ASSESSMENT OF VARIATION AND LOCATION OF THE INFRA ORBITAL FORAMEN WITH ITS NEIGHBOURING STRUCTURES USING CONE BEAM COMPUTED TOMOGRAPHY

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CHENNAI

DECLARATION BY THE CANDIDATE

I hereby declare that this dissertation titled **"ASSESSMENT OF VARIATION AND LOCATION OF THE INFRA ORBITAL FORAMEN WITH ITS NEIGHBOURING STRUCTURES USING CONE BEAM COMPUTED TOMOGRAPHY"** is a bonafide and genuine research work carried out by me under the guidance of **Dr. S. KAILASAM, B.Sc., M.D.S.**, Professor and Head, Department of Oral Medicine & Radiology, Ragas Dental College and Hospital, Chennai.

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CERTIFICATE

This is to certify that this dissertation titled **"ASSESSMENT OF VARIATION AND LOCATION OF THE INFRA ORBITAL FORAMEN WITH ITS NEIGHBOURING STRUCTURES USING CONE BEAM COMPUTED TOMOGRAPHY'** is a bonafide record of work done by **Dr. B.Niranjana** under my guidance during her postgraduate study period 2014-2017.

This dissertation is submitted to **THE TAMILNADU Dr. M.G.R.MEDICAL UNIVERSITY,** in partial fulfilment for the degree of **MASTER OF DENTAL SURGERY, BRANCH IX – Oral Medicine & Radiology.**

It has not been submitted (partial or full) for the award of any other degree or diploma.

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LIST OF ABBREVIATIONS

S.NO	ABBREVIATION	EXPANSION
1.	**CBCT**	Cone Beam Computed Tomography
2.	**CT**	Computed Tomography
3.	**ZIs**	Zygomatic Implants
4.	**IOC**	Infra Orbital Canal
5.	**ION**	Infra Orbital Nerve
6.	**IOF**	Infra Orbital Foramen
7.	**IOM**	Infra Orbital Margin
8.	**IOR**	Infra Orbital Rim
9.	**DC**	Dacryon
10.	**PA**	Piriform Aperture
11.	**AM**	Alveolar Margin
12.	**ANS**	Anterior Nasal Spine
13.	**SON**	Supra Orbital Notch

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Introduction

INTRODUCTION

In patients with severely atrophic maxilla, prosthetic rehabilitation with complete restoration of form and function pose a challenge due to lack of adequate bone support.[6,30] Inadequate bone volume can be due to resorption following extraction, traumatic injuries, infection, pneumatisation of the maxillary sinus, juvenile periodontitis, congenital malformations, genetic disorder like ectodermal dysplasia, and ablative tumour surgery. To overcome this, advanced surgical procedures such as bone grafting, dental implants, sinus lifting, Le Fort I osteotomy with interpositional bone grafting, guided bone regeneration or combinations are advocated by maxillofacial surgeons.[28] These procedures are technique sensitive and have limitations like need for hospitalization, morbidity of donor site, unpredictable resorption of the bone graft, and delayed placement of the implant.

With a goal to reduce the surgical morbidity, anchorage from the extra-oral sites like zygoma or pterygoid are considered. Professor Per –Ingvar Branemark in 1988, introduced zygomatic implants as a new treatment alternative for bone augmentation, sinus lift procedures in the management of the atrophic edentulous maxilla.[57,64] Combination of conventional and zygomatic implants or multiple zygomatic implants (Quad zygomatic implants) are preferred in areas of severely atrophic edentulous ridge with pneumatisation of maxillary sinuses.[48,50]

Sensitivity disorders after zygomatic surgery had been reported in several studies. Complications of these procedures include infection, sinusitis, paraesthesia and oro-antral fistula formation. 0.4 to 1% of paraesthesia of the infra orbital nerve were also documented. Iatrogenic injuries to the neurovascular bundle during anesthesia or while performing surgical procedure can result in transient or permanent hypoesthesia, paraesthesia or neuralgia.[6, 12, 25, 49]

So, for a successful implant placement, complete pre-surgical evaluation of the implant site, sinus status, bone quality and quantity, and evaluation of vital structures like orbit, infra orbital nerve and blood vessels around the implant site are mandatory.[16]

Zygomatic implants are self- tapering screws available in different length ranging from 30-52mm, angulated at 45˚ to the maxilla. The portion of bone that engages the residual ridge has a diameter of 4.5mm and to the zygoma has a diameter of 4mm.[6, 48] Pre - operative evaluation of the relative distance from the implant site to the foramen helps to minimize the risk of injuries to the neurovascular bundles.

