dental identification used in the above disaster in his blood '***L" Art Dentaire enmedicine Lagale"*** published in 1898. It was he who suggested the need for an Internationals System of Uniform Charting and a Mutual Understanding of Nomenclature. He is considered as "Father of Forensic Odontology"[22].

Advertisements, especially in professional journals, were found to be helpful in assisting the coroner in identifying the victim. It was first used in 1939 by Commissioner Edward J Hickey , who advertised in Journal of American Dental Association. It was seen by a Massachusetts dentist who recognised the bridge constructed by him leading to the identification of victim[22].

Interest in forensic dentistry was relatively dormant until the 1960s when renewed interest was sparked by the first formal instructional program in forensic dentistry given in the United States at the armed forces institute of pathology. Since then the number of cases reported has expanded to such an extent that the term 'forensic

odontology' is familiar, not only to the dental profession, but also to law enforcement agencies and other forensic groups.

Dentition was an important lead in the identification of the remains of various leaders who were killed like Zia Ul Haq, former Pakistani president (1988) and Rajiv Gandhi,(1991) former Indian Prime minister[23].

In 1966 Gustafson wrote a comprehensive textbook ' Forensic Odontology' which was considered as the Bible in its time[23]. The first format instruction program in forensic dentistry was started at the Armed Forces Institute of Pathology in US in the sixties.

Areas of forensic odontology:

It involves antemortem dental identification, postmortem dental identification ,postmortem dental profiling and bite mark investigation .

Antemortem dental identification:

An antemortem dental record contains written notes, charts, diagrams, dental and medical histories ,radiographs, clinical photographs, study models, results of specific tests, prescriptions, and referral letters and other information. Their accuracy and availability have a huge impact on the speed and efficacy of identification. Problems arise when the dental records are incomplete, irregular ,lost or damaged and have radiographs in poor quality.

Dental records of good quality are an essential part of patient care, a medico-legal requirement and are necessary for dental identification. A forensic dentist records the postmortem records completely by charting down the dental findings and taking photographs and radiographs. On completion a comparison between the two is carried

out, similarities and discrepancies are noted on the comparison and a result is established[24].

POSTMORTEM DENTAL IDENTIFICATION:

In India, qualified forensic odontologists are very few .An effort should be made to create awareness among dental practitioners about the role of dental surgeons in person identification and to awaken the response for maintaining dental records of all patients .

Firstly, the most frequently performed examination is a comparative identification, used to find the remnants of a decedent and a person represented by ante mortem dental records are of the same individual.

Secondly, when dental records are unavailable and other methods of identification are not feasible, the forensic odontologist can often produce a picture of the general features of the individual.

In such a situation a dental profile of the individual is developed to aid the search for the individual's identity. This is known as postmortem dental profiling[25].

Post mortem dental profiling:

A dental profile will typically give information on the deceased's age ,ancestry background ,sex and socio economic status.

A.**POPULATION DIFFERENCE/RACE / ETHNICITY:**

Dentists with the help of forensic anthropologist can determine the sex and ancestry from skull shape and form. A forensic dentist can determine race with in three major groups :Caucasoid ,Mongoloid and Negroid based on the skull appearance. Additional

Characteristics such as cusps of carabelli, shovel shaped incisors and multicusped premolars can also help in determination of ancestry[26].

Ancestry can be assessed by studying the facial skeleton and comparing the features with the main characteristics of the three racial groups: Mongoloid, Negroid, and Caucasoid.

Individuals that belong to the Caucasoid or 'White' group may be found in America, Europe, the Near East, India and North Africa. The Negroid or 'Black' group is found in sub –Saharan Africa and the Mongoloid or 'Asian' group consists of the Native American groups and the people of the Far East.

Caucasians: They have long narrow faces with retreating zygomatics, sloping orbits and lack of prognathism. Their nasal aperture is narrow with a pronounced nasal spine.They also have narrow 'v' shaped arch and cusp of carabelli is seen among 37% of cases.

Mongoloids: They have flat face, rounded orbits and pronounced zygomatics with shovel shaped incisors, prominent marginal lingual ridges, more width of anterior crowns ,and tubercle on buccal cusp of premolars(Dens Evaginatus).

Negroids: Height of the vault of negroids is reduced .There is post bregmatic depression, square orbits and pronounced prognathism. Nasal aperture is very wide and the nasal spine very slight. Midline diastema and third molars are always present and are rarely impacted[27].

B.**SEX DIFFERENCES:**

Sex determination is usually based on cranial appearance, as no sex differences are apparent in the morphology of teeth[28].

By skull in the male, supra-orbital ridges, glabella,mastoid process and the malar areas become more prominent in contrast to the female.

In the female, the orbits are more rounded, have sharper margins and are relatively larger compared to the upper facial skeleton than in the male.

In males the gonial angle formed between the body and ramus is less obtuse than in the female.

Rocker shaped mandible predominated in males (68.1%), whereas most females (84.6%) exhibited a straight mandible[29].

The shape of the chin in most males was generally bilobate or square where as the chin in females was either square or pointed[30]

Minute quantities of DNA even from very old tooth specimens are helpful in determining the sex. Ameloblasts of the enamel secrete amelogenin (AMEL gene) which is present in the X and Y chromosome of humans, females have two identical AMEL genes (XX) and males have two non identical AMEL genes(XY).

Discrimination of male and female is based on the length of the base pairs of the gene which is 106 and 112 for X and Y respectively. A sample which shows two discrete bands of 106 and 112 is identified as male and a female sample appears as a single band of 106 for the amelo gene[26]. In 1934, Sedwick suggested vertical height of maxillary sinus is less in Indians comparative to Caucasians .In 1957, Lasker and Lee have referred to the pulp cavity in the Mongoloid race as exceptionally wide and deep. By teeth gender can be determined diagonal distances of teeth. Canine crown diameters are useful in gender determination by odontometric analysis. Each tooth was measured in four different dimension distolingual –mesiobuccal (DL-MB) and distobuccal –mesiolingual (DB-ML).

A digital vernier caliper is used and vernier caliper held parallel to the occlusal surface of crown[15].

C.**AGE ESTIMATION:**

Teeth act as a reliable tool in estimation of age. Eruption sequence ,neonatal line formation ,incremental lines of Retzius, Schour and Massler chart and Gustafson's method are parameters used for age estimation .The use of radiographs is ideal to determine the stages of mineralization ,degree of formation of root and crown structures ,and stages of eruption which are reliable and helpful in predicting the age of an individual[1].

BITE MARK INVESTIGATION:

Bite mark is a vital evidence in case of crime and abuse and can go unnoticed by untrained individuals. Recording, comparing and determining whether the mark is truly a result of biting is important for a forensic odontologist. Knowledge on the arch alignments and specific tooth morphology of animals is also required for forensic odontologists to distinguish human bites from non human.

Bite marks are usually documented taking photographs or taking impressions. Measuring the size of the tooth of the suspect and comparing it with bite marks can be done with metric analysis. The amount of details recorded on the surface may vary in each case. When a good impression of the bite is left behind the physical characteristics like distance from cuspid to cuspid, shape of the arch, evidence of malalignment, spacing, teeth width and thickness, missing teeth and wear patterns are taken into consideration for comparing bite mark wound and suspect's teeth.

Bite mark Analysis:

Bite can be defined as the mark made by human or animal teeth in the skin of alive people, cadavers or unanimated objects with relatively softened consistency[31].

Classification of Bite Marks:

A. Cameron And SIMS Classification:

This is based on the type of agent producing the bite mark and material exhibiting it.

1. Agents:

a) Human

b) Animal

2. Materials:

a) Skin, body tissue

b) Food stuff

c) Other materials

B. Mac Donald's Classification:

a) Tooth Pressure Marks: Marks produced on tissues as a result of direct application of pressure by teeth. These are generally produced by the incisal or occlusal surfaces of teeth.

b) Tongue Pressure Marks: When sufficient amount of tissue is taken into mouth, the tongue presses it against rigid areas.

c) Tooth Scrape Marks: These are caused due to scraping of teeth across the bitten material. They are usually caused by anterior teeth and present as scratches or superficial abrasions [32].

C. According To Degree of Impression:

a) **Clearly Defined** - significant pressure

b) **Obviously Defined** - first degree pressure

c) **Quite Noticeable** - violent pressure

d) **Lacerated** - skin violently torn from body[33].

Besides the agent identification, bite mark analysis, in a forensic investigation, can elucidate the kind of violence and the elapsed time between its production and the examination. Newer techniques that have enhanced bite mark identification include application of electron microscopy and computer enhancement technique. There are many drawbacks of bite mark analysis. The size of the bite mark may shrink in size in a relatively short duration (10-20 minutes) and this necessitates their recording at the earliest possible time.

Dentists should be in a position to explain the obstacles, which interfere with accurate analysis and apply the bite mark evidence consistent with scientific principles while reporting bite mark evidence[3].

Sex determination in Forensics:

Sex determination is a sub discipline of the forensic sciences and is an important part of every identification process, especially when information relating to an individual is unavailable.

In the specialty of forensic odontology, dentistry plays a small, but significant role in this process[34].

Forensic odontologists can usually determine the sex, race and age (at the time of death) from careful study of the teeth, their anatomical arrangement and the skull's osteological features.

The different methods employed in forensic dentistry include anthropology, rugoscopy, cheiloscopy, tooth prints, dental DNA analysis, radiographs, etc.

Forensic anthropology:

The role of the physical anthropologist is to describe biological variation and explain it in terms of adaptation, evolution, and history. As teeth are under strong genetic control and are also the only hard part of the skeleton directly exposed to the environment, this variation takes different forms[35]. Genetic information is sought in the size, shape, and morphology of teeth, along with numerical deviations away from a species' dental formula. Dental anthropologists are concerned with genetic and environmental variation provided by teeth, which are the objects of study.

As teeth are extremely hard and durable, it is not surprising that they make up a significant portion of the fossil record.

Rugoscopy:

The palatal rugae have been considered relevant for human identification due to its stable, being equivalent to the fingerprint, unique for each individual. The anatomical position of the rugae inside the oral cavity (surrounded by cheek, lips, tongue and the buccal pad of fat) also give some protection in cases of trauma or incineration. When identification of an individual by other methods is difficult, palatal rugae may thus be

considered as an alternative source of information (usually if comparative material is available) enabling the search field to be narrowed.

The study of palate in general is called as Palatoscopy and the study of the patterns of the grooves and ridges (rugae) of the palate to identify individual patterns is called as Rugoscopy. Palatal rugae comprise about three to seven ridges radiating out tangentially from the incisive papilla.

Classification of Lysell (1955)[36]

A) The rugae were classified based on their size of length as

• Primary: 5mm or more

• Secondary: 3 to 5 mm

• Fragmentary: 2 to 3 mm

B) The rugae were divided into four types based on

their shape as

• A= curved

• B= wavy

• C= straight

• D= circular

Thomas and kotz[37]from their studies concluded that different patterns of rugae are genetically determined, and so can be rather used in population differentiation than individual identification. There are different ways to analyze the palatal rugae. Intraoral inspection is probably the most used and most easy, economic method. However, this can create difficulties if a future comparative review is required. While observing the shape of the rugae is a subjective process, it is relatively easy to record and does not require

complex instrumentation. The pattern of the rugae is considered unique to an individual and can be used as reliable method in postmortem cases.

Lip prints (cheiloscopy):

Lip prints are normal lines and fissures in the form of wrinkles and grooves present in the zone of transition of human lip, between the inner labial mucosa and outer skin, examination of which is known as cheiloscopy.

Fischer was the first anthropologist to describe the furrows on the red part of the human lips. The use of lip prints were first recommended as early as in 1932 by Edmond Locard (1877-1966). One common problem that is encountered during the cheiloscopic studies is that of smudging or spoiling of lip prints leading to unidentifiable marks.

Classification of cheiloscopy by Augustine et al (2008)[38]following Suzuki and Tsuchihashi classification (1970)

Type I Complete vertical

Type I Incomplete vertical

Type II Branched

Type III Intersected

Type IV Reticular

Type V Irregular.

DNA Methods:

Dental structures are relatively more resistant to higher temperatures. Techniques involving DNA in Forensic Dentistry offers a new tool when traditional identification methods fail due to the effects of heat, traumatism or autolytic processes, as well as in

distortions and difficulties in analysis[39]. Polymerase Chain Reaction is an enzymatic amplification of a specific DNA sequence, aiming millions of copies production from this sequence in a test tube, which was first described by Kary Mullis, in the late 1980's, and enabling a new strategy of gene analysis though a simple and fast method, excusing all the laborious stages of genic cloning[39].The method using PCR enables the distinction of a subject among the other ones with a high level of reliability, starting by 1ng (nanogram), equivalent to a single part in a billion grams, of the DNA target[40].Saliva is a very useful DNA source due to the fact of being collected by painless and non-evasive way.

Forensic anthropometry:

Academic anthropologists investigate the evolutionary significance of differences in body proportion between populations whose ancestors lived in different environmental settings. Human populations exhibit similar climatic variation patterns to other large-bodied mammals, following Bergmann's rule, which states that individuals in cold climates will tend to be larger than ones in warm climates, and Allen's rule which states that individuals in cold climates will tend to have shorter, stubbier limbs than those in warm climates.

Sex Determination:

Several authors have examined the ability to determine gender using odontometric analyses. A famous study by Rao et al. uses the mandibular canine index to determine sex, although another study has issued a caution in using this technique[41, 42]. Another study, using dental casts of children, showed that the teeth, and in particular the canines were larger in males than females. The first is a microscopic technique in which the pulp

tissue is examined for Barr bodies (present only in females). The second method is based upon PCR analysis of DNA, sourced from the dental pulp, and the subsequent analysis of the amelogenin gene for sex determination. Females, and suggested this method for determining gender in children whose secondary sexual characteristics had not develop[43].

Forensic Radiology:

Forensic radiology, as do all other academic and scientific disciplines, rests on the sometimes unsteady four legged stool of service, education, research and administration. As the fields of diagnostic radiology has undergone rapid expansion in technology and utilization in the past quarter century, so may the range of forensic applications burgeon in the near future.

It is common practice to obtain radiographs as part of postmortem examinations in order to locate foreign bodies or document fractures or other injuries[44] .The stage at which radiology is implemented during autopsy varies according to the individual circumstances, but usually it is after the external examination and prior to the dissection[12].The utilization of radiographs in identification is valuable if sufficient antemortem records are available. Various morphological and pathological alterations can be studied from the radiographs. Crown and root morphology aids in identification. The presence of decayed, missed, filled, and fractured teeth, various stages of wound healing in extraction sockets, degree of root formation, and bone trabecular pattern in the jaws aid in identification.

The following fields are the main areas of interests harboring tremendous scope in forensic radiology.

A.Service

1. Determination of identity.

2. Evaluation of injury and death

a .Accidental

b. Non accidental

1. Osseous injury

2. Missiles and foreign bodies

3. Other trauma

4. Other causes

3. Criminal Litigation

1. Fatal

2. Non fatal

4. Civil Litigation

1. Fatal

2. Non fatal

B.Education

C.Research

D.Administration

The analysis of the digitized images of the available radiographs for the volume measurements has provided new pathways in the field of gender determination. Various digital radiology techniques can be found in the literature, but essentially the method comprises of the following steps:

(1)Radiographic image digitization with the aid of a scanner or video camera, or image acquisition directly from the X –ray system, coupled with a computer with monitor, printer and CD-ROM recorder.

(2) Image processing through the appropriate software, with resources for image rotation, translation and scaling without the necessity of new exposures.

GENDER DIFFERENCES IN THE SKULL:

According to Krogman et al 1962, the degree of accuracy in sexing the adult skeleton is

Entire Skeleton 100%

Pelvis alone 95 %

Skull alone 90%

Pelvis and Skull 98%

Long bones alone 80%

Parameters	**Male**	**Female**
General size	Large endocranial volume>200cc	Small lighter with thinwalls
Architecture	Rugged	Smooth
Glabella	More pronounced	Less pronounced
Orbits	Square ,lower, smaller with rounded margins	Rounded, higher, larger
Supraorbital ridges	Prominent	Less prominent
Forehead	Steeper and less rounded	Vertical, round and fantile
Frontonasal junction	Distinct angulation	Smoothly curved
Cheek bones	Heavier, laterally arched	Lighter and more pronounced
Zygomatic arch	More pronounced	Less pronounced
Frontal eminence	Small	Large
Parietal eminence	Small	Large
Occipital area	Muscle lines and protuberance marked	less marked
Mastoid process	Medium to large round and blend	Small to medium smooth and pointed
Condylar facet	Long and slender	Shorter and broad
Occipital Condyles	Large	Small
Palate	Larger, broader, U shaped	Small and parabola shaped

Frontal Sinus	Well developed	Less developed
Nasal aperture	High and narrower margins and sharp	Lower and broader
Foramina	Larger	Smaller
F.magnum	Large and long	Small and round
External auditory meatus	Bony ridge along the upper border is prominent	often absent
Chin	Square	Rounded

GENDER DETERMINATION USING MANDIBLE:

The identification of skeletal remains is of paramount importance in medico-legal investigations. The skeletal components most often investigated for gender determination are the pelvis and skull, with the mandible being a practical element to analyze sexual dimorphism in the fragmented bones. Presence of a dense layer of compact bone makes it very durable and well preserved than many other bones.

Mandible is a dimorphic bone of the skull and has aided in determining the sex as well as the age of an individual.

The mandible is a Latin word which means lower jaw. 'Mandere' means to chew. Thus the word mandible is derived. The mandible is a U-shaped bone. It is the only mobile bone of the facial skeleton, and, since it houses the lower teeth, its motion is essential for mastication. The mandible is composed of 2 hemi mandibles joined at the midline by a vertical symphysis. The hemi mandibles fuse to form a single bone by age 2 years. Each

hemi mandible is composed of a horizontal body with a posterior vertical extension termed the ramus [45]. The ramus extends vertically in a postero superior direction posterior to the body on each hemi mandible. The mandibular angle is formed by the intersection of the inferior rim of the body and the posterior rim of the ascending ramus. The inferior borders of mandibles from males tended to be rocker shaped whereas inferior borders of mandibles from females tended to be straight.

The mandible is the largest, strongest and lowest bone in the face. Mandible retains its shape better than other bones, so it plays an important role Forensic osteology and Anthropological works. Mandibular condyle,as well as the ramus of the mandible, have particularly shown sexual dimorphism.

There are various differences in mandible of male and female. In males the lateral aspect of the angle of the mandible shows rough or rigid appearance. In females the angle of the jaw is often more rounded and gracile in construction. The male mandible tends to have a square shape. Mandibles tend to have a pointed chin. Mandible in the male is closer to a right angle than female .In the female, the ramus, is an obtuse angle to the jaw bone. The ramus in the mandible is wider and larger. The inferior borders of mandibles of males tended to be rocker shaped whereas inferior borders of mandibles from females tended to be straight[46].

GENDER DIFFERENCES IN MANDIBLE:

Features	Male mandible	Female mandible
Size	Larger and thicker	Smaller and thinner
Height of the body	Greater	Lesser
Angle of mandible	Everted	Inverted

Gonial angle	Less obtuse (125)	More obtuse
Inferior border of mandible	Irregular	Smooth
Condyles	Larger	Smaller
Ascending ramus	Greater breadth	Smaller breadth

Sex determination based only on characteristics of teeth and their supporting structures had been a difficult task where as X-ray examination of the mandible gives definitive information about the sex. The mandibular condyles are smaller in females. By radiological examination sex determination of skull is possible to the extent of 88 percent[47]. Mandible and its variations in age, sex and race will help physicians, surgeons, medico-legal authorities and anthropologists to give correct interpretations for the results of diagnostic procedures in living.

Application of radiology in forensic sciences was introduced in 1896, just one year after the discovery of X-Ray by Roentgen to demonstrate the presence of bullets inside the head of a victim.

Digital panoramic radiographs can be used to determine age and sex. Mandibular ramus can be used to differentiate between sexes and it also expresses strong univariate sexual dimorphism. When skeleton sex determination is considered, metric analyses on the radiographs are often found to be of superior value owing to their objectivity, accuracy, and reproducibility.

GENDER DETERMINATION USING MANDIBLE – ANTHROPOMETRIC MEASUREMENTS:

The earliest contributions to mandibular morphometrics were aimed not simply at documenting population and sex differences in mandibular morphology, but rather at using mandibular measurements as a vehicle to explore and develop new statistical methods and techniques (Martin 1936;Morant et al. 1960)[7]

Giles and Eliot (1964)[48] measured 265 mandibles of known sex using anthropometric measurements in American population and reported that mandibular ramus height maximum ramus breadth and minimum ramus breadth as highly significant.

Humphrey et al (1999)[7] conducted a study in 317 modern humans and 91 apes to study the morphological variation .They stated that that almost any site of mandibular bone deposition, or resorption, or remodeling for that matter, seems to have a potential for becoming sexually dimorphic.

Franklin D, et al (2008)[6] conducted a study to perform a comprehensive analysis of sexual dimorphism in the mandible of Black South Africans. They incorporated individuals from a selection of the larger local population groupings with the primary aim of producing a series of metrical standards for the determination of sex. The sample analyzed comprised 225 non-pathological mandibles of Black South African individuals. All of the measurements examined are found to be sexually dimorphic; the dimensions of the ramus and corpus lengths are most dimorphic. The sex classification accuracy of the discriminant functions ranged from 70.7 to 77.3% for the univariate method, 81.8% for the stepwise method, and 63.6 to 84% for the direct method.

Duric M et al (**2008**)[8]tested the applicability of morphological methods for sex assessment, based on seven pelvic and nine cranial traits, using contemporary Balkans population. The material involved in the study comprises 262 pelvic bones and 180 skulls of male individuals. Sex was correctly estimated by the experienced anthropologist in 100% of individuals using all of the 16 pelvic and cranial criteria. Looking at the skull alone, sex was correctly determined in 70.56% cases. It was shown that the most accurate single indicators among cranial methods was the robustness of the mandible (with accuracy of 70.93%),while the sharpness of the supraorbital margins was the least reliable indicator demonstrating accuracy in only 28.75% of crania. They conclude that the mandible is a very useful element for sex determination in this population.

Saini et al (2011)[4] conducted the study on 116 dry adult human mandibles and the parameters were measured using sliding calipers. The ramus showed greatest univariate sexual dimorphism in terms of coronoid height followed by condylar height. The best parameters for males were coronoid height and condylar height and projective height for females. Measurements of the height of mandibular ramus tend to show higher sexual dimorphism than the measurements of body height and breadth, thus emphasing sex differences are more pronounced in mandibular ramus than body.

Mihai et al(2013)[49]in an study on 100 Romanian Population used three measurements- chin height, bigonial width and bicondylar breadth to evaluate whether or not an increase in the sample number (200 mandibles) can produce a different discriminant function that will allow similar accuracy rates, but with fewer measurements. In their study they concluded. The most dimorphic singular

measurement was bigonial width, which provided a discriminant function with 80.5% accuracy when used alone.

Punarjeevan etal (2013)[50]in his study on 80 human mandible bones to to study the morphological and morphometric features by using 22 different parameter, they concluded that mandible of unknown gender can be sexed to the extent of 75% accuracy by six dominating parameters and not to consider these for complete sex determination of the mandible bone in osteometric studies. Six dominating parameters that explained the nature of the mandible are height of the ramus, body thickness, anthropometric arch width, inter incisor width, mandibular index and mandibular angle.

Anupam Datta et al (2015)[51] conducted a study in 50 adult mandibles to analyse sexual dimorphism in the mandible of South Indian population. They measured following parameters such as Gonial angle, Bigonial width, Height of ramus, Bicondylar breadth, Mandibular length, Length of lower jaw, Mandibular index, Body thickness, Coronoid height, Bimental breadth, Symphyseal height and Body height using Mandibulometer and Digital Vernier caliper .The Gonial angle, Bigonial width, Height of ramus, Bicondylar breadth, Mandibular length, Length of lower jaw, Body thickness, Coronoid height, Bimental breadth, Symphyseal height and Body height showed statistically significant gender difference.

Tejavathi Nagaraj (2016)[29] conducted a study in 90 adult dry mandibles they analysed the non parametric features of mandible such as the inferior border of mandible, shape of the chin and shape of coronoid process bilaterally.They concluded that

male mandibles showed rocker-shaped predominantly (58.9%), whereas about (41.1%) of female mandibles exhibited a straight inferior border of the mandible. The shape of the chin in most of the males was bilobate (45.5%), square (43.6%), whereas female mandible had pointed chin (71.4%). Shapes of coronoid process observed were hook in (27.8%), rounded (31.1%), and triangular (41.1%) with $P < 0.05$ which indicated statistical significance.

GENDER DETERMINATION USING MANDIBLE – RADIOGRAPHIC MEASUREMENTS:

Analyzing panoramic radiographs was introduced by **Levandoski** in 1991and various methods have been made on this subject for forensic purposes[52].The material of this study consisted of lateral cephalograms and panoramic radiographs obtained from 30 patients. They concluded that panoramic radiographs provide information on the vertical structures of the craniofacial structures.

Schulz et al[53] **(2000**) studied a series of 70 digital panoramic radiographs of a dry skull and it was shown that the most reliable measurements were obtained of linear objects in the horizontal plane and digital measurements were sufficiently accurate for clinical use.

Xie et al (2004) and **Sujoy *et al*** **(2009**) conducted a study in 1000 patients to find out Changes in the gonial angle in relation to age, gender, and dental status were studied and they noted gonial angle was higher in females and males[54,55].

in Indian and other populations.

Oettle etal(2005)[56]conducted a study to find differences between male and female mandibular rami using the computerized method of geometric morphometrics in twenty-eight mandibular rami of black females and 43 of black males. They concluded that mandibular condyle and ramus in particular are generally the most sexually dimorphic as they are the sites associated with the greatest morphological changes in size and remodeling during growth.

Kambylafkas and Schulz(2006) conducted a study to evaluate the accuracy of panoramic radiographs for diagnosing vertical asymmetry of the posterior mandible and they stated that differences between the sexes are marked in the mandibular ramus than in the mandibular body[57].

Upadhay (2012)[58]et al conducted a study to evaluate relationship between complete loss of teeth and changes in the gonial angle in variation in gonial angle with age and gender. They stated that gonial angles in males were greater than females.

Indira et al (**2012)**[59] conducted a retrospective Study using orthopantomographs of 100 patients, and the mandibular ramus measurements were carried out using Masterveiw 3.0 software. The mandibular ramus demonstrated greatest univariate sexual dimorphism in terms of minimum ramus breadth, condylar height,

followed by projective height of ramus. Thus, strongly suggesting the use of mandibular ramus as an aid in gender determination in forensic analysis.

Sandeep Singh et al (2013)[60] conducted a study to evaluate the utility of orthopantomography for human identification and propose a coding system for orthopantomogram (OPG), which can be utilized as an identification tool in forensic sciences. They concluded that Records of the dental hard tissues from a coded panoramic radiograph could serve as an ante-mortem and post-mortem comparative tool for forensic identification of an individual.

Shiva kumar et al (2013)[61] conducted a study to evaluate various measurements of mandibular ramus, mental index and their relationship to sex and also the usefulness of these parameters in sex determination. They concluded that coronoid height and the mental index can be used effectively in identification of sex where as maximum and minimum breadth of ramus of the mandible can be used for sex determination only in older age group and for the age determination can be used only for females.

Pokhrel R et al (2013)[62] studied a total of 158 rami out of which 79 intact mandibles of known sex were obtained. Two parameters for mandible and two parameters for condyle were taken. The predictive value yielded by condyle was low and required further studies for it to be used as a forensic tool. Minimum and maximum ramus breadth

showed very promising results and hence can be used for sexing from the ramus of the mandible in the population.

Moni Thakur et al (2014)[63]conducted a study in Orthopantomographs of 102 Dentulous patients for determination of sex based on the measurement of the height of the mandible and the position of the mental foramen in dentulous patients on the right side of the orthopantomograph. They concluded that the height of the mandible and the distance from the superior margin of the mental foramen to the alveolar crest can be used to determine the gender.

Jodi Leversha et al (2015)[64] conducted a study in 2699 panoramic radiographs to determine a correlation of mandibular parameters with individual's age and gender in dentate subjects in Far North Queensland. They found that males were shown to have a larger ramus height and bigonial width than females and females were shown to have larger gonial angle than males.

Noha Saleh Abu-Taleb et al(2015)[65] conducted a study to assess the usefulness of various mandibular ramus linear and gonial angle measurements on digital panoramic images as indicators for sex and age.In their study ,191 patients were selected and Five mandibular ramus linear measurements (upper ramus breadth, lower ramus breadth, projective height, condylar ramus height and coronoid ramus height) and gonial angle measurements were performed bilaterally. In their study they showed that males showed statistically significant higher mean linear ramus measurements and lower mean

gonial angle values than females. Condylar and coronoid ramus heights were the most significant predictors for sex and age respectively. Hence mandibular ramus and gonial angle could be used for sex estimation.

Atiyaah Muskaan et al (2015)[66] conducted a study to evaluate various radiomorphometric indices in digital dental panoramic radiograph identify possible interrelationships between these indices and sex and age of the patients. Forty digital panoramic radiographs were selected and mental index, maximum and minimum breadth of ramus of mandible and the height of the coronoid were measured. They concluded that coronoid height and the mental index can be used in identification of sex and age.

Ajit Damera et al (2016)[67] conducted a study to evaluate to assess the usefulness of the mandibular ramus as an aid in gender estimation. They conducted using 80 digital orthopantomographs of Visakhapatnam's population in the age group of 20–50 years. They concluded that mandibular ramus measurements using orthopantomographs can be used as a reliable parameter for gender estimation.

Materials and Methods:

Study Population:

The study population was selected from the outpatient Department of Oral Medicine and Radiology, Tamilnadu Government Dental College & Hospital, Chennai, Tamilnadu, India. Patients who are referred to the Radiology Department for digital panoramic radiograph were be selected for the study.

Ethical approval:

An approval from the Institutional Ethics was obtained prior to the beginning of the study and all the participants were given brief information regarding the purpose of the study.

Inclusion Criteria:

Patients from 18 years till 65 years both dentulous and edentulous, who are referred to the Radiology Department for digital panoramic radiograph, are included.

Patients of any gender who are physically healthy and well oriented

Exclusion Criteria:

Patients with congenital developmental anomaly of mandible

Patients with pathological lesions of mandible

Patients with history of mandibular fracture or major surgical procedures involving the mandible

Patients who are pregnant or with suspected to be conceived.

Sampling Procedure:

Simple Random Sampling

Sample size:

Sample size : 200

Group A 100 (male)

Group B 100(female)

Study Design:

A Comparative study

Methodology:

The selected subjects were seated comfortably in the dental chair and the details specified in the case history proforma were recorded. Oral cavity was examined under adequate light of the dental chair by a single examiner using mouth mirror, probe, disposable gloves and mouth mask.

After clinical examination of the subjects, OPGs were taken using digital panoramic system: Orthophos XG machine. Exposure parameters used were 64 KV, 8mA and 14.1 seconds.

The measurements were measured using SIDEXIS XG software with mouse driven method.

1. Maximum ramus breadth

2. Minimum ramus breadth

3. Condylar height

4. Projective height of ramus

5. Coronoid height

6. Height of mandible

7. Distance between the superior margin of mental foramen to inferior border

8. Distance between inferior margin of mental foramen to inferior border

9. Distance between superior margin of mental foramen to alveolar bone

10. Gonial angle

11. Antegonial angle

12. Antegonial depth

Method of Analysis:

Each radiograph was viewed digitally. Measurements were made using the reference lines drawn from anatomical landmarks.

1**. Maximum ramus breadth:** The distance between the most anterior point on the mandibular ramus and a line connecting the most posterior point on the condyle and
the angle of jaw.

2. **Minimum ramus breadth:** Smallest anterior–posterior diameter of the ramus.

3. **Condylar height:** Height of the ramus of the mandible from the most superior point on the mandibular condyle to the tubercle, or most protruding portion of the inferior border of the ramus.

4**. Projective height of ramus:** Projective height of ramus between the highest point of the mandibular condyle and lower margin of the bone.

5. **Coronoid height:** Projective distance between coronion and lower wall of the bone

A line joining the most prominent point on the chin the 'menton' and the most prominent point of the angle of the mandible 'joining' was marked using mouse driven method.

The mental foramen was identified and marked on both sides. A line perpendicular to this tangent was marked from the inferior mandibular border to the alveolar crest such that it intersected the inferior edge of the mental foramen on the right side.

6. The distance from the inferior surface of the mandibular body to the height of the alveolar crest on the right side (height).

7. The distance between the superior margins of the mental foramen to the inferior border of the mandible on the right side (SM to IB).

8. The distance between the inferior margins of the mental foramen to the inferior border of the mandible on the right side (IM to IB).

9. The distance between the superior margin of the mental foramen to the alveolar crest on the right side (SM to AC) – were measured.

The mandibular line was constructed as a tangent to the two lowest points on the anterior and posterior borders of the mandible. The ramus line was constructed through the two most distal points of the ramus. The intersection of these lines formed the gonial (mandibular) angle.

10. Gonial angle is measured by the intersection of these lines.

11. The antegonial angle was measured by two lines parallel to the antegonial region that will intersect at the deepest point of the antegonial notch.

12. The antegonial depth was measured as the distance along a perpendicular line from the deepest point of the notch concavity to a tangent through the inferior border of the mandible.

The following measurements are measured after taking panoramic radiograph. The following measurements were measured after taking orthopantomogram.

Variable	Measurement - Right	Measurement- Left
Maximum ramus breadth		
Minimum ramus breadth		
Condylar height		
Projective height of ramus		
Coronoid height		
Height of mandible		
Superior margin of mental foramen to inferior border		
Inferior margin of mental foramen to inferior border		
Superior margin to alveolar crest		
Gonial angle		
Antegonial angle		
Antegonial depth		

Figure 1

Armamentarium for clinical examination of oral cavity

Figure 2

Pictorial Representation of Gonial angle

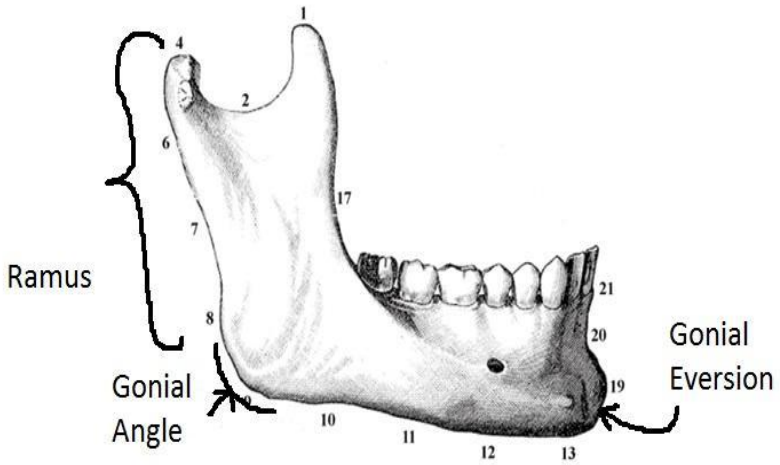


Fig. 1. Right lateral view of the mandible showing selected landmarks (see Table 1 for key).

Figure 3

Pictorial representation of Antegonial angle

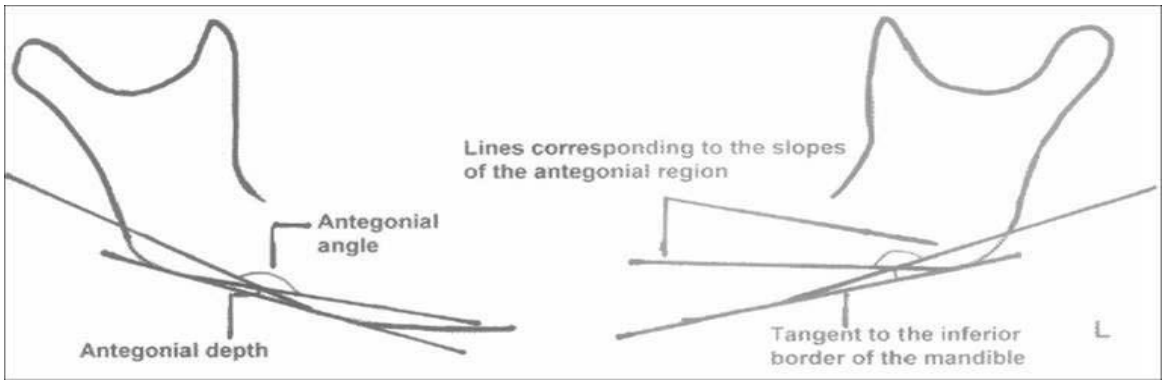


Figure 4

OPG machine

Figure 5

Patient positioned for digital OPG

Figure 6

Digital OPG showing measurement of maximum Ramus breadth on Right side

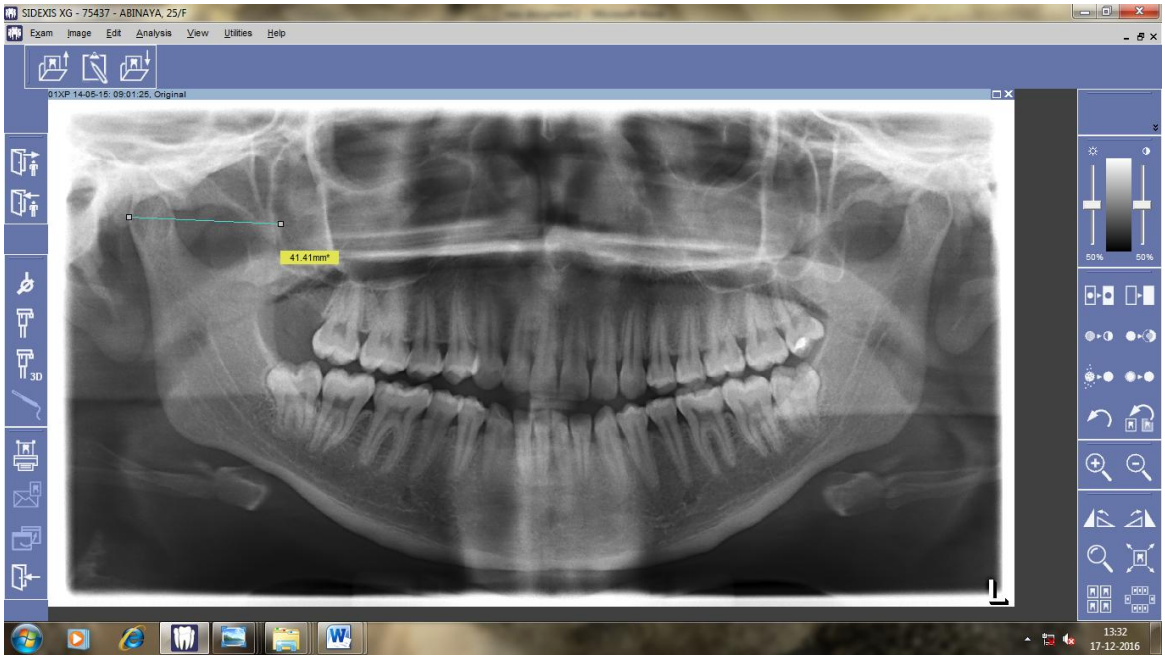


Figure 7

Digital OPG showing measurement of minimum ramus breadth on Right side

Figure 8

Digital OPG showing measurement of Condylar height on right side

Figure 9

Digital OPG showing measurement of Projective height of ramus on right side

Figure 10

Digital OPG showing measurement of coronoid Height on right side

Figure 11

Digital OPG showing measurement of height of mandible on right side

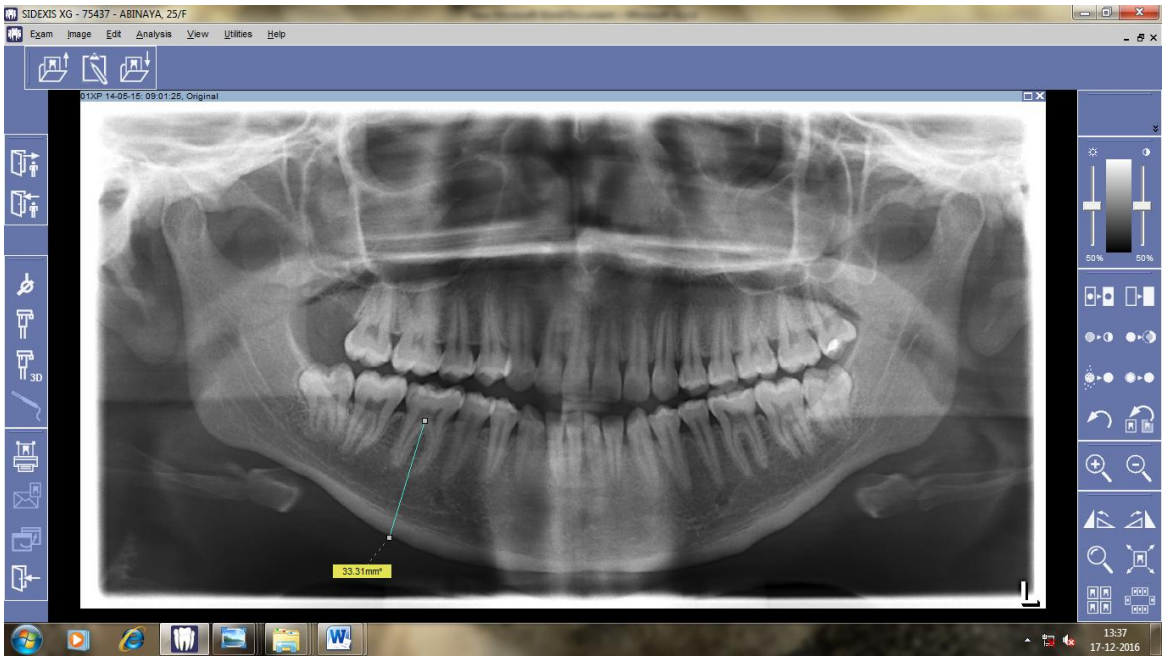


Figure 12

Digital OPG showing identification of mental foramen on right side

Figure 13

Digital OPG showing measurement of superior margin of mental foramen to inferior border of mandible on right side