Infra orbital nerve, a direct extension of the maxillary division of the trigeminal nerve exits the cranium via infra orbital foramen.[55, 70]

Anatomical knowledge about the location of infra orbital foramen is crucial for maxillofacial surgeons both during anesthesia and various surgical

procedures. Many topographic studies on dry skull were conducted to determine the location and variation of the foramen from different anatomical reference points. It shows clear evidence of variation and relative position of the infra orbital foramen among different racial groups. [53, 65]

Since there were many topographic studies reported about the variation in the location of infra orbital foramen from various anatomic landmarks like mid-line, piriform aperture, the present study was an attempt to evaluate the location and variation of the foramen with its neighbouring structures using CBCT.

Aim and Objectives

AIM AND OBJECTIVES

AIM OF THE STUDY:

- To assess the variation and location of the infra orbital foramen with its neighbouring structures using CBCT.

OBJECTIVES OF THE STUDY:

- To measure the distance of infra orbital foramen from the mid sagittal plane to the centre of the foramen on both right and left side.
- To measure the distance of infra orbital foramen from the infra orbital rim to the centre of the foramen on both right and left side.
- To measure the distance of infra orbital foramen from the zygomatic buttress to the centre of the foramen on both right and left side.
- To assess the presence of accessory infra orbital foramen**.**
- To compare and assess the variation in the location of infra orbital foramen among different age group and gender.

Review of Literature

REVIEW OF LITERATURE

Rehabilitation of the defects in the craniofacial region caused due to congenital mid facial anomaly, genetic disorders like ectodermal dysplasia, juvenile periodontitis, traumatic loss, tumour resection is critical to improve the quality of life in affected patients. Correction of these defects and restoring the functional occlusal harmony with conventional prosthesis is challenging due to lack of adequate bone volume for anchorage.[6,28,30] To resolve this, advanced techniques such as bone grafting, dental implants, sinus lifting, Le Fort I osteotomy with interpositional bone grafting, pterygoid implants, and zygomatic implants are preferred.[50] Professor Per–Ingvar Branemark in 1988, observed insufficient bone volume for implant anchorage in patients with atrophic maxilla, fully edentulous maxilla, cleft lip and palate.[49,60] With an effect to reduce surgical morbidity in these patients he considered the dense, compact zygomatic bone as anchorage site for implant supported prosthesis.[8,64]

In the last two decades, zygomatic implants are considered as an effective alternative for bone augmentation, sinus lift procedures in the management of the atrophic edentulous maxilla caused due to tumour resections, trauma and congenital defects. In patients with severe atrophic maxilla with significant sinus pneumatisation, combination of conventional implants with zygomatic implants or multiple zygomatic implants (Quad zygomatic implants) are preferred.[48,50,64] Complications with these procedures

include infection, sinusitis, paraesthesia , and oro-antral fistula formation.0.4 to 1% of paraesthesia of the infra orbital nerve were reported.[6, 12, 25, 49]

Henceforth, for a successful implant placement pre-surgical evaluation of the zygomatic implant site and the sinus status, critical assessment of the vital structures like the orbit, infra orbital nerve and vessels as well as for the implant path is mandatory. The amount of available bone in the zygomatic arch and in the residual alveolar crest has to be explored before planning.

Infra orbital foramen which transmits both nerve and blood vessels is the important anatomical landmark for oral and maxillofacial surgeons both from perspective of implant placement and local anesthesia. Transient or permanent hypoesthesia, paraesthesia or neuralgia result due to iatrogenic injuries to the infra orbital nerve. [25, 57]

To our knowledge, many topographic studies on dry skull were conducted to determine location of the infra orbital foramen from various anatomical landmarks. Since there were not many radiological studies done to assess the variations in the infra orbital foramen both by location and number, and its relationship with zygomatic bone, the present study aimed at assessing the variations and location of the infra orbital foramen using CBCT.