Figure 14

Digital OPG showing measurement of inferior margin of mental foramen to inferior border of mandible on right side

Figure 15

Digital OPG showing measurement of superior margin of mental foramen to alveolar crest on right side

Figure 16

Digital OPG showing measurement of gonial angle on right side

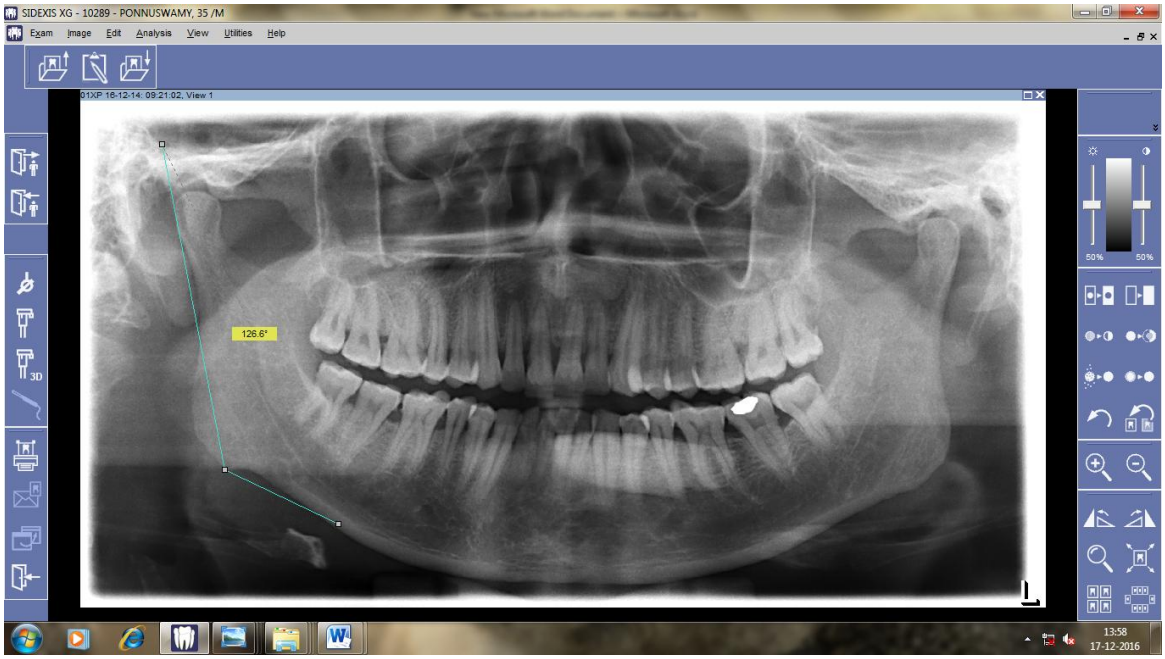


Figure 17

Digital OPG showing measurement of antegonial angle on right side

Figure 18

Digital OPG showing measurement of antegonial depth on right side

ARMAMENTARIUM:

Diagnostic Instruments (Figure1):

Disposable Face mask

Disposable latex examination gloves

Stainless Steel Kidney tray

Mouth Mirror

Probe

Tweezer

William's Probe

Divider

Scale

A total of 200 patients who satisfied the inclusion criteria were included in the study. They were divided into two groups. Group A consisted of 100 male patients Group B consisted of -100 female patients (Table 1 and Graph 1).

The distribution of age group among 100 male patients included in the study were 40 patients(40%) in the age group of 18-28 years,22 patients(22%) in the age group of 29 -38 years,19 patients(19%) in the age group of 39-48 years,8 patients (8%) in the age group of 49-58 years,11 patients (11%)in the age group 59-65 group(Table 2 and Graph 2).

The distribution of age group among 100 female patients included in the study were 28 patients(28%) in the age group of 18-28 years,20 patients(20%) in the age group of 29 -38 years,28 patients(28%) in the age group of 39-48 years,17 patients (17%) in the age group of 49-58 years, 7 patients (7%)in the age group 59-65 group (Table 3 and Graph 3).

Digital panoramic radiograph was taken for the patients using Orthophos XG machine .The following measurements such as maximum ramus breadth, minimum ramus breadth, condylar height, projective height of ramus, coronoid height, height of mandible, superior margin of mental foramen to inferior border, inferior margin of mental foramen to inferior border, superior margin of mental foramen to alveolar crest, gonial angle, antegonial angle and antegonial notch were measured on both sides on digital panoramic radiographs using mouse driven method and statistical analysis were done using SPSS version 17. Students unpaired t test was used.

Significant difference in maximum ramus breadth was found between males and females. Maximum ramus breadth in males were found to be 45.3092±4.06995 where as in females were found to be 43.0910 ±3.59791 (p value<0.05) (Table 4 and Graph 4).

Significant difference in minimum ramus breadth was found between males and females .Minimum ramus breadth in males were 33.2252±.50578 and in females were 31.5619±3.12655 with p value < 0.05 (Table 4 and Graph 4).

Significant difference in condylar height was observed with males having values of 71.5530±5.61006 and females having the values of 66.2183±4.9030 with p value <0.05 (Table 5 and Graph 4).

Significant difference in projective height of ramus was found between males and females. Projective heights of ramus in males were 74.4057±5.43548 and in females were 66.2315±5.60217 with p value < 0.05 (Table 5 and Graph 4).

Significant difference in coronoid height was found with males having values of 67 .2466±4.74079 and females having the values of 61.6321±4.49901 with p value < 0.05 (Table 5 and Graph 4).

Significant difference in height of mandible was found between males and females. The mean values of males were 33.2379±3.4526 and females were 30.6157± 3.46668 with p value <0.05 (Table 6 and Graph 5).

Significant difference in Superior Margin (SM) of Mental Foramen (MF) to Inferior Border (IB) was achieved. The mean values of SM-IB in males were 17.9864±1.63099 and in females were 15.9901±1.41340 with p value < 0.05 (Table 6 and Graph 5).

Significant difference in Inferior margin (IM) of Mental Foramen (MF) to inferior border (IB) of mandible was observed. The mean values of IM-IB in males were 14.8795±3.33484 and in females were 12.9411±1.32816 with p value < 0.05 (Table 6 and Graph 5).

There was no statistical significant difference observed in Superior Margin to Alveolar Crest (AC).The mean values of SM- AC in males were 19.6971+-2.84475 and in females were 18.4303± 6.13953 with p value = 0.63 (Table 6 and Graph 5).

Significant difference in Gonial angle was found between males and females. The mean value of gonial angle in males were 124.25±6.79838 and in females were 130.28±6.81115 with p value <0.05) (Table 7 and Graph 6).

Significant difference in Antegonial angle was found between males and females. The mean values of antegonial angle in males were 152.40±12.14595 and in females were 159.94± 7.67674 with p value <0.05 (Table 7 and Graph 6).

Significant difference in antegonial depth was achieved between male and female. The mean values of antegonial depth in males were 2.9552±.53715 and in females were 2.8126± .23638 with p value =0.016 (Table 7 and Graph 7).

In the present study, significant differences of these parameters among the age groups were also analysed. Comparison of these parameters did not show significant difference.

Among all these paramaters eleven parameters such as maximum ramus breadth, minimum ramus breadth, condylar height, projective height of ramus ,coronoid height, height of mandible, superior margin of mental foramen to inferior border, inferior margin of mental foramen to inferior border ,gonial angle, antegonial angle and antegonial notch showed statistically significant difference .

Among all these parameters, projective height of ramus showed highly significant difference between males and females with a mean difference of -8.17420.

Table 1

Distribution of gender

Gender	No. of patients	Percentage
Male	100	50
Female	100	50

Table 2

Distribution of age group in Male (Group A)

Age group	No. of Patients	Percentage
18 to 28 years	40	40.0
29 to 38 years	22	22.0
39 to 48 years	19	19.0
49 to 58 years	8	8.0
59 to 65 years	11	11.0
Total	100	100

Table 3

Distribution of age group in Female (Group B)

Age group	No. of Patients	Percentage
18 to 28 years	28	28.0
29 to 38 years	20	20.0
39 to 48 years	28	28.0
49 to 58 years	17	17.0
59 to 65 years	7	7.0
Total	100	100

Table 4

Mean and Standard Deviation of Maximum Ramus Breadth and Minimum Ramus Breadth in Males (Group A) and Females (Group B)

Parameters	Groups	Mean	Standard Deviation	p value
Maximum Ramus Breadth	Male	45.3092	4.06995	.0001
	Female	43.0910	3.59791	
Minimum Ramus Breadth	Male	33.2252	2.50578	.00001
	Female	31.5619	3.12655	

Table 5

Mean and Standard deviation of Condylar Height, Projective Height of Ramus, Coronoid Height in Males (Group A) and Females (Group B)

Parameters	Groups	Mean	Standard Deviation	p value
Condylar Height	Male	71.5530	5.61006	.0001
	Female	66.2183	4.90305	
Projective Height of ramus	Male	74.4057	5.43548	.0001
	Female	66.2315	5.60217	
Coronoid Height	Male	67.2466	4.74079	.0001
	Female	61.6321	4.49901	

Table 6

Mean and Standard deviation of Height of Mandible, Superior Margin of mental foramen to inferior border ,Inferior Margin of mental foramen to inferior border, Superior margin to alveolar crest in Males (Group A) and Females (Group B)

Parameters	Groups	Mean	Standard Deviation	p value
Height of Mandible	Male	33.2379	3.42526	.0001
	Female	30.6157	3.46668	
Superior Margin of mental foramen to inferior border	Male	17.9864	1.63099	.0001
	Female	15.9901	1.41340	
Inferior margin of mental foramen to inferior border	Male	14.8795	3.33484	.0001
	Female	12.9411	1.32816	
Superior margin to alveolar crest	Male	19.6971	2.84475	0.63
	Female	18.4303	6.13953	

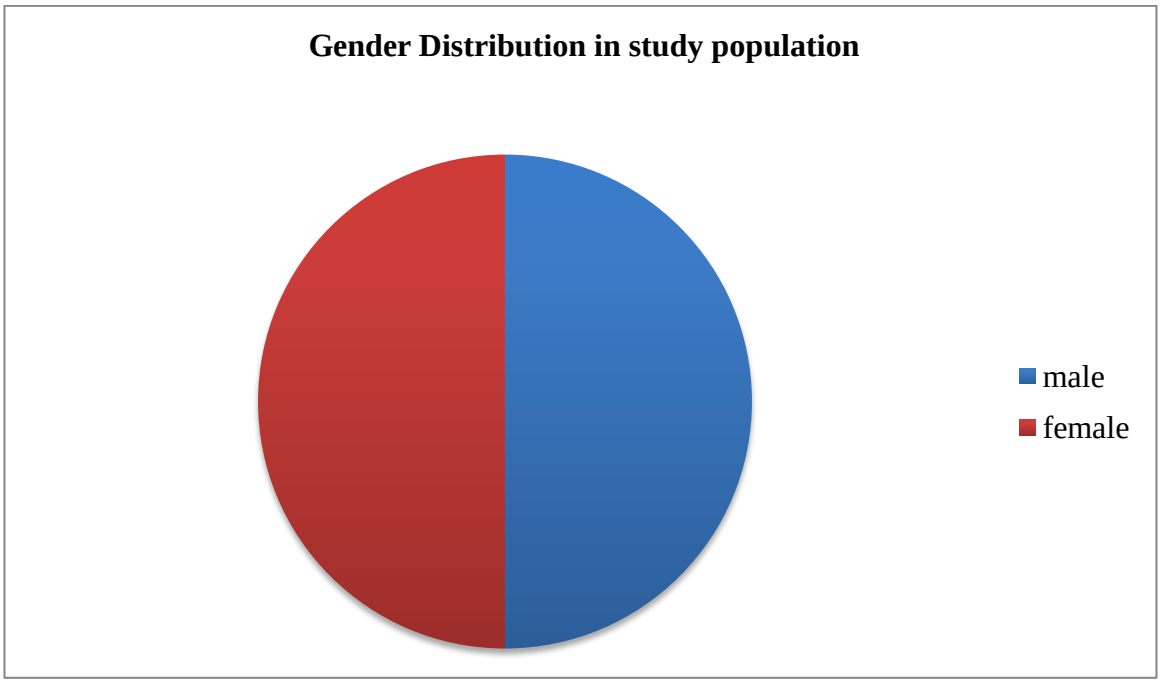
Table 7

Mean and Standard Deviation of Gonial Angle, Antegonial Angle, Antegonial depth in Males (Group A) and Females (Group B)

Parameters	Groups	Mean	Standard Deviation	p value
Gonial Angle	Male	124.25	6.79838	.0001
	Female	130.28	6.81115	
Antegonial angle	Male	152.40	12.14595	.0001
	Female	159.94	7.67674	
Antegonial Depth	Male	2.9552	.53715	.063
	Female	2.8126	.23638	

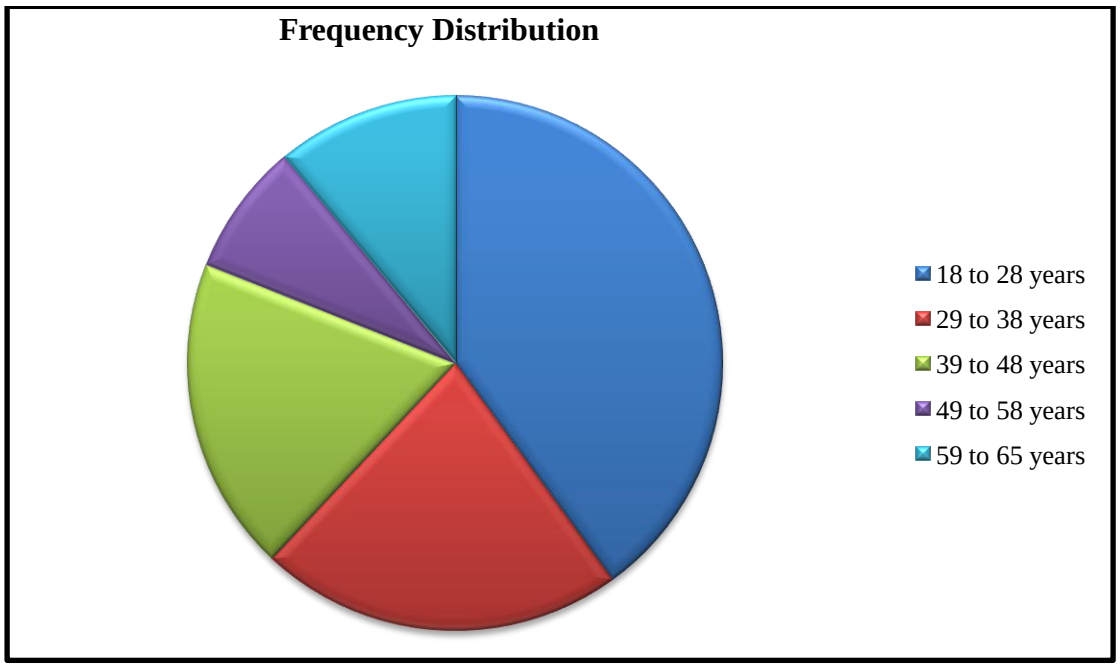
Graph 1

Distribution of Gender in Study Population



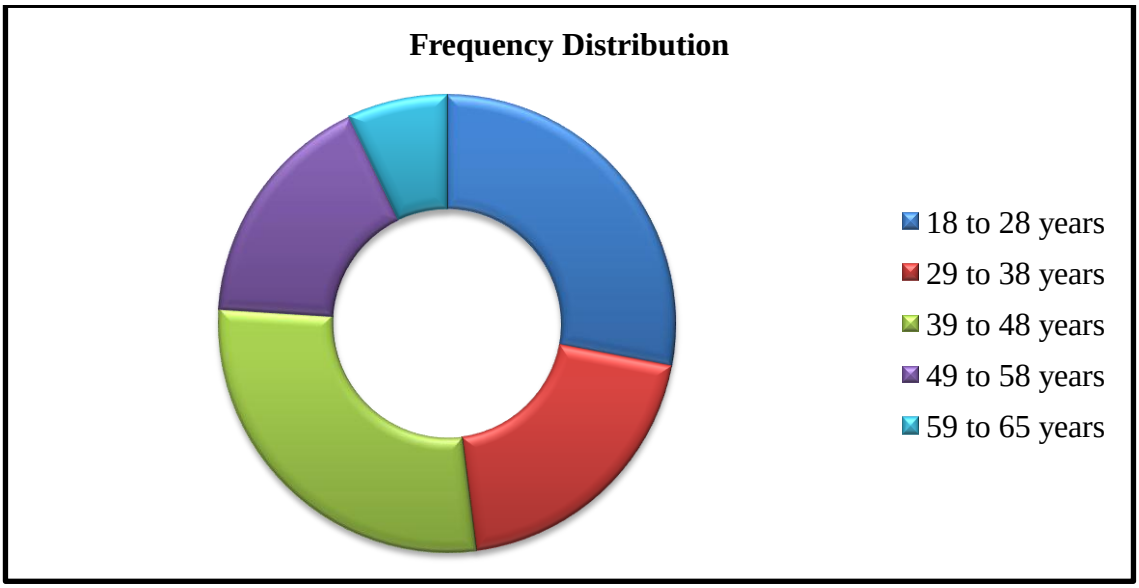
Graph 2

Distribution of age group in Males (Group A)



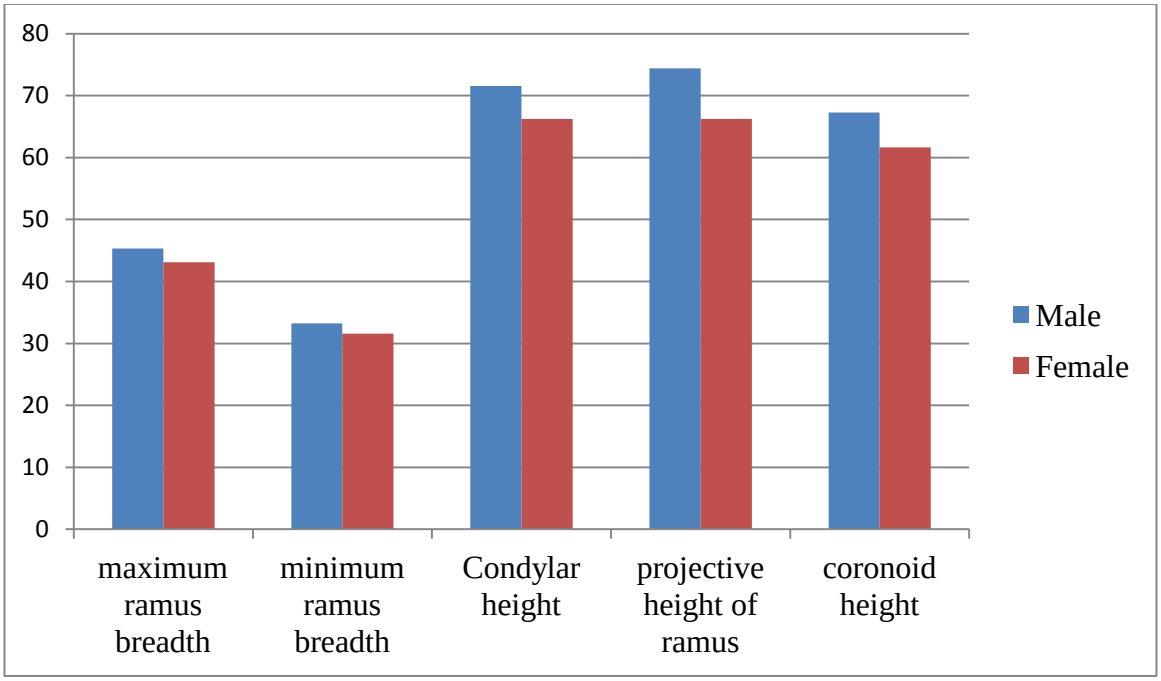
Graph 3

Distribution of age group in Females (Group B)



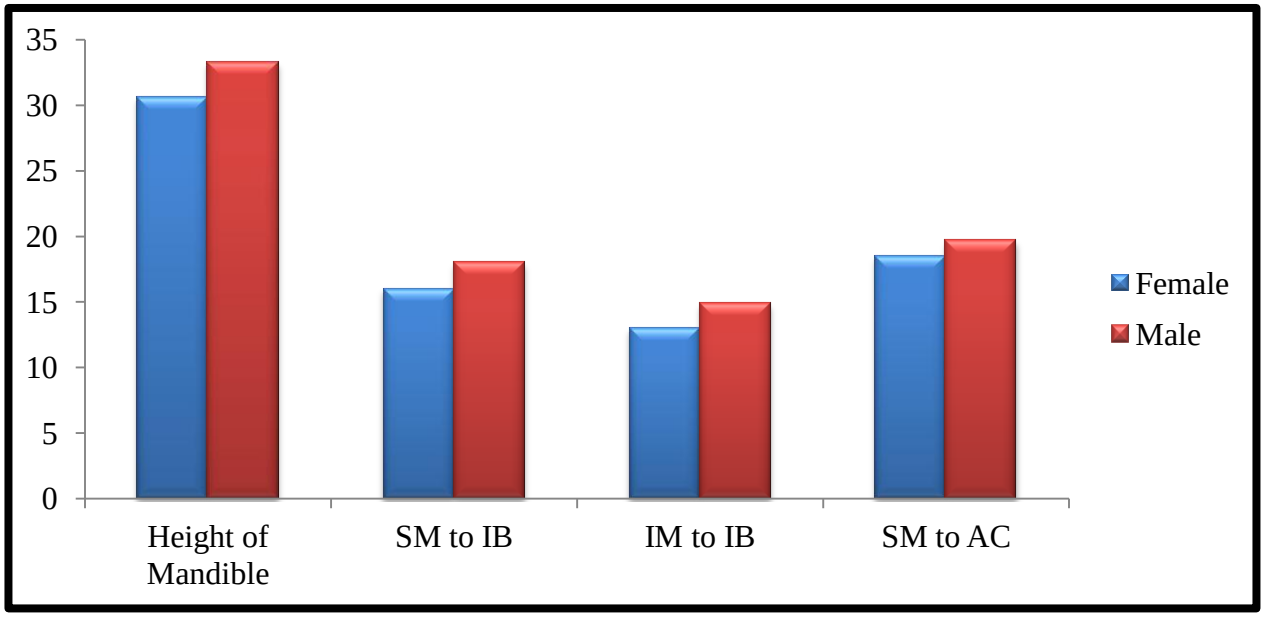
Graph 4

Mean Measurements of Maximum Ramus Breadth, Minimum Ramus Breadth, Condylar Height, Projective Height of Ramus and Coronoid Height in Males (Group A) and Females (Group B)



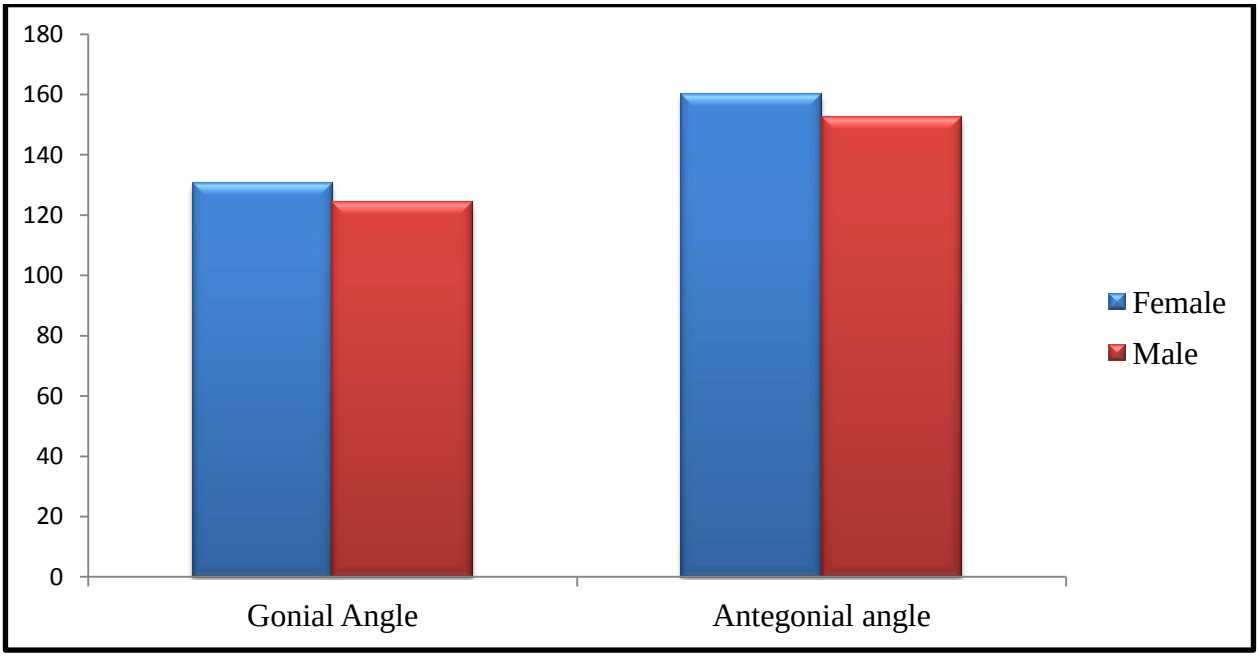
Graph 5

Mean Measurements of Height of Mandible, Superior Margin of mental foramen to inferior border ,Inferior Margin of Mental Foramen to Inferior Border, Superior Margin to Alveolar Crest in Males (Group A) and Females (Group B)



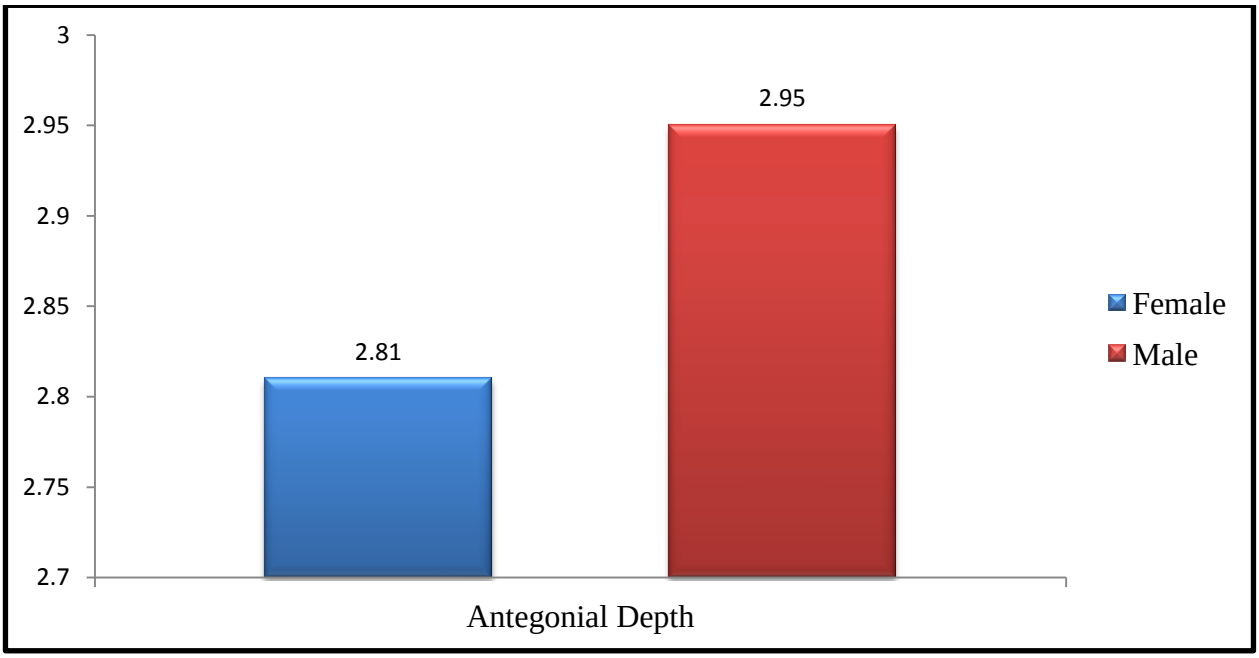
Graph 6

Mean measurements of Gonial angle and Antegonial angle in Males (Group A) and Females (Group B)



Graph 7

Mean measurements of Antegonial depth in Males (Group A) and Females (Group B)



The identification of gender from human remains is of fundamental importance in forensic medicine and anthropology, especially in criminal investigations of missing persons and in attempts at reconstructing the lives of ancient population. One of the important aspects of forensics is to determine gender from fragmented jaws and dentition[7].

Mandible plays a vital role in sex determination in cases where intact skulls are not found[4, 5,8,14]. Mandible is used for this study for two simple reasons: Firstly there appears to be paucity of standards utilizing these elements and secondly the bone is largely intact[6].

The accuracy of panoramic radiographs in providing anatomic measurements has already been established. Panoramic Radiograph has been used by the clinicians as an accurate screening tool for the diagnosis of oral diseases. Principal advantages of panoramic radiographs include broad coverage, low patient radiation dose, short time required for image acquisition[68]. Other advantages are that interference of superimposed images is not encountered. The contrast and brightness enhancement and enlargement of images in digital panoramic radiographs provide an accurate and reproducible method of measuring the chosen points[69, 70]. The limitations of panoramic radiographs are magnification and geometric distortion, the vertical dimension in contrast to the horizontal is little altered and positioning errors can also occur due to positioning errors because of relatively narrow image layer[68].

Kambylafkas et al[57] concluded that the panoramic radiograph for the evaluation of ramal height is reliable and an asymmetry of more than 6% is an indication of a true asymmetry.

Schulze et al [53] found that the most reliable measurements were obtained for linear objects in the horizontal plane and digital measurements are sufficiently appropriate for clinical use.

Panoramic radiographs have been used in forensic dentistry for the purpose of age estimation.Plenty of studies available regarding the use of panoramic radiographs in age estimation.

Only a few studies are available in the literature regarding gender determination using panoramic radiographs. Previously published studies have analyzed the morphometric parameters of the ramus, condyle, coronoid process, gonial angle, antegonial angle, antegonial depth, and height of the mandible, superior margin of mental foramen to inferior border of the mandible, inferior margin of mental foramen to the inferior border of the mandible and superior margin of mental foramen to the alveolar crest separately. Hence we chose to analyze all the above morphological features of the mandible in digital panoramic radiographs together in our study and find out which of these parameters is more significant in gender determination.

To determine gender variation between male and female we conducted a study in 200 patients. The study population is divided into two groups Group A(Male) and Group B (Female).Digital panoramic radiographs were taken and the following measurements such as maximum ramus breadth, minimum ramus breadth, condylar

height, projective height of ramus, coronoid height, height of mandible, superior margin of mental foramen to inferior border, inferior margin of mental foramen to inferior border, superior margin of mental foramen to alveolar crest, gonial angle, antegonial angle and antegonial notch were measured on both sides using mouse driven method and anatomical land marks.

Humphrey[7] **et al** emphasized that almost any site of mandibular bone deposition or resorption, or remodeling seems to have a potential for becoming sexually dimorphic. Hence mandibular condyle and ramus are generally the most dimorphic as these are the sites associated with the greatest morphological changes in size and remodeling during growth.

Several studies have investigated the sexual dimorphism of the mandibular ramus flexure using direct visual assessment, e.g. Donnelly et al (1998), Indrayana et al (1998),Hill (2000) and Kemkes – Grothenthaler et al and found that results of these studies were contradictory and not repeatable.

Wical and Swoope[71] reported that inspite of the resorption above the mental foramen, the distance from the foramen to the inferior border of the mandible remains constant throughout life. Lindh et al and Guler et al also suggested that the stability of this region does not depend on resorption of alveolar process above the foramen. Because of the stability of the basal bone and mental foramen, these landmarks were selected as a point of reference for our study.

Significant difference was found between males and females in the following parameters such as maximum ramus breadth, minimum ramus breadth, condylar height, projective height of ramus, coronoid height, height of mandible, superior margin of mental foramen to inferior border, inferior margin of mental foramen to inferior border, gonial angle, antegonial angle and antegonial notch. The mean values of superior margin to alveolar crest did not show any significance between males and females.

Our results correlated with **Huumonen**[72] et al who found significantly larger gonial angle in females as compared to males. In our study values of gonial angle in females (130.28±6.81115) were higher than males (124.25± 6.79838).

Our study correlated with **Ghosh et al** [73] with respect to antegonial angle, females had higher antegonial angles when compared to males. In our study females had higher antegonial angles when compared to males. The mean values of antegonial angles in females (159.94± 7.67674) were higher than males (152.40± 12.14595).With respect to antegonial depth, females (2.8126±.23638) had smaller values as compared to males (2.9552± .53715).

Our study did not correlate with **Baydas** [74] who found no statistically significant differences between males and females in gonial angle and antegonial depth .This was not consistent with our study since our study showed significant differenence in gonial angle and antegonial depth.

Our results correlate with **Dutra** et al [75] who concluded that males had significantly smaller values of antegonial angle than females and males have higher values of antegonial depth than female. This was consistent with our study. In our study,

mean values of antegonial angle in males were 152.40± 12.14595 and in females were 159.94± 7.67674.

Our results were consistent with **Chole et al** [76] who concluded that males had significantly smaller antegonial angle and antegonial depth than females. In our study, males had smaller antegonial angle and higher antegonial depth than females.

Giles [48] measured mandibles of known sex using anthropometric measurements in American Whites and Negroes and reported that mandibular ramus height, maximum ramus breadth and minimum ramus breadth are highly significant with an accuracy of 85%. Our study was consistent with this study since all these paramaters are significant The mean values of projective height of ramus in males (74.4057±5.43548) were higher than females (66.2315±5.60217). The mean values of maximum ramus breadth were higher in males (45.3092±4.06995) than females (43.0910± 3.59791). The mean values of minimum ramus breadth were higher in males (33.2252±.50578) than females (31.5619±3.12655).

Our results were consistent with **Dayal** [74] et al who reported mandibular ramus height to be the best parameter in the study, since our study showed significant difference between males and females.

Saini [4] et al conducted a study on dry adult mandibles in Northern part of India and found that ramus expressed strong sexual dimorphism in that population, the best parameters were coronoid height, condylar height and projective height of ramus and breadth measurements were not very dimorphic study in their sample. But in our study breadth measurements were also showed dimorphism.

In a study done by **Indira**[59] et al minimum ramus breadth was found to be the best parameter and breadth measurements were found to be very dimorphic. Our study was consistent with this study and other osteometric studies done by Giles (1964) and Vodanovic (2006).This is related to the differences in musculoskeletal development and to the differences related to a different growth trajectory in males and females[7, 48].

In the present study the mean values SM-IB was found to be higher in males (17.9864±1.63099) than females (15.9901±1.41340) and the mean values of IM-IB were found to be higher in males (14.8795±3.33484) than females (12.9411+1.32816). Our study was consistent with the study done by **Thomas et al** [77] and **Catovie et al** [78] **and Moni Thakur et al** [63]. Our study was not consistent with the study done by **Vodanovic**[18]since in his study he concluded that IM-IB does not show sexual dimorphism. In our study IM-IB was significant.

In the present study, the mean values of the height of the mandible were significantly higher in males (33.2379±3.4526) than females (30.6157±3.4666).These studies were consistent with **Cagri Ural et al** [17], **Ortman et al** [79]and **Moni Thakur et al** [63].

In the present study, the mean values of maximum ramus breadth, minimum ramus breadth, condylar height, projective height of ramus ,coronoid height, height of mandible, superior margin of mental foramen to inferior border, inferior margin of mental foramen to inferior border and antegonial depth were found to be higher in males (Group A) than females (Group B).Whereas Gonial angle, antegonial angle were found to be higher in females (Group A)than males (Group B).

In our study variations between different age groups of the following parameters were also analysed. There was no statistically difference between different age groups.

In our present study, among the twelve parameters, projective height of the ramus showed highest significant difference. The mean values of superior margin to alveolar crest did not show any significance.

Forensic odontology is a specialized field of dentistry which analyzes dental evidence in the interest of justice It is an investigate part of dentistry that analyzes dental evidence for human identification. Various methods are available for sex determination such as anthropology, rugoscopy, cheiloscopy, tooth prints, dental DNA analysis, and radiographs.

The skeletal components often investigated for gender determination are the pelvis and skull, with the mandible being an important element to analyze sexual dimorphism in the fragmented bones. Panoramic radiograph has become routine in dental clinics. In forensic anthropology comparison of postmortem and antemortem radiographs are valuable tool in identification of human remains.

Gender determination based only on characteristics of teeth and their supporting structures had been a difficult task where as X-ray examination of the mandible gives definitive information about the sex. When skeleton gender variation is considered, the metric analyses on the radiographs are found to be superior due to their objectivity, accuracy and reproducibility.

This study was conducted to determine gender variations in various morphometric parameters in the mandible, in male and female patients in 200 subjects using digital panoramic radiographs, to find out which parameter is more significant. The study population was divided into two groups Group A – Male (100 subjects), Group B – Female (100 Subjects).After getting Institutional Ethical Committee approval, the study was commenced.

. A complete clinical examination was carried out. Digital panoramic Radiographs were taken for the patients. Measurements were made using the reference lines drawn from anatomical landmarks using SIDEXIS XG SOFTWARE with mouse driven methods .Twelve measurements were made on both the sides of the mandible digitally. The values were tabulated and subjected to statistical analysis using Student's unpaired t test.

In all the twelve parameters, as maximum ramus breadth, minimum ramus breadth, condylar height, projective height of ramus ,coronoid height, height of mandible, superior margin of mental foramen to inferior border, inferior margin of mental foramen to inferior border ,gonial angle, antegonial angle and antegonial notch showed gender variation with statistical significance. One parameter i.e. superior margin of mental foramen to alveolar crest did not show any significance.

The mean values of maximum ramus breadth, minimum ramus breadth, condylar height, projective height of ramus, coronoid height, height of mandible, superior margin of mental foramen to inferior border, inferior margin of mental foramen to inferior border and antegonial depth were found to be higher in males (Group A) than females (Group B).Whereas Gonial angle, antegonial angle were found to be higher in females (Group A) than males (Group B)

The most reliable paramater in this study is projective height of ramus, since it showed greatest variation between Males (Group A) and Females (Group B).

This study was conducted to determine gender variations in various morphometric parameters in the mandible, in male and female patients in 200 subjects, using digital panoramic radiographs.

To conclude the present study, the following parameters such as maximum ramus breadth, minimum ramus breadth, condylar height, projective height of ramus ,coronoid height, height of mandible, superior margin of mental foramen to inferior border, inferior margin of mental foramen to inferior border , gonial angle, antegonial angle and antegonial depth showed statistically significant difference.

The highest significant difference was found in projective height of ramus. The mean values of superior margin of mental foramen to alveolar crest did not show significance.

We found that mandibular measurements using panoramic radiographs were reliable for gender determination. According to the results obtained from our study we conclude that the projective height of the ramus is the most significant of all the parameters, which may be used for gender determination using the mandible.

Limitations:

1. Inability to assess the gender in case of edentulous patients.
2. Inability to assess gender in different age groups.
3. Panoramic radiographs are not taken by the single observer, leading to intra observer variablity.
4. Inability to involve other landmarks than mandible.

Strengths:

1. Patients were selected in a wide age group between 18 and 65 years.
2. In previous studies only few parameters were analysed. In our study twelve parameters were analysed.
3. In previous studies all these parameters swere measured on only one side of mandible. In our study all these parameters were measured on both sides.

However in future, further studies on diverse populations and large samples and assessments of various other parameters should be carried out for definitive results.

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TRIPARTITE AGREEMENT

This agreement herein after the "Agreement" is entered into on this day ----------between the Tamil Nadu Government Dental College and Hospital represented by its **Principal** having address at Tamil Nadu Government Dental College and Hospital, Chennai – 600 003, (hereafter referred to as, 'the college')

And

Prof Dr. G.V. MURALI GOPIKA MANOHARAN aged 50 years working as **Professor** in Department of Oral Medicine and Radiology at the Tamil Nadu Government Dental College, having residence address at Old No:3,New No:5,Avvaiyar Street, Nilamangai Nagar, Adambakkam,Chennai -600088 (Herein after referred to as 'Principal Investigator')

And **Dr. S.ARULEENA SHAMINEY,** aged 27 years currently studying as **Post Graduate student** in Department of Oral Medicine and Radiology, Tamil Nadu Government Dental College ,residing at Room no 414,TamilNadu Government Dental College Ladies Hostel, Chennai -3 (herein after referred to as the 'PG and co-Investigator').

Whereas the PG student as part of her curriculum undertakes this research on "**GENDER BASED VARIATIONS IN MORPHOLOGICAL FEATURES OF MANDIBLE IN DIGITAL PANORAMIC RADIOGRAPHS - A COMPARATIVE STUDY"** for which purpose the Guide shall act as Principal investigator and the college shall provide the requisite infrastructure based on availability and also provide facility to the PG student as to the extent possible as a Co- investigator.

Whereas the parties, by this agreement have mutually agreed to the various issues including in particular the copyright and confidentiality issues that arise in this regard.

Now this agreement witnessed as follows

1. The parties agree that all the Research material and ownership therein shall become the vested right of the college, including in particular all the copyright in the literature including the study, research and all other related papers.
2. To the extent that the college has the legal right to do go, shall grant to licence or assign the copyright so vested with it for medical and/or commercial usage of interested persons/ entities subject to a reasonable terms/ conditions including royalty as deemed by the college.
3. The royalty so received by the college shall be shared equally by all the three parties.

4. The Co-investigator and Principal Investigator shall under no circumstances deal with the copyright, Confidential information and know – how – generated during the course of research/study in any manner whatsoever, while shall sole west with the college.
5. The Co-investigator and Principal Investigator undertake not to divulge (or) cause to be divulged any of the Confidential information or, know – how to anyone in any manner whatsoever and for any purpose without the express written consent of the college.
6. All expenses pertaining to the research shall be decided upon by the Principal investigator/ Co-investigator or borne sole by the PG student (Co-investigator)
7. The college shall provide all infrastructure and access facilities within and in other institutes to the extent possible. This includes patient interactions, introductory letters, recommendation letters and such other acts requires in this regard.
8. The Principal Investigator shall suitably guide Co-investigator the Student Right from selection of the Research Topic and Area till its completion. However the selection and conduct of research, topic and area of research by the student researcher under guidance from the Co-Investigator shall be subject to the prior approval, recommendations and comments of the Ethical Committee of the College constituted for the purpose.
9. It is agreed that as regards other aspects not covered under this agreement, but which pertain to the research undertaken by the Co-investigator, under the guidance from the Principal Investigator, the decision of the college may be binding and final.
10. If any dispute arises as to the matters related or connected to this agreement herein, it shall be referred to arbitration in accordance with the provisions of the Arbitration and Conciliation Act, 1996.

In witness whereof the parties hereinabove mentioned have on this day month and year herein above mentioned set their hands to this agreement in the presence of the following two witnesses.

College represented by its **Principal** **PG Student**

Witnesses **Student Guide**

1.

2.

TAMIL NADU GOVRNMENT DENTAL COLLEGE & HOSPITAL, CHENNAI – 3.
TELEPHONE : 044-253403343
FAX: 044- 25300681
date : 24/09/2015

Ref No: R.C No.0430/DE/2015 dated 27.01.2015, O/O Principal, TNGDC
Sub: IEC review of the research proposals,

Title of the work: Gender based variations in morphological features of mandible in digital panoramic radiographs – A comparative study

Principal Investigator: Dr. S. Aruleena Shaminey
II Yr. M.D.S., Student.

Department : Department of Oral Medicine and Radiology
Tamil Nadu Govt. Dental College & Hospital , Chennai-3

Thank you for submitting your research proposal , which was considered at the Institutional Ethics Committee meeting held on 02-07-2015, at TN Govt. Dental College and the documents related to the study referred above were discussed and the modifications done as suggested and reported to us through your letter dated 23-09-2015 have been reviewed.

The decision of the members of the committee , the secretary and the Chairperson IEC of TN Govt. Dental College is here under:

Approved	Approved and advised to proceed with the study
Approved with suggestions	----------
Revision	----------
Rejected	----------

The principal investigators and their team are advised to adhere the guide lines given below:

1. You should get detailed informed consent from the patients / participants and maintain confidentiality.
2. You should carry out the work without affecting regular work and without extra expenditure to the Institution or the Government.
3. You should inform the IEC, in case of any change of study procedure, site, and investigating guide.
4. You should not deviate from the area of work for which you have applied for ethical clearance.
5. You should inform the IEC immediately in case of any adverse events or serious adverse reactions. You should abide to the rules and regulations of the institution(s) .
6. You should complete the work within specific period and if any extension of time is required, you should apply for permission again to do the work.
7. You should submit the summary of the work to the ethical committee every 3 months and on completion of the work.
8. You should not claim any kind of funds from the Institution for doing the work or on completion/ or for any kind of compensations.
9. The members of the IEC have the right to monitor the work without prior intimation.
10. Your work should be carried out under the direct supervision of the guide/ Professor.

MEMBER SECRETARY,
INSTITUTIONAL ETHICS COMMITTEE
Tamil Nadu Govt. Dental College & Hospital
Chennai

CHAIRPERSON
INSTITUTIONAL ETHICS COMMITTEE
Tamil Nadu Govt. Dental College & Hospital
Chennai

ஆராய்ச்சி பற்றிய தகவல் படிவம்

மரு.செ.அருளீனா ஷாமினியாகிய நான், மரு.க.வெ.முரளி கோபிகா மனோகரன், MDS, அவர்களின் வழிகாட்டுதலின் கீழ், ''எண்ணியல் அகலப் பரப்பு தாடை ஊடுகதிர் நிழற்படத்தில் கீழ்த்தாடை எலும்பு அளவீடுகள் மூலம், பாலினம் அறிதலை ஒப்புநோக்கும் ஆய்வு'' நடத்த திட்டமிட்டுள்ளேன்.

ஆய்வின் நோக்கம் :

இந்த ஆய்வின் நோக்கமானது எண்ணியல் அகலப்பரப்பு தாடை ஊடுகதிர் நிழற்படத்தில் கீழ்த்தாடை எலும்பு அளவீடுகள் மூலம் பாலினம் கண்டறிவது.

செய்முறை :

முழுமையான மருத்துவ வரலாறு அறியப்பட்டு, முழுவாய் பரிசோதனை செய்யப்படும். அகலப்பரப்பு தாடை ஊடுகதிர் பாதுகாப்பாக எடுக்கப்படும்.

நன்மைகள் :

இந்த ஆய்வினால் அறியப்படும் தகவல்கள் பற்தடயவியலில் பாலினம் கண்டறிவதற்கு பயன்படும்.

அபாயங்கள் :

அகலப்பரப்பு தாடை ஊடுகதிர் நிழற்படம் எடுக்கும் சமயத்தில் உபயோகிக்கப்படும் குறைந்த அளவு கதிர்வீச்சினால், ஏற்படும் பக்கவிளைவுகள் மிகவும் குறைவு, எனினும் அவ்வாறு குறைந்த அளவு பக்கவிளைவுகள் ஏதும்கூட ஏற்படாமல் இருக்க ஆய்வில் பங்கேற்பவருக்கு காரீயக் கவசம் அணியவைத்த பின்பே ஊடுகதிர் நிழற்படம் எடுக்கப்படும்.

இரகசியத் தன்மை :

நோயாளிகள் பற்றிய குறிப்புகள், ஆராய்ச்சி முடியும் வரை ரகசியமாக பாதுகாக்கப்படும். இந்த ஆராய்ச்சியை வெளியிடும் போது நோயாளிகள் தனிப்பட்ட விவரங்கள் எதுவும் பாதிக்கப்படமாட்டாது.

பங்குபெறுவோரின் உரிமை :

இந்த ஆராய்ச்சியில் பங்குபெறுவது நோயாளிகளின் தனிப்பட்ட விருப்பம். மேலும் நோயாளிகள் இந்த ஆராய்ச்சியிலிருந்து எப்போது வேண்டுமென்றாலும் விலகிக் கொள்ளலாம். நோயாளிகள் இந்த முடிவினால் அவருக்கோ அல்லது ஆராய்ச்சியாளருக்கோ எந்தவித பாதிப்பும் கிடையாது.

இந்த ஆராய்ச்சியின் முடிவுகள் நோயாளிகளுக்கு ஆராய்ச்சியின் இடையிலோ அல்லது முடிவிலோ தெரிவிக்கப்படும். இதில் ஏதேனும் பின் விளைவுகள் ஏற்பட்டால் அதை சரிசெய்ய சிகிச்சை அளிக்க தகுந்த உதவிகள் செய்யப்படும்.

இழப்பீடு :

எதும் வழங்கப்படமாட்டாது.

ஆய்வு பற்றிய தகவல் பெற :

மரு.செ.அருளீனா ஷாமினி,
இரண்டாம் ஆண்டு MDS முதுநிலை மாணவி,
வாய்நோய் அறிதல் மற்றும் ஊடுகதிர் துறை,
தமிழ்நாடு பல் மருத்துவ கல்லூரி மற்றும் மருத்துவமனை.
சென்னை.

நோயாளியின் பெயர் கையொப்பம்/கைரேகை

ஆராய்ச்சியாளரின் பெயர் கையொப்பம்

தேதி

PATIENT INFORMATION SHEET

I, Dr. S.Aruleena Shaminey, II – MDS student, Department of Oral Medicine and Radiology, primary investigator under the guidance of Prof. Dr. G.V. Murali Gopika Manoharan, MDS, Professor, Department of Oral Medicine And Radiology, Tamil Nadu Government Dental College and Hospital, have planned to conduct a study titled **'Gender based variations in morphological features of mandible in digital panoramic radiographs– A Comparative Study'** in Tamilnadu Government Dental College and Hospital, Chennai - 3

Purpose of the study

We are conducting this study to find which parameter is more useful in gender prediction using digital panoramic radiographs.

Procedures

Complete medical history, oral cavity examination will be done. A digital panoramic radiograph will be taken with proper protection.

Benefits of participation

By utilising the outcome of this study,the parameters which are more useful in gender prediction can be determined. The results will be of immense help in Forensic Odontology and add to information regarding these parameters found in Chennai population.

Participant's rights

Taking part in this study is voluntary. Patients are free to decide whether to participate in the study or to withdraw at any time; patient's decision will not result in any loss of benefits to which you are otherwise entitled. The results of this special study may be intimated to patient at the end of the study period.

Risk of participation

Patients will be properly explained about the risks undergoing the procedure. Patients will be properly protected during exposure.

Confidentiality

The identity of the patients participating in the research will be kept confidential throughout the study. In the event of any publication or presentation resulting from the research, no personally identifiable information will be shared.

Compensation

Nil

Contacts for queries related to the study: **Dr.S.Aruleena Shaminey,**

II year PG student,

Department of Oral Medicine and Radiology,

Tamilnadu Government Dental College,

Chennai: 600003.

Phone no: 7598256109

Name of the Patient **Signature /Thumb impression**

Name of the investigator **Signature**

Date

சுய ஒப்புதல் படிவம்

ஆய்வு செய்யப்படும் தலைப்பு

எண்ணியல்அகலப் பரப்பு தாடை ஊடுகதிர் நிழற்படத்தில் கீழ்த்தாடை எலும்பு அளவீடுகள் மூலம் பாலினம் அறிதல்-ஒப்பு நோக்கு ஆய்வு

ஆராய்ச்சி நிலையம் : அரசு பல் மருத்துவக் கல்லூரி
சென்னை - 600 003

பங்கு பெறுபவரின் பெயர் :

பங்கு பெறுபவரின் எண் :

பங்கு பெறுவரின் பிறந்த தேதி : _____ / _____ /_____
தேதி மாதம் வருடம்

இந்த ஆய்வு சம்பந்தமாக நான் மேலே கூறப்பட்ட தகவல் படிவத்தை முழுமையாக படித்துப் பார்த்தேன் என்று உறுதி கூறுகிறேன்.

நான் இது தொடர்பான அனைத்து கேள்விகளுக்கும் நிறைவான பதில்கள் பெறப்பட்டேன்.

இந்த ஆய்வின் எனது பங்கு தன்னிச்சையானது என்றும் எந்த நேரத்திலும் இந்த ஆய்வில் இருந்து சட்ட உரிமைகள் பாதிக்கப்படாமல் விலகிக் கொள்ள சம்மதிக்கிறேன்.

மருத்துவ ஆய்வு அதிகாரிகள், எனது சிகிச்சை தொடர்பான பதிவேடுகளை பார்வையிடவும் எந்த நேரத்திலும், ஆய்வில் இருந்து நான் விலகினாலும் பார்வையிட சம்மதிக்கிறேன். எனது அடையாள குறிப்புகள் மூன்றாவது நபருக்கு தெரிவிக்கப்படமாட்டாது என்று புரிந்து கொண்டேன்.

இந்த ஆய்வு அறிக்கைகளை பயன்படுத்தவும், வெளியிடவும், நான் சம்மதிக்கிறேன். ஆய்வாளர் எனது மருத்துவக் குறிப்புகளை வெளியிட தடையாக இருக்கமாட்டேன் என உண்மையாக சம்மதிக்கிறேன்.

பங்கேற்பவரின் கையொப்பம் ..... இடம்..... தேதி.....

கட்டைவிரல் ரேகை

பங்கேற்பவரின் பெயர் மற்றும் விலாசம் .....

ஆய்வாளரின் கையொப்பம் ..... இடம்..... தேதி.....

ஆய்வாளரின் பெயர் .....

Annexure: AF 06/004/01.0
Template for Informed Consent Form

Informed Consent Form

Gender based variations in morphological features of mandible in digital panoramic radiographs – A Comparative Study

Participant ID No:

"I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions I have asked have been answered to my satisfaction. I consent voluntarily to participate as a participant in this study and understand that I have the right to withdraw from the study at any time without in any way it affecting my further medical care."

Date	Name of the participant	Signature/thumb impression of the participant

[The literate witness selected by the participant must sign the informed consent form. The witness should not have any relationship with the research team; If the participant doesn't want to disclose his / her participation details to others, in view of respecting the wishes of the participant, he / she can be allowed to waive from the witness procedure (This is applicable to literate participant ONLY). This should be documented by the study staff by getting signature from the prospective participant]

_____

_____

"I have witnessed the accurate reading of the consent form to the potential participant and the individual has had opportunity to ask questions. I confirm that the individual has given consent freely"

Date	Name of the witness	Signature of the witness

Date	Name of the interviewer	Signature of the interviewer

Department Of Oral Medicine and Radiology

Tamilnadu Govt. Dental College and Hospital

Chennai -3.

Case Proforma

Gender Based Variations In Morphological Features Of Mandible In Digital Panoramic Radiographs - A Comparative Study

Date **Serial No;**

Name; **O.P No**

Age/Sex

Address

Phone No;

Occupation: **Income**

Religion

Centre: Dept of Oral Medicine and Radiology

Tamil Nadu Govt Dental College and Hospital, Chennai-3.

Chief Complaint and Duration

Past Medical History

Past Surgical History

Past Dental History

Personal History

Family History

Local Examination

Extra Oral Examination

Facial Asymmetry

Eyes

Ears

Lips

Nose

Temporomandibular Joint

Intra Oral Examination

Hard Tissue Examination

Mouth Opening-:

Jaw Movements:

Teeth Present

Dentition:

Size and Shape of Teeth:

Colour:

Dislodged Filling:

Dental Caries:

Attrition:

Abrasion:

Erosion:

Fractured Teeth:

Nonvital Teeth:

Mobile Teeth:

Pain on Percussion:

Pain on Probing:

Stains:

Calculus:

Supernumerary Teeth:

Soft Tissue Examination

Gingiva:

Alveolar Mucosa:

Buccal Mucosa:

Labial Mucosa:

Tongue:

Floor of the Mouth:

The Following Measurements are measured after taking orthopantomogram.

Variable	Measurements - Right	Measurements- Left
Maximum Ramus Breadth		
Mininmum Ramus Breadth		
Condylar Height		
Projective Height Of Ramus		
Coronoid Height		
Height Of Mandible		
Superior Margin Of Mental Foramen To Inferior Border		
Inferior Margin Of Mental Foramen To Inferior Border		
Superior Margin To Alveolar Crest		
Gonial Angle		
Antegonial Angle		
Antegonial Depth		

S.No	Name	Age	Sex	Right											
				Maximum Ramus Breadth	Minimum Ramus Breadth	Condylar Height	Projective Height Of Ramus	Coronoid Height	Height Of Mandible	Superior Margin Of Mental Foramen To Inferior Border	Inferior Margin Of Mental Foramen To In Ferior Border	Superior Margin To Alveolar Crest	Gonial Angle	Antigonial Angle	Antigonial Depth
1	Benny	28	Male	44.12	31.07	64.19	67.61	63.25	33.28	21.33	17.69	21.41	118.2	158.9	2.56
2	Vettrivel	40	Male	41.61	28.69	65.22	65.75	65.02	34.67	16.42	13.18	20.23	124.3	156.7	2.78
3	Vijayakumar	61	Male	46.78	31.46	69.34	72.62	64.16	35.8	22.87	18.08	19.51	118.8	158.6	2.67
4	Chandra Sekar	25	Male	40.15	35.73	60.35	65.2	60.09	31.01	17.7	12.77	17.42	124	156.9	2.67
5	Dharma Durai	23	Male	48.71	36.62	81.73	74.66	70.1	35	16.96	11.67	20.09	115.2	152.3	2.78
6	Dharma Raj	23	Male	44.29	31.33	77.86	75.17	70.65	34	17.04	12.13	17.64	132.7	158.3	2.56
7	Abdul	49	Male	50.46	35.11	81.43	78.42	67.53	30.89	22.15	18.93	14.59	119.4	156.7	2.67
8	Abdul	49	Male	43.21	34.52	74.41	75.08	62.4	33.15	18.31	16.94	16.95	126.3	158.7	2.67
9	Mubarak	30	Male	52.09	39.88	70.05	72.86	64.74	31.88	17.35	11.74	20.98	128.7	152.6	3.75
10	Murugesan	48	Male	45.04	31.79	79.56	87.41	75.58	26.92	17.8	14.45	11.89	122.1	137.2	4.11
11	Annasamy	54	Male	51.79	36.73	71.08	76.04	70.52	37.21	16.23	14.4	23.71	124.5	141.5	3.97
12	Shanawaz	24	Male	51.11	33.1	82.78	86.62	80.07	32.51	16.37	14.59	20.66	120.8	145.2	3.26
13	Parthiban	54	Male	42.36	30.13	69.38	72.05	66.95	27.95	22.55	15.99	14.2	120.6	151.5	4.59
14	Kamaraj	32	Male	43.4	29.21	72.6	72.25	72.6	30.81	18.08	14.32	19.11	131.3	140.8	2.77
15	Haffiz	50	Male	46.66	30.54	73.51	73.03	69.11	31.94	21.3	17.5	15.31	126.2	144.7	3.25
16	Ajay Deepak	22	Male	51.63	38.77	77.81	80.58	69.39	21.67	18.25	15.64	32.58	128.9	146.9	3.24
17	Krishnan Pitchai	46	Male	41.88	28.77	69.65	71.98	63.53	29.74	18.01	15.11	17.19	117.8	147.8	3.15
18	Jabaseelan	32	Male	41.23	27.47	84.65	86.84	74.85	41.58	15.88	12.82	27.67	124.5	151.3	3.35
19	Anbazhaagan	27	Male	46.56	36.72	76.69	78.74	73.39	36.4	15.7	13.18	21.12	123.5	144.5	3.2
20	Gopi	34	Male	43.91	34.41	77.23	82.25	74.38	37.85	19.92	15.77	20.2	116.6	164.8	3.09
21	Gangadharan	40	Male	43.95	35.45	79.44	80.89	73.44	38.24	19.43	15.99	23.17	127.4	132.1	3.05
22	Elumalai	46	Male	53.87	36.13	80.74	80.56	75.65	35.96	18.19	14.8	19.44	121.8	143.5	3.45

23	Imrahin	40	Male	47.48	36.43	73.25	75.48	72.75	37.87	20.1	15.27	21.04	125.3	151.1	2.3
24	Vignesh	38	Male	44.69	32.1	77.32	80.68	67.73	37.89	16.35	13.12	24.48	135.2		
25	Achuthan	22	Male	50.37	35.08	65.16	66.66	62.32	34.54	19.71	16.77	19.51	139.9	149.9	2.1
26	Sugumar	32	Male	42.41	32.14	68.2	72.61	65.23	36.48	18.22	16.23	18.93	125.7	155.7	3.89
27	Sugumar	32	Male	42.56	32.14	67.02	68.2	67.9	38.01	20.17	15.99	19.31	127.1	154.4	2.46
28	Ashok	19	Male	46.24	31.66	61.78	64.48	60.83	30.81	19.16	14.43	17.29	121.2	152.9	3.91
29	Raja	28	Male	41.5	30.04	69.96	70.69	62.08	35.03	19.3	15.03	24.97	124.6	150	2.92
30	Suresh	27	Male	54.17	37.05	79.12	80.6	73.48	38.55	20.48	16.83	21.9	131.7	156	3.02
31	Sureh Kumar	55	Male	44.94	36.29	74.3	81.51	69.66	31.4	16.87	14.8	18.92	121	151.1	3.46
32	Thiyagarajan	63	Male	44.82	32.6	71.04	74.23	70.62	31.32	16.41	12.54	16.29	121.6	159	3.62
33	Thambidurai	64	Male	47.53	33.57	76.85	77.41	68.08	32.67	17.08	14.21	19.89	119.9	153	3.15
34	Anandhan	45	Male	49.21	34.67	62.28	68.68	62.1	35.27	17.83	15.15	19.83	130.8	159.1	2.5
35	Anbumoorthy	25	Male	47.29	36.41	67.1	76.48	66.5	32.66	18.02	15.04	19.87	126.7	173.3	2.13
36	Arul Pinto	21	Male	47	31.15	62.9	67.2	63.33	35.6	16.55	14.12	20.02	139.8	160	3.3
37	Babu	39	Male	50.98	33.3	66.96	69.35	66.12	32.79	17.3	13.92	16.75	133	160	3.48
38	Bala Murali	22	Male	47.81	39.2	69.78	72.84	67.96	32.61	17.02	14.42	18.01	121.9	150.01	4.84
39	Balaji	23	Male	52.73	37.77	69.72	76.42	67.98	35.57	17.16	14.15	22.34	138.2	165.5	2.91
40	Baskar	42	Male	52.79	39.18	75	72.74	66.27	40.31	21.39	17.85	18.94	124	154	2.9
41	Ashok	37	Male	49.28	37.64	70.8	76.63	68.59	35.04	17.17	12.65	23.43	116.3	145	2.45
42	Akilan	19	Male	42.5	33.01	71.3	76.68	68.18	34.43	18.89	14.98	25.25	127.6	145.7	2.19
43	Agilan	22	Male	45.71	37.8	70.57	72.38	70.57	37.05	18.35	15.34	23.54	119.7	150.5	2.35
44	Vigneshwaran	25	Male	45.71	37.07	79.4	80.48	68.97	36.85	15.11	12.35	25.69	127.1	149	2.84
45	Parthiban	26	Male	46.64	38.14	75.39	82.53	72.15	35.15	19.66	14.32	20.67	117.1	174	4.9
46	Rajendiran	60	Male	43.04	29.19	71.62	72.87	59.6	32.58	20.61	15.26	19.12	133.2	147.5	3.16
47	Mohammed	35	Male	41.61	34.67	72.58	77.81	64.25	34.42	19.02	14.72	23.23	129.3	146.1	3.93
48	Senthil Kumar	28	Male	45.92	37.09	70.83	76.25	66.81	31.88	18.76	13.19	22.33	122.7	151	1.69
49	Raj	52	Male	49.49	31.65	72.59	74.25	70.67	30.24	19.23	14.33	19.87	136.8	149.3	2.15
50	Selvam	60	Male	44.54	31.92	64.53	66.69	63.26	32.63	20.38	17.9	17.34	121.9	154	4.03
51	Sankar	42	Male	46.66	34.91	64.03	70.1	63.44	34.68	20.67	16.05	17	131.6	149.7	2.14

52	Selvam	60	Male	44.07	31.38	64.85	66.98	61.92	33.01	20.48	17.15	16.68	125.8	155.5	2.84
53	Selvam	65	Male	49.63	34.35	81.21	87.57	72.49	43.57	21.19	18.19	26.73	128.2	152.1	2.51
54	Sasikumar	33	Male	47.01	31	68.27	71.72	65.81	34.69	18.71	14.17	21.74	120.8	152.4	3.25
55	Sakthivel	27	Male	4.99	32.23	74.6	79.44	67.95	32.87	15.72	14.91	19.49	19.2	160.6	2.31
56	Udhayakumar	40	Male	49.92	34.06	66.64	67.29	65.13	30.38	16.67	14.01	15.99	137	151.9	2.06
57	Thiyagarajan	63	Male	44.82	32.6	71.04	74.23	70.62	31.32	16.41	12.54	16.29	121.6	159	3.62
58	Suresh Kumar	55	Male	44.94	36.29	74.23	81.51	69.66	31.4	16.87	14.8	18.92	121	151.1	3.46
59	Suresh	32	Male	45.56	34.67	74.39	77.23	68.19	29.74	22.88	19.03	17.81	128.7	159.3	2.81
60	Suresh	27	Male	41.5	30.04	69.96	70.69	62.08	35.03	19.3	15.03	24.97	124.6	150	2.92
61	Raja	28	Male	54.17	37.05	79.12	80.6	73.48	38.55	20.48	16.83	21.9	131.7	156	3.02
62	Ashok	19	Male	46.24	31.66	61.78	64.48	60.83	30.81	19.16	14.43	17.29	121.2	152.9	3.91
63	Ismail	25	Male	46.2	34.25	70.32	73.96	64.19	31.93	19.96	16.77	18.57	124.8	150.4	3.15
64	Sugumar	32	Male	42.56	32.41	67.02	68.02	67.92	38.01	20.17	15.99	19.31	127.1	154.4	2.46
65	Achuthan	22	Male	56.37	35.08	65.16	66.66	62.32	34.54	19.17	16.77	19.51	139.9	149.9	2.1
66	Ajeesh	30	Male	50.04	32.1	68.81	73.79	68.04	33.04	17.03	15.89	16.93	133	154.5	2.73
67	Anandhan	28	Male	50.98	40.22	69.73	71.41	67.74	33.06	17.9	16.42	21.47	126.3	154.4	2.83
68	Annamalai	60	Male	45.96	34.93	66.8	69.83	65.12	18.33	15.11	15.11	18.37	132.4	2.61	2.61
69	Arun Kumar	27	Male	44.84	32.66	83.15	84.79	71.67	33.41	15.67	13.43	18.96	117.6	155	2.02
70	Ashok	32	Male	43.07	33.5	74.49	79.25	66.49	29.94	19.68	13.72	15.88	125.2	151.5	3.52
71	Aslam	25	Male	46.88	35.44	79.14	78.77	70.68	33.58	18.17	14.53	18.57	124.3	154.1	3.28
72	Babu	28	Male	39.58	33.42	65.5	72.7	62.85	34.74	18.68	12.39	21.71	124.2	142.5	2.32
73	Karthik	40	Male	46.02	33.57	73.59	77.39	71.25	31.39	18.99	16.91	20.63	129.2	150	2.3
74	Dhanapandian	34	Male	44.86	33.27	78.68	84.04	68.06	33.72	18.98	14.37	18.07	118.6	152.8	2.49
75	Albert	35	Male	40.51	31.98	79.04	80.36	73.34	35.66	17.5	14.8	17.64	119.6	158.1	2.38
76	Anandhan	44	Male	48.3	35.73	65.32	69.43	65.34	33.65	18.04	13.96	20.27	131.1	151.8	2.7
77	Ansar Basha	20	Male	39.59	30.67	71.13	75.46	72.87	31.45	15.93	11.9	21.2	127.5	156.8	2.57
78	Arjun Raj	27	Male	37.71	28.69	65.67	68.56	63.6	34.34	18.04	14.1	18.92	126.2	153.4	2.03
79	Baskar	20	Male	47.03	34.2	63.6	63.6	64.39	32.73	17.09	11.32	17.85	135.6	155.9	3.31
80	Dhandapani	34	Male	40.13	33.91	69.93	74.16	68.51	32.1	17.6	13.44	16.22	124.5	151.5	2.78
81	Dhayanidhi	47	Male	42.19	29.98	66.15	71.22	60.53	28.27	16	13.25	17.96	129	150.3	2.63

82	Dinesh	23	Male	38.79	34.11	78.87	80.83	76.51	33.16	19.08	15.58	18.5	114.6	157.4	3.8
83	Divakaran	43	Male	46.24	32.31	72.88	76.26	66.55	33.96	18.37	13.57	17.29	127.5	155.1	2.2
84	Durairaj	29	Male	45.86	31.72	69.65	71.92	64.1	32.87	17.56	12.96	20.32	133.8	155.1	3.38
85	Gokul Raj	21	Male	58.54	29.84	71.32	74.55	58.54	33.65	16.82	14.19	19.86	126.9	152.6	3.09
86	Gopinath	26	Male	45.47	32.51	77.69	80.67	64.62	32.67	19.14	15.96	22.27	133.6	152.5	2.9
87	Govindharaj	42	Male	46.38	36.6	81.2	85.66	68.69	34.42	16.53	12.9	18.93	119.6	156.8	3.25
88	Gunasekar	48	Male	50.35	39.11	84.78	80.97	74.41	37.43	18.34	14.52	20.01	125.7	158.8	2.91
89	Hayaz Biq	43	Male	43.97	34.83	73.62	75.06	62.85	31.88	14.9	11.46	20.88	125.7	161.1	3.41
90	Pandian	32	Male	43.65	32.65	71.54	76.49	72.95	34.74	17.83	14.27	18.5	115.8	156.6	3.41
91	Isakkimuthu	30	Male	49.59	37.62	75.03	79.71	65.61	37.69	17.79	15.82	22	124.1	166.1	3.24
92	Iyyampillai	65	Male	50.02	34.96	74.52	77.67	72.97	31.26	19.86	15.56	18.47	130.5	159.4	3.14
93	Janarthanan	35	Male	47.11	29.49	76.42	78.31	68.77	28.86	15.88	13.66	12.23	134	153	1.94
94	Ilango	32	Male	46	31.79	68.77	70.64	54.62	32.42	17.61	14.1	21.84	124.9	159	3.65
95	Akilesh	20	Male	46.9	38.56	83.6	87.95	71.57	33.96	15.09	12.28	19.87	120.4	155.9	2.82
96	Allendeva Prince	22	Male	46.33	33.7	67.71	70.53	63.08	29.7	18.96	16.64	18.83	127.7	153.1	3.2
97	Amaran	40	Male	58.29	34.56	61.53	70.32	58.29	29.03	17.19	13.15	15.45	120.7	154.3	2.15
98	Anburaj	36	Male	38.56	30.48	71.19	74.62	68.04	32.04	18.32	14.52	16.02	120.8	156.8	2.39
99	Aruldhas	60	Male	41.17	30.24	71.8	74.87	68.03	34.14	15.44	12.98	21.04	126.6	161.4	3.56
100	Arun Balaji	28	Male	52.17	36.72	73.61	76.06	74.25	35.87	19.09	15.28	21.74	123.5	154.5	2.87

S.No	Name	Age	Sex	Left											
				Maximum Ramus Bredth	Minimum Ramus Breadth	Condylar Height	Projective Height Of Ramus	Coronoid Height	Height Of Mandible	Superior Margin Of Mental Foramen To Inferior Border	Inferior Margin Of Mental Foramen To Inferior Border	Superior Margin To Alveolar Crest	Gonial Angle	Antigonial Angle	Antigonial Depth
1	Benny	28	Male	47.17	29.18	71.87	72.62	64.48	34.09	21.02	17.55	21.7	122	158	2.76
2	Vettrivel	40	Male	37.01	25.06	65.52	66.65	60.09	31.7	16.22	11.21	19.95	118.9	159.7	2.89
3	Vijayakumar	61	Male	48.49	32.19	68.82	70.34	60.77	37.14	18.3	15.23	21.32	122.7	160	3.12
4	Chandra Sekar	25	Male	40.77	31.35	64.13	67.22	58.87	27.14	14.68	11.13	16.24	125.9	161.8	2.67
5	Dharma Durai	23	Male	45.02	35.53	78.03	72.55	67.83	36.14	18.24	15.41	18.52	124.4	162.5	2.56
6	Dharma Raj	23	Male	39.85	32.62	73.86	71.53	66.82	34.12	13.28	11.84	22.4	117.3	159.6	2.89
7	Abdul	49	Male	37.74	35.86	78.63	76.47	68.29	30.77	18.88	14.38	16.5	112.2	156.7	2.67
8	Abdul	49	Male	43.07	34.14	69.61	69.5	66.89	31.64	17.07	13.43	16.22	118.5	158.5	2.78
9	Mubarak	30	Male	49.48	33.82	69.29	74.41	66.62	33.1	16.73	14.2	17.97	120.6	152.6	3.75
10	Murugesan	48	Male	40.23	30.16	76.55	79.06	74.73	27.87	17.8	14.45	11.89	122.1	137.2	4.11
11	Annasamy	54	Male	48.54	31.29	73.59	76.08	68.58	36.41	15.94	13.95	24.06	121.9	152.7	2.78
12	Shanawaz	24	Male	45.88	33.66	79.56	84.43	79.12	34.77	16.38	11.77	19.67	114.7	145.8	3.89
13	Parthiban	54	Male	44.59	31.87	69.29	71.19	67.05	35.41	21.54	16.63	15.07	127.1	140.1	3.61
14	Kamaraj	32	Male	44.77	30.39	72.19	73.01	70.19	32.67	19.24	15.69	18.28	124.3	142.5	2.73
15	Haffiz	50	Male	46.86	32.63	70.88	70.53	66.69	35.16	20.01	17.35	15.53	128	147.1	2.92
16	Ajay Deepak	22	Male	47.68	36.09	74.69	76.28	68.6	20.57	19.8	16.35	32.76	129.3	138	3.3
17	Krishnan Pitchai	46	Male	50.46	32.35	63.53	73.65	70.9	31.12	18.3	11.95	17.11	126.5	149.8	3.05
18	Jabaseelan	32	Male	41.4	29.46	79.88	84.84	71.76	38	18.05	15.25	22.03	117.6	149.3	2.73
19	Anbazhaagan	27	Male	43.15	34.68	77.62	80.62	73.62	34.02	14.9	12.21	20.74	121.6	144.7	3.3
20	Gopi	34	Male	48.06	32.08	77.01	79.19	73.54	37.09	18.86	16.06	20.17	114.9	165.6	2.61
21	Gangadharan	40	Male	48.54	35.66	72.95	78.44	72.54	37.74	18.05	14.62	24.52	128.6	136.1	3.21
22	Elumalai	46	Male	48.67	35.49	83.68	84.69	75.69	36.51	16.01	13.83	16.01	125.3	156.8	3.35
23	Imrahin	40	Male	45.19	31.87	71.41	73.34	70.39	37.29	19.21	14.64	19.36	124.1	158.2	2.3

24	Vignesh	38	Male	44.46	34.08	72.88	75.18	72.88	39.41	18.78	13.74	24.84	128.2	159.8	2.78
25	Achuthan	22	Male	45.6	31.02	65.25	66.1	56.18	29.31	19.76	15.65	19.51	125	154.5	3.05
26	Sugumar	32	Male	39.75	31.23	66.38	70.11	65.48	35.86	16.77	13.37	19.46	128.7	156.5	2.48
27	Sugumar	32	Male	43.86	31.57	64.8	68.91	62.27	35.61	16.76	11.54	24.61	131.7	159.4	3.15
28	Ashok	19	Male	39.42	30.14	63.11	67.31	61.82	32.83	17.73	13.62	19.67	123.1	153.5	3.53
29	Raja	28	Male	47.5	32.4	69.35	69.35	59.41	35.08	19.77	13.88	20.3	129.6	142.3	3.62
30	Suresh	27	Male	45.97	33.83	79.97	81.5	72.61	36.45	18.31	14.93	24.25	128.3	155.7	2.23
31	Sureh Kumar	55	Male	43.93	30.31	72.11	77.19	68.19	29.74	13.22	12.77	18.26	117.6	161.4	3.82
32	Thiyagarajan	63	Male	44.51	33.73	69.17	72.06	70.37	32.7	18.34	15.38	16.86	132.2	154.2	2.85
33	Thambidurai	64	Male	44.91	32.41	73.82	73.82	76.27	31.54	17.29	14.63	20.25	126.8	158	3.2
34	Anandhan	45	Male	40.36	27.36	61.11	65.94	54.26	31.01	18.61	17.25	19.93	120	157.3	3
35	Anbumoorthy	25	Male	42.41	30.84	65.77	69.64	62.07	31.15	18.47	16.14	16.56	124.8	177.2	3.3
36	Arul Pinto	21	Male	42.8	30.83	62.52	64.57	62.68	37.56	18.11	14.01	22.53	137	161.1	3.4
37	Babu	39	Male	48.16	30.22	66.03	68.16	65.98	31.22	20.22	15.48	16.75	125.6	159	2.66
38	Bala Murali	22	Male	45.25	36.1	68.06	68.09	65.05	31.05	15.51	12.91	18.13	125.4	154	3.89
39	Balaji	23	Male	53.16	35.86	69.06	75.78	66.78	31.98	17.82	13.7	20.3	139.4	168.6	3.48
40	Baskar	42	Male	56.63	38.63	77.02	81.29	71.76	37.5	19.05	16.04	20.58	119.4	153	2.28
41	Ashok	37	Male	45.56	35.87	70.54	76.6	64.47	36.24	16.97	14.13	24.02	123.8	150	2.61
42	Akilan	19	Male	40.24	33.05	71.8	77.71	67.91	34.35	20.25	15.46	19.96	128.9	153.6	2.67
43	Agilan	22	Male	51.03	35.43	71.85	73.38	69.68	34.93	19.98	15.22	22.93	126	156.7	2.6
44	Vigneshwaran	25	Male	44.04	35.11	71.41	76.57	68.74	34.7	15.03	12.63	19.78	121.5	157	3.24
45	Parthiban	26	Male	45.4	33.64	77.26	78.97	68.26	32.65	16.58	14.11	20.52	125.3	156.7	4
46	Rajendiran	60	Male	43.81	31.8	66.25	69.57	60.93	37.39	18.78	14.76	20.53	123.2	146.9	3.33
47	Mohammed	35	Male	39.69	34.47	73.28	79.01	62.57	31.1	18.15	14.07	20.83	125.6	146.7	3.15
48	Senthil Kumar	28	Male	46.94	36.45	74.85	78.02	67.49	33.38	21.86	16.75	21.87	119.2	155.6	2.91
49	Raj	52	Male	44.54	30.81	72.69	70	68	30.45	19.45	17.09	17.89	128.6	142.9	1.95
50	Selvam	60	Male	44.27	32.18	63.28	68.62	65.51	31.25	19.8	15.44	18.47	119.9	163.2	3.48
51	Sankar	42	Male	44.21	33.91	62.75	71.04	63.37	37.7	19.12	17.08	16.62	118.5	148.1	2.23
52	Selvam	60	Male	43.2	32	66.96	66.75	65	32.28	18.86	15.58	18.68	124.2	159.3	3.21

53	Selvam	65	Male	45.15	32.71	83.9	87.76	76.55	43.45	21.04	18.5	26.07	128.8	153.6	3.8
54	Sasikumar	33	Male	46.39	30.69	68.78	72.03	65.98	33.95	19.95	17.37	20.49	129.5	159.4	3.72
55	Sakthivel	27	Male	39.92	30.18	72	71.51	69.62	34.9	18.21	14.56	16.99	127.7	148.5	2.41
56	Udhayakumar	40	Male	48.29	34.35	69.86	68.6	67.98	33.67	17.7	13.83	18.47	132.6	152.3	3.65
57	Thiyagarajan	63	Male	44.51	33.73	69.17	72.06	70.37	32.7	18.34	15.38	16.86	132.2	154.2	2.85
58	Suresh Kumar	55	Male	43.93	30.31	72.11	77.19	67.84	28.84	13.22	12.77	18.26	117.16	161.4	3.82
59	Suresh	32	Male	42.95	31.24	66.51	74.26	62.57	30.19	17.63	13.66	23.44	124.8	154.1	2.19
60	Suresh	27	Male	47.5	32.4	69.35	71.35	59.41	35.08	19.77	73.88	20.3	129.6	142.3	3.62
61	Raja	28	Male	45.97	33.83	79.97	81.5	72.61	36.45	18.31	14.93	24.25	128.3	155.7	2.23
62	Ashok	19	Male	39.42	30.14	63.11	67.31	61.82	32.83	17.73	13.62	19.67	123.1	153.5	3.53
63	Ismail	25	Male	43.41	33.28	70.45	72.5	69.41	33.49	18.06	13.88	21.99	126.9	153.5	2.9
64	Sugumar	32	Male	43.86	31.57	64.82	68.91	62.27	35.61	16.76	11.54	24.61	121.7	159.4	3.15
65	Achuthan	22	Male	45.6	31.02	65.25	66.1	56.18	29.31	19.76	15.65	19.51	124.5	154.5	3.05
66	Ajeesh	30	Male	52.64	32.74	74.22	76.73	67.13	31.86	20.93	14.63	16.09	127.1	153.1	2.1
67	Anandhan	28	Male	44.75	35.34	69.07	69.23	66.33	32.89	20.24	17.79	16.74	127.2	151.6	2.53
68	Annamalai	60	Male	45.4	33.37	67.62	70.93	62.95	17.97	15.41	17.37	15.41	130.6	150.2	2.88
69	Arun Kumar	27	Male	43.75	30.67	81.96	84.06	70.49	33.24	16.87	14.93	17.93	117.6	159.6	2.28
7	Ashok	32	Male	47.41	36.51	71.61	75.26	68.68	29.78	15.49	13.03	16.01	118.6	155.2	4.37
71	Aslam	25	Male	47.34	36.58	76.24	81.11	71.19	32.45	17.7	12.86	20.72	121.8	157.2	3.62
72	Babu	28	Male	37.71	29.48	70.54	75.32	66.61	32.74	17.78	13.41	19.33	127.3	151.4	2.19
73	Karthik	40	Male	46.99	31.97	72.56	76.54	63.36	31.12	20.25	17.58	18.55	120.8	151	2.4
74	Dhanapandian	34	Male	45.61	34.62	81.41	82.12	66.91	31.83	17.73	13.4	19.34	119	153.2	1.96
75	Albert	35	Male	36.65	27.32	79.16	82.91	71.16	33.61	16.11	12.8	19.8	125.5	157.2	2.63
76	Anandhan	44	Male	40.66	29.28	65.08	66.3	62.43	30.83	15.43	12.13	22.17	120.4	150	2.31
77	Ansar Basha	20	Male	39.85	31.23	68.84	71.66	73.3	32.69	13.1	11.042	22.56	118.2	153.2	3.21
78	Arjun Raj	27	Male	41.49	31.63	61.22	63.71	61.48	32.34	17.07	13.05	18.12	125.6	154.5	2.16
79	Baskar	20	Male	45.03	34.3	65.33	71.42	64.64	29.36	16.86	12.48	16.86	132.1	150.9	3.15
80	Dhandapani	34	Male	39.23	33.06	68.96	68.06	65.51	30.8	13.91	11.04	18.7	122.1	149.6	2.48
81	Dhayanidhi	47	Male	40.29	29.39	63.88	63.78	57.13	29.27	15.7	12.47	17.45	128.4	153.7	2.26

82	Dinesh	23	Male	43.22	36.85	76.44	76.54	76.61	18.67	14	18.21	18.21	120.5	149.5	3.21
83	Divakaran	43	Male	43.51	30.9	69.44	71.33	67.15	34.89	20.38	18.84	20.18	124.3	156.1	2.59
84	Durairaj	29	Male	41.85	28.63	66.02	66.34	57.33	34.54	17.22	14.04	21.46	120.2	153.3	4.43
85	Gokul Raj	21	Male	47.62	31.76	66.76	70.21	62.67	31.94	15.55	13.39	19.54	115.4	156.9	4
86	Gopinath	26	Male	48.63	32.23	72.8	78.11	68.56	34.97	20.32	16.54	25.59	115.9	150.3	2.83
87	Govindharaj	42	Male	51.11	38.8	76.43	82.45	69.85	37.49	16.64	12.02	19.44	119.7	154	2.84
88	Gunasekar	48	Male	43.57	38.94	87.51	85.02	78.68	37.63	18.94	14.59	16.85	108.6	153	2.73
89	Hayaz Biq	43	Male	44.62	33.7	65.72	76.2	77.8	32.56	16.75	13.64	18.85	118.7	157.8	2.87
90	Pandian	32	Male	47.03	37.26	69.89	73	67.58	38.9	16.93	14.77	20.16	123.9	163.2	2.97
91	Isakkimuthu	30	Male	51.67	36.08	71.48	72.04	62.16	33.69	18.03	15.91	22.68	123.3	160.2	2.05
92	Iyyampillai	65	Male	50.17	32.34	74.2	77.77	74.54	33.58	17.44	12.81	17.33	116	158.3	2.44
93	Janarthanan	35	Male	47.27	25.72	74.85	76.06	71.48	28.24	13.87	10.99	15.23	120.9	156.7	2.04
94	Ilango	32	Male	42.77	26.94	60	63.91	53.83	30.74	16.43	13.01	22.29	129.2	160.2	2.67
95	Akilesh	20	Male	45.41	35.21	78.1	84.93	73.18	36.16	16.8	13.97	18.66	120.3	155.9	2.82
96	Allendeva Prince	22	Male	47.36	30.83	66	68.74	59.26	29.89	14.97	13.16	19.43	125.8	157.4	3.19
97	Amaran	40	Male	40.5	36.06	59.5	70.2	60.92	28.45	18.48	14.17	15.03	124.1	153.9	3.13
98	Anburaj	36	Male	39.68	32.48	69.96	72.27	66.59	30.05	13.8	12.71	18.82	121.8	158.8	3.2
99	Aruldhas	60	Male	41.25	30.43	69.01	71.37	65.22	31.31	19.83	15.11	18.38	123.1	150.4	2.23
100	Arun Balaji	28	Male	47.18	33.58	75.47	78.77	71.59	35.94	19.78	17.73	20.96	115.5	156.1	2.74

S.No	Name	Age	Sex	Right											
				Maximum Ramus Breadth	Minimum Ramus Breadth	Condylar height	Projective height of ramus	Coronoid height	height of mandible	Superior margin of mental foramen to inferior border	Inferior margin of mental foramen to in ferior border	Superior margin to alveolar crest	gonial angle	antigonial angle	antigonial depth
1	Vasanthi	35	Female	36.72	33.28	60.87	55.52	60.88	28.17	15.84	13.64	15.8	124.5	159.7	2.78
2	Janamitra	20	Female	34.13	27.98	69.55	73.35	67.8	27.91	17.29	15.48	14.07	132.8	162.2	2.87
3	Abhinaya	20	Female	45.5	32.94	73.5	69.33	60.33	28.96	14.09	12.42	20.22	131	161.2	2.67
4	Vennila	25	Female	42.31	40.41	75.92	75.04	64.09	27.15	11.95	13.48	16.9	128	162.2	2.56
5	Indrani	65	Female	49.57	35.46	73.02	64.07	60.79	27.15	18.21	15.66	18.36	133	160.3	2.98
6	Lakshmi	31	Female	41.63	28.55	73.89	70.31	66.5	27.97	13.85	10.27	17.01	122.9	158.5	3.01
7	Padmini	50	Female	38.28	29.22	70.6	69.49	66.51	25.97	16.65	13.61	12.15	133.7	159.8	3.12
8	Arul Mozhi	23	Female	40.86	30.35	74.03	74.02	64.01	29.19	14.4	12.02	16.21	128	158.9	3.65
9	Latha	40	Female	43.7	27.8	74.59	71.59	67.36	32.48	16.88	10.7	17.82	130.3	160.2	2.76
10	Gayathri	45	Female	44.68	27.47	72.63	7.63	62.21	32.03	16.87	13.39	17.85	131	161.2	2.76
11	Indhra	59	Female	39.93	29.99	69.89	65.99	57.92	34.03	18.8	14.38	17.4	131	162.3	2.98
12	Mahalakshmi	39	Female	47.4	26.35	69.61	64.5	60.07	27.15	15.38	10.69	21.81	138.5	165.5	2.76
13	Chandra	50	Female	41.43	39.1	68.67	69.12	64.82	31.57	17.07	14.2	25.9	128.8	163.3	2.98
14	Manjula	45	Female	45.17	32.41	67.11	67.78	63.04	31.37	13.66	11.12	18.29	130.6	162.1	2.89
15	Jamuna Bai	63	Female	46.47	31.64	64.49	69.59	62.32	26.16	15.85	11.87	12.9	132.8	162.7	2.78

16	Alyama	52	Female	50.56	37.19	78.93	70.71	75.84	31.72	15.22	12.01	22.13	131.7	156.7	2.67
17	Chanjal	58	Female	48.9	39.11	78.23	65.72	78.63	19.47	13.22	17.5	22.07	118.2	154.8	2.65
18	Aishwarya	21	Female	35.41	32.7	68	65.67	57.22	27.33	15.56	13.56	18.05	131.9	156.8	2.12
19	Kasthuri	55	Female	43.17	31.11	63.26	64.59	58.39	33.42	17.06	13.45	20.77	125.9	156.8	2.89
20	Jothilakshmi	21	Female	43.68	31.25	61.99	60.62	57.77	27.28	14.16	10.17	14.91	138.4	147.8	3.14
21	Mentusingh	40	Female	40.08	26.69	68.79	70.61	57.29	29.08	11.28	17.92	132.8	132.8	16	2.14
22	Annalakshmi	35	Female	45.33	30.57	69.65	69.88	61.85	32.84	17.92	13.24	19.49	135.9	156.7	3.14
23	Sugunehwari	43	Female	40.9	32.42	69.64	68.83	56.38	30.01	14.81	12.24	19.69	138.8	160	2.91
24	Vennila	26	Female	42.31	40.41	75.92	75.04	64.09	27.15	16.9	13.48	11.95	128.5	158	3.02
25	Niranjiu	30	Female	37.44	29.06	74.33	73.5	62.8	30.33	16.33	14.26	16.33	123.5	153.8	4.03
26	Eswari	34	Female	46.66	32.62	72.68	75.33	68.08	32.03	14.49	11.4	18.47	127	158	3.42
27	Ajantha	33	Female	43.14	36.42	67.81	68.59	61.58	29.69	16.81	13.94	18.44	126	162	3.17
28	Agnes Manuel	29	Female	38.43	27.97	66.33	66.29	61.32	33.89	16.52	12.84	19.43	133.1	163.1	2.6
29	Alamalumegai	49	Female	41.25	31	61.02	61.81	59.22	31.7	17.65	14.72	16.63	128.9	162	3.15
30	Amutha	54	Female	43.3	27.22	66.41	68.42	55.9	33.99	13.7	10.31	13.99	133.8	162	2.87
31	Dilshad	48	Female	46.53	28.41	68.62	67.64	65.54	30.01	14.86	13.43	14.77	130.7	160	2.96
32	Jerina	26	Female	44.74	32.13	71.08	69.4	68.67	30.02	14.7	12.86	20.25	129.1	165	2.33
33	Lakshmi	24	Female	45.5	30.82	66.57	63.59	54.69	31.22	14.65	13.44	18.06	130	162	2.45
34	Sudha	36	Female	45.45	31.03	60.3	61	54.58	30.26	16.65	13.01	16.5	138.2	159	2.33

35	Divya	20	Female	39.57	33.73	71.54	73.01	69.51	30.73	16.16	13.09	15.99	125	155	3.13
36	Gnanammal	62	Female	46.16	34.45	68.12	70.09	65.82	33.39	14.65	13.04	19.47	130.6	161.7	2.87
37	Hemalatha	31	Female	39.41	28.74	69.61	71.08	64.62	31.56	15.67	13.62	18.68	127.9	157.5	2.12
38	Geetha	45	Female	31.27	26.14	67.29	64.86	57.63	28	13.74	10.82	13.74	125.9	155	2.43
39	Gowsalya	47	Female	44.58	31.12	60.6	60.27	59.18	29.71	14.82	10.87	16.86	130.7	153	2.67
40	Bavani	32	Female	36.26	27.79	61.14	62.24	57.48	28.41	17.03	14.08	17.71	139.1	163	3.12
41	Nagavalli	33	Female	44.74	36.12	69.93	65.48	62.7	30.96	15.3	13.39	17.55	134.1	162.5	2.67
42	Selvi	26	Female	43.28	29.6	61.89	61.24	56.83	29.61	15.77	12.89	16.89	132.9	162.3	2.65
43	Maheshwari	60	Female	40.18	29.17	63.49	62.21	62.79	28.47	15.76	12.65	19.86	136.8	162.2	2.14
44	Anandhi	40	Female	44.68	32.07	66.8	66.86	60.03	37.61	14.85	12.35	22.43	126	158	2.87
45	Premalatha	55	Female	36.95	26.57	66.61	66.88	63.18	27.07	13.99	11.7	27.07	125.7	161.2	2.76
46	Allyammal	55	Female	53.86	37.72	74.86	73.98	69.69	32.52	16.71	13.19	22.1	127	159	3.12
47	Shanthi	40	Female	44.36	30.67	71.51	70.04	65.23	32.66	16.53	12.05	17.93	125.8	162.3	3.22
48	Sundari	21	Female	49.25	36.5	66.38	68.48	64.46	30.44	14.57	11.53	16.99	132	162.2	2.76
49	Rajeshwari	59	Female	57.53	34.99	60.27	62.46	60.27	31.07	14.06	11.71	18.24	128.2	158.3	3.12
50	Bhuvaneshwari	27	Female	43.89	27.01	71.19	66.23	57.44	27.97	16.64	12.08	17.09	132	162.4	2.65
51	Binshi	24	Female	46.25	29.39	68.67	70.48	65.34	30.08	16.21	12.43	17.63	131.4	160.4	3.54
52	Nirmala	41	Female	43.47	34.03	62.48	64.48	62.83	31.97	16.43	14.39	18.29	128.2	162.3	3.22
53	Shakila Begum	46	Female	45.64	32.8	60.16	65.01	60.58	26.46	15	12.16	14.98	127.8	159.9	2.76

54	Amutha	40	Female	43.66	32.41	69.69	68.82	59.48	32.47	15.56	11.95	20.67	134	160	2.34
55	Anuradha	26	Female	41.02	31.21	71.7	71.67	71.27	69.67	17.82	18.84	14.62	139.96	150.9	3.15
56	Banu	32	Female	44.69	33.74	61.11	56.71	57.62	28.08	14.51	11.59	18.79	134.4	154.4	2.78
57	Dhanalakshmi	45	Female	45.39	28.37	62.06	60.08	57.47	27.44	14.99	13.04	16.12	134.3	162.7	2.67
58	Gayathri	27	Female	46.43	29.53	72.27	68.97	64.66	32.62	17.76	14.68	17.21	132.2	162.23	2.45
59	Geetha	41	Female	49.2	35.16	62.14	65.41	58.89	28.05	16.19	14.47	17.12	132.8	161.12	2.67
60	Gomathi	38	Female	44.11	34.59	68.01	64.97	64.96	33.58	19.77	15.47	16.77	127.1	162.2	2.56
61	Gracy	40	Female	45.05	34.9	66.8	62.65	62.65	30.79	15.13	12.08	17.86	123.9	165.6	2.87
62	Abirami	19	Female	44.49	31.62	58.25	57.35	54.11	31.13	13.8	10.44	20.84	134.3	162.4	2.87
63	Anju	23	Female	45.71	33.05	61.83	61.78	62.52	30.85	14.42	11.2	16.92	124.1	161.7	2.78
64	Chitra	34	Female	44.88	35.95	63.12	64.77	58.1	34.68	16.81	13.36	22.16	132.5	162.3	2.65
65	Dharmaiya	20	Female	45.54	32.32	66.05	67	57.84	28.64	17.42	12.1	15.09	128.7	164.3	2.65
66	Eswari	24	Female	41.09	28.01	63.94	64.01	56.94	29.91	15.7	12.88	16.18	129.8	162.1	2.5
67	Kastoori	45	Female	44.08	36.72	67.77	70.94	66.08	36.44	16.74	15.06	21.17	123.7	161.1	2.74
68	Kavitha	27	Female	37.47	28.99	65.11	66.35	55.17	30.56	16.35	13.05	17.39	125.2	160.2	2.45
69	Maheshwari	42	Female	39.19	31.24	64.52	65.9	60.6	29.92	17.26	13.56	16.78	130.6	162.2	2.43
70	Malar	51	Female	41.84	30.37	61.6	61.68	56.69	28.67	14.32	10.67	16.85	126.2	164.4	3.12
71	Aishwarya	21	Female	39.41	32.67	61.5	63.12	53.23	26.1	14.33	10.14	18.1	132.2	166.2	3.3
72	Usha	43	Female	36.65	28.53	65.78	65.96	66.83	28.05	16.71	13.97	16.45	132.5	164	3.45

73	Anandhi	40	Female	43.07	32.97	66.41	66.67	59.38	35.65	17.26	14.16	21.17	124.7	162.1	2.76
74	Anandhi	28	Female	45.08	33.96	61.95	62.71	58.85	32.19	16.71	13.02	21.45	126.8	161.2	2.65
75	Devaghi	40	Female	44.78	28.2	63.86	63.85	63.01	33.08	17.34	12.5	18.41	126.4	164.2	2.65
76	Devipriya	30	Female	48.13	31.66	69.77	70.85	66.65	34.36	19.21	14.28	21.05	128.2	162.3	2.45
77	DIVYA	24	Female	44.09	31.99	69.6	71.91	61.66	32.82	14.94	10.97	19.23	134.5	162.1	2.56
78	Gajalakshmi	40	Female	41.55	33.6	65.08	69.87	54.63	26.34	14.62	10.49	16.66	125.3	162.4	3.13
79	Sivakumari	56	Female	37.44	29.06	74.33	73.87	62.8	29.6	16.33	14.26	16.63	123.5	157.6	2.98
80	Hemalatha	31	Female	46.86	35.48	70.56	73.55	65.45	36.56	17.39	12.55	19.96	129.6	161.6	3.12
81	Jagadeeswari	58	Female	40.09	25.81	62.34	70.64	58.65	30.33	18.49	13.3	15.9	132.6	160.8	3.12
82	Jenita	38	Female	38.15	32.18	62.78	68.36	58.34	32.56	14.63	12.94	16.33	132.2	162.3	2.43
83	Kala	27	Female	49.58	34.69	66.57	67.49	63.31	31.78	18.26	13.95	17.54	130.6	163.2	2.45
84	Kasthuri	48	Female	49.12	32	67.54	70.64	60.57	29.17	14.87	13.22	19.35	133.7	163.2	2.34
85	Kumari	47	Female	44.8	28.95	64.92	65.38	57.78	29.14	14.54	10.48	19.52	132.2	160.4	2.67
86	Sundari	60	Female	46.77	32.62	56.87	57.21	55.73	27.63	15.89	12.88	17.68	132.8	161.3	2.67
87	Thenmozhi	42	Female	50.11	33.5	60.03	67.84	59.11	31.25	13.36	11.35	16.43	137.7	165.4	2.54
88	Rani	53	Female	44.67	33.51	61.86	65.24	60.45	33.19	16.64	13.05	19.14	126.8	161	3.12
89	Mariamma	40	Female	41.23	33.53	58.65	61.02	57.67	30.49	14.61	11.79	18.05	130.9	167	2.89
90	Swethaa	21	Female	44.66	34.67	68.74	71.01	67.9	33.76	19.16	15.37	19.11	137.8	164.8	2.78
91	Amuthasiva	38	Female	46.03	33.27	70.25	73.44	68.53	34.98	18.21	15.01	19.41	137.2	162.3	3.23

92	Teja	21	Female	43.65	33.97	63.87	69.66	58.06	32.8	16.44	13.41	19.53	131.9	162.6	2.45
93	Asha	36	Female	40.23	28.02	66.11	69.6	57.55	32.27	18.01	14.58	15.22	127.9	163.4	2.67
94	Chandra	40	Female	44.66	33.5	66.33	70.74	64.74	33.86	17.46	13.83	20.24	128.9	159.6	2.98
95	Thabisha	42	Female	46.27	35.77	69.36	71.25	67.91	33.34	16.59	12.73	19.24	17.6	162.3	3.12
96	Vijaya	40	Female	44.13	35.13	55.58	62.85	50.61	25.37	15.37	12.88	11.99	133.9	163.4	2.98
97	Parvatham	28	Female	43.93	28	55.92	57.78	55.17	26.57	16.19	12.57	16.65	138.4	162.4	3.43
98	Saraswathi	36	Female	47.87	33.4	70.64	71.49	62.36	35.43	18.21	14.61	21.75	131.1	158.9	3.12
99	Banumadhi	52	Female	46.25	29.71	54.54	55.99	54.4	30.13	18.11	14.8	18.79	133.5	162.3	2.15
100	Chanjal	58	Female	48.9	34.11	76.23	78.63	75.72	31.07	19.47	13.22	17.5	129.2	160.3	2.89

S.No	Name	Age	Sex	**Left**											
				Maximum Ramus Breadth	Minimum Ramus Breadth	Condylar Height	Projective Height Of Ramus	Coronoid Height	Height Of Mandible	Superior Margin Of Mental Foramen To Inferior Border	Inferior Margin Of Mental Foramen To Inferior Border	Superior Margin To Alveolar Crest	Gonial Angle	Antigonial Angle	Antigonial Depth
1	Vasanthi	35	Female	36.29	32	58.75	55.76	62.94	25.04	12.06	9.79	18.01	124.6	154.6	2.56
2	Janamitra	20	Female	35.05	30.68	72.1	72.04	67.32	27.95	15.19	14.14	14.51	126.7	158.7	2.45
3	Abhinaya	20	Female	43.76	29.38	68.84	67.61	63.15	28.69	15.43	12.32	19.06	129	159.1	2.67
4	Vennila	25	Female	44.82	40.4	73.83	75.24	68.33	27.04	14.55	11.65	15.46	116.3	160.1	2.56
5	Indrani	65	Female	41.2	33.59	69.22	63.84	62.21	28.84	17.82	15.99	16.42	133	162.2	2.87
6	Lakshmi	31	Female	39.88	28.19	68.16	66.93	64.75	26.74	14.52	10.64	15.41	121.8	158.2	2.87
7	Padmini	50	Female	33.39	25.06	67.31	61.91	59.01	24.87	17.85	12.89	12.08	131.3	159.7	2.87
8	Arul Mozhi	23	Female	40.48	30.35	71.96	72.17	64.58	33.09	17.54	14.26	17.01	131	158.9	2.78
9	Latha	40	Female	43.27	24.95	75.19	72.41	64.91	31.29	16.63	11.6	18.62	131	160.1	2.89
10	Gayathri	45	Female	41.77	27.22	67.55	63.48	61.01	26.88	16.3	12.84	17.61	135.3	160.4	2.67
11	Indhra	59	Female	38.08	27.02	62.77	62.64	60.47	33.62	18.32	14.45	19.23	127.2	159.7	2.89
12	Mahalakshmi	39	Female	42.13	27.65	67.95	64.29	57.24	29.8	18.93	12.5	18.93	137	167.8	2.87
13	Chandra	50	Female	42.03	35.11	61.96	63.61	60.2	29.27	15.04	12.02	19.64	132.9	160.2	2.78
14	Manjula	45	Female	42.34	32.35	65.72	67.8	62.86	28.97	16.21	12.46	16.95	128.9	162.7	2.98
15	Jamuna Bai	63	Female	40.09	30.69	65.41	65.5	63.2	26.6	15.29	11.41	12.86	126.4	160.6	2.97
16	Alyama	52	Female	45.41	32.69	76.74	75.04	72.3	31.06	16.12	12.42	20.28	129.4	156.4	2.82
17	Chanjal	58	Female	51.8	37.22	79.12	69.48	79.12	28.89	17.98	13.56	19.45	128.2	154.9	2.73
18	Aishwarya	21	Female	37.47	30.75	63.59	65.67	57.22	27.33	17.56	15.53	18.05	131.9	156.5	2.76

19	Kasthuri	55	Female	42.74	31.54	63.26	64.59	58.34	33.42	20.77	14.67	20.77	125.9	162.4	3.13
20	Jothilakshmi	21	Female	41.28	28.2	60.68	68.18	63.19	25.03	13.96	12.34	15.03	131.1	159	2.98
21	Mentusingh	40	Female	39.77	26.4	63.97	65.46	55.07	29.08	15.76	13.62	15.55	131.7	160	3.12
22	Annalakshmi	35	Female	44.5	30.61	69.89	69.29	62.41	31.95	17	14.07	18.09	135.6	162	2.98
23	Sugunehwari	43	Female	44.46	37.91	66.13	68.12	62.43	32.01	15.65	13.7	18.48	129.1	159	2.18
24	Vennila	26	Female	44.82	40.4	73.83	75.24	68.33	27.04	15.46	14.55	11.64	116.8	148	2.98
25	Niranjiu	30	Female	33.04	26.89	72.04	69.78	63.22	26.65	13.59	10.15	20.2	129	155	3.1
26	Eswari	34	Female	45.96	31.98	67.27	73.12	67.27	31.49	15.47	11.56	18.15	125.8	153	2.53
27	Ajantha	33	Female	42.35	33.48	68.37	67.08	56.64	27.68	15.08	12.01	16.67	126.4	156.4	3.14
28	Agnes Manuel	29	Female	41.27	29.6	66.43	68.58	62.05	31.92	17.06	14.66	16	128.9	150	3.12
29	Alamalumegai	49	Female	46.34	24.45	63.28	63.49	60.58	31.07	16.35	13.36	16.85	135.7	154	3.45
30	Amutha	54	Female	43.32	26.36	62.91	62.43	56.2	30.45	14.32	14	11.59	135.1	160	2.34
31	Dilshad	48	Female	42.14	27.03	64.42	64.27	63.95	30.14	17.85	14.18	13.61	131	161	2.97
32	Jerina	26	Female	46.02	34.02	67.47	65.91	67.98	31.87	14.7	12.86	20.5	129.1	157	3.01
33	Lakshmi	24	Female	39.67	29.9	67.98	63.85	56.09	30.08	16.32	13.05	16.32	132	160	3.32
34	Sudha	36	Female	46.03	34.45	60.3	60.45	59.35	30.01	17.63	13.95	16	134.8	162	2.67
35	Divya	20	Female	40.1	34.92	69.25	71.29	66.34	31.04	16.93	12.92	16.01	126.2	160	2.43
36	Gnanammal	62	Female	48.8	37.16	68.01	71.02	64.6	33.92	15.87	13.76	19.53	127.2	159.7	3.12
37	Hemalatha	31	Female	40.5	28.58	69.08	68.73	65.51	31.36	14.64	11.58	17.7	128.4	158.2	2.13

38	Geetha	45	Female	35.62	28.47	63.12	64.86	57.63	28	13.74	10.82	13.75	124.7	159	2.67
39	Gowsalya	47	Female	44.57	33.82	63.06	62.86	56.31	28.74	14.48	10.91	18.09	135.9	158	2.65
40	Bavani	32	Female	34.33	26.58	59.01	59.62	55.24	27.09	16.85	13.02	19.85	137.3	162.3	2.87
41	Nagavalli	33	Female	47.02	31.78	62.97	63.67	59.79	31.03	14.28	11.79	19.98	127.4	158.4	2.43
42	Selvi	26	Female	45.5	31.43	64.54	64.31	56.25	30.06	15.59	13.45	17.29	135.7	159.5	2.43
43	Maheshwari	60	Female	43.49	31.62	65.85	65.67	60.7	26.11	15.86	12.45	19.96	134	159.4	2.78
44	Anandhi	40	Female	43.2	32.24	65.29	65	61.11	35.55	15.03	12.22	22.72	127.6	161	2.84
45	Premalatha	55	Female	41.49	27.54	56.9	56.8	56.2	26.13	13.8	10.73	26.13	130.1	162.3	2.65
46	Allyammal	55	Female	44.75	32.85	70.39	71.47	71.34	30.22	16.27	13.31	18.56	130.5	163.7	3.23
47	Shanthi	40	Female	42.97	27.91	68.98	68.7	61.53	31.43	15.56	11.67	17.81	131.2	162.5	2.87
48	Sundari	21	Female	49.13	35.74	64.16	65.15	62.71	30.44	14.57	11.53	16.99	131.3	161.3	2.32
49	Rajeshwari	59	Female	41.23	32.62	58.21	56.93	58.21	29.15	16.55	13.34	16.05	131.2	159.8	2.45
50	Bhuvaneshwari	27	Female	41.03	30.41	65.9	66.37	66.97	33.67	17.15	12.64	18.7	131.4	162.5	2.98
51	Binshi	24	Female	44.14	33.48	70.73	72.23	64.23	28.95	14.07	11.35	18.28	132.6	160.2	2.87
52	Nirmala	41	Female	47.58	34.7	68.1	68.18	61.67	35.86	17.5	15.39	18.37	134.7	167	3.54
53	Shakila Begum	46	Female	43.97	33.92	61.52	64.01	65.04	26.6	16.4	14.41	11.9	138	161.7	3.65
54	Amutha	40	Female	46.52	34.68	61.94	61.34	61.97	30.16	15.45	13.1	18.53	135	162	2.18
55	Anuradha	26	Female	39.8	31.34	74.39	73.42	69.86	33.38	15.52	11.95	20.67	134	163.7	3.12
56	Banu	32	Female	44.18	38.77	64.92	60.08	59.63	28.42	13.58	12.37	19.2	129.6	162.5	2.78

57	Dhanalakshmi	45	Female	41.73	32.3	63.16	60.28	57.79	25.62	16.74	13.16	13.87	137.8	162.7	2.45
58	Gayathri	27	Female	41.21	28.01	63.97	62.89	60.04	30.4	17.27	13.34	17.61	135.6	162.1	2.67
59	Geetha	41	Female	44.69	32.08	66.49	65.63	61.45	29.82	16.33	13.77	16.4	134.9	162.4	2.87
60	Gomathi	38	Female	41.69	32.85	64.89	65.07	62.74	34.75	18.53	14.01	18.99	137.2	163.3	2.78
61	Gracy	40	Female	45.06	34.9	66.8	62.65	62.65	30.73	15.13	12	17.86	132.5	162.6	2.65
62	Abirami	19	Female	43.43	26.89	60.19	57.83	57.72	29.54	13.84	12.09	23.4	134.8	162.3	2.76
63	Anju	23	Female	42.4	32.54	60.55	60.57	60.82	31.64	13.62	11.38	16.89	119.1	156.1	2.87
64	Chitra	34	Female	43.49	34.22	62.73	62.01	55.66	34.24	16.66	13.69	23.12	133.9	162.3	2.67
65	Dharmaiya	20	Female	41.12	31.09	66.84	67.99	60.38	29.23	15.34	11.62	17.61	128.8	161.1	2.54
66	Eswari	24	Female	38.14	26.26	57.64	58.02	55.63	28.55	14.12	12.14	16.32	132.6	162.2	3.12
67	Kastoori	45	Female	42.74	37.91	69.84	72.11	62.68	34.83	18.51	16.52	18.25	134.2	162.1	2.78
68	Kavitha	27	Female	38.61	28.53	62.11	63.54	54.33	30.1	14.45	12.57	16.24	137.4	162.1	3.12
69	Maheshwari	42	Female	36.95	27.22	60.6	63.99	60.53	30.35	14.15	10.39	19.51	137.2	164.5	3.45
7	Malar	51	Female	38.79	26.19	59.52	54.32	68.07	35.69	14.99	12.62	16.85	130.8	161.5	2.87
71	Aishwarya	21	Female	41.39	28.64	63.7	63.51	57.34	26.95	14.6	10.77	18.79	125.9	159.9	2.78
72	Usha	43	Female	37.1	28.73	63.62	65.73	59.24	31.78	14.98	12.15	20.1	129.8	162.2	2.67
73	Anandhi	40	Female	43.38	29.05	62.65	65.57	62.36	35.05	16.76	14.81	21.03	133.2	160.2	2.65
74	Anandhi	28	Female	44.77	31.6	59.3	59.9	57.22	31.97	15.95	11.17	21.52	131.8	165.4	2.54
75	Devaghi	40	Female	44.78	28.2	63.86	63.85	63.01	33.09	17.34	12.25	18.41	129.1	162.2	3.12

76	Devipriya	30	Female	48.2	31.25	73.9	74.01	63.29	33.36	17.65	13.74	20.15	123.1	157.5	2.56
77	DIVYA	24	Female	37.98	29.18	68.74	72.02	61.33	30.91	14.4	10.93	19.3	138.3	162.2	2.65
78	Gajalakshmi	40	Female	36.68	26.85	67.87	69.45	65.27	23.57	13.76	10.1	15.6	136.7	159.8	3.12
79	Sivakumari	56	Female	33.94	26.89	70.04	72.04	69.78	26.65	13.59	10.15	20.6	134.5	161	2.34
80	Hemalatha	31	Female	43.22	32.19	70.05	73.21	64.56	33.18	17.83	13.26	18.94	129.7	162.2	2.65
81	Jagadeeswari	58	Female	46.88	30.64	64.09	68.97	60.03	31.07	19.2	13.45	15.03	125.7	157.8	2.45
82	Jenita	38	Female	40.62	29.82	62.25	66.23	53.78	30.17	16.71	14.32	18.58	123.8	157.8	3.14
83	Kala	27	Female	49.42	32.21	69.98	70.43	65.69	31.64	16.15	13.47	18.54	130.8	160.5	3.12
84	Kasthuri	48	Female	46.16	35.54	64.1	64.63	60.63	32.11	15.95	13.1	17.78	129.8	161.2	2.67
85	Kumari	47	Female	43.46	28.63	60.61	60.82	53.47	26.09	14.9	10.49	16.1	134.1	162.3	2.87
86	Sundari	60	Female	48.33	32.88	59.01	61.3	63.87	25.99	15.17	12.01	15.55	136.8	161.6	3.14
87	Thenmozhi	42	Female	42.37	31.52	61.44	63.28	58.35	28.07	14.33	12.08	14.58	130.3	162.3	2.67
88	Rani	53	Female	43.15	31.02	60.3	65.49	57.61	32.92	17.1	12.82	18.34	134.6	162.3	2.76
89	Mariamma	40	Female	43.05	33.28	58.64	58.94	57.65	37.93	15.36	11.75	16.85	133.7	162.3	2.34
90	Swethaa	21	Female	41.2	32.85	68.55	70.96	64.62	33.72	19.16	15.37	19.11	137.8	163.2	2.67
91	Amuthasiva	38	Female	40.82	31.21	72.36	73.55	62.32	35.79	20.3	16.32	16.42	133.4	163.4	2.67
92	Teja	21	Female	42.73	31.19	61.24	65.65	59.06	35.14	15.67	14.16	18.54	139	162.4	2.67
93	Asha	36	Female	39.93	29.17	68.37	71.46	65.96	30.56	16.69	13.16	16.21	128.9	163.2	2.65
94	Chandra	40	Female	46.18	33.27	67.95	69.84	61.95	33.96	16.15	14.03	18.95	132.3	162.3	2.87

95	Thabisha	42	Female	45.86	36.86	72.58	73.98	67.04	34.39	15.78	13.19	18.36	128.6	161.2	2.67
96	Vijaya	40	Female	39.35	31.7	55.1	59.74	52.31	24.64	16.53	13.42	10.8	130.65	164.4	2.87
97	Parvatham	28	Female	43.17	29.07	56.01	58.06	54.02	26.62	15.23	12.13	15.46	136.9	162.3	2.98
98	Saraswathi	36	Female	48.99	31.06	66.3	66.54	57.38	36.96	17.63	14.07	22.15	129.6	162.1	2.87
99	Banumadhi	52	Female	46.46	28.25	52.47	56.62	54.34	30.56	18.43	17.29	12.86	133.7	160.4	2.98
100	Chanjal	58	Female	51.8	37.22	78.12	79.01	69.48	28.89	17.98	13.56	19.45	131.2	162.3	2.67