ZYGOMATIC IMPLANTS:

The zygoma is a paired quadrangular bone occupying the anterolateral corner of the midface. It forms the floor and anterolateral wall of orbit as well as roof of maxillary sinus. It articulates with the maxilla, the temporal bone, the sphenoid bone and the frontal bone .The zygomatic bone are composed of regular trabecular and compact bone with an osseous density of 98%. The body of zygoma shows minimal changes in the morphology with age. It functional efficiency is to transmit the mandibular masticatory loads generated directly by the maxillary molar region to the anterior skull base region.[30, 57]

The zygomatic implants are self-tapping titanium screws introduced by Branemark in 1988, provided a new treatment alternative that offers a predictable anchorage for fixed prostheses and eliminates the need for bone grafting procedures for rehabilitation of severely atrophic maxilla. [64]

They are available in different lengths ranging from 30 to 52.5 mm. They are angulated at 45° head to compensate for the angulation between the zygoma and the maxilla .The portion that engages the zygoma has a diameter of 4.0 mm and the portion that engages the residual maxillary alveolar process has a diameter of 4.5 mm. [6, 48]

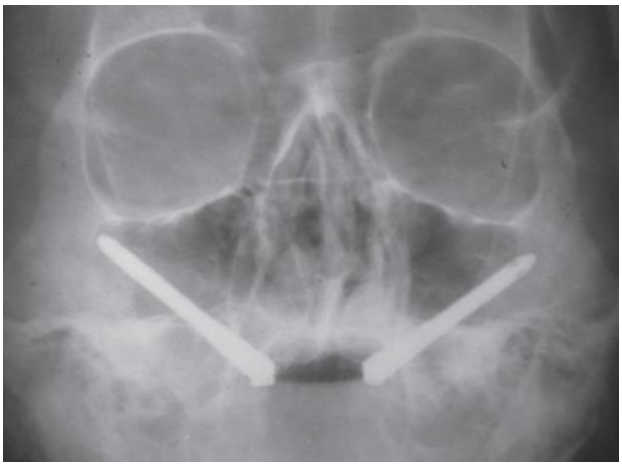


FIG 1- RADIOGRAPHIC IMAGE OF PATIENT WITH TWO ZYGOMATIC IMPLANTS

Yuki Uchida et al (2001)[75], conducted a study to assess the angular and linear distances between the maxilla and the zygoma in 12 cadavers. The result concluded for an implant with apex of a 3.75 mm- diameter implant requires a zygoma of at least 5.75 mm in thickness. The mean distance between the alveolar crest in the canine region and the lateral margin of the orbital socket was 53.42 mm, and between the alveolar crest in the premolar region and the area closest to the lateral margin of the orbital socket was 42.47 mm. It is essential to determine the mean antero- posterior length of the maxillary zygomatic process and zygoma preoperatively to avoid exposure and safe installation of zygomatic implants.

Emeka Nkenke et al (2003)[21], conducted a study with the aim to morphometric assessment of zygomatic bone for implant placement on 30 human zygoma specimen using CT. The result concluded that the average anterior-posterior length for female and male were 25.40±2.64mm and 24.93±4.67mm.The medio-lateral thickness for the female group female 7.60±1.45mm, male 8.00±2.26mm. Pre-surgical evaluation of the zygomatic bone from vital structures like orbit, maxillary sinus and infra orbital foramen during implant placement is mandatory to prevent surgical complication.

Paulo Maló, et al (2008)[48], conducted a pilot study with aim to assess the survival rate on single or multiple zygomatic implants on 29 patients for rehabilitation of the complete edentulous atrophied maxillae with anchorage from zygoma. The result concluded that 98.5% and 100% survival rate at 1year.

Amrita Pandita et al (2016)[6]**,** conducted a review on rehabilitation of resorbed maxilla with zygomatic implants. The study concluded that zygomatic implants were considered as an alternative treatment option to bone augmentation, maxillary sinus lift procedures and bone grafts in patients with posterior atrophic maxilla. The use of zygomatic implants shortens treatment time and reduces morbidity. 82% and 100% of success rate is indicating in previous studies.

COMPLICATIONS IN ZYGOMATIC IMPLANTS PLACEMENT:

Various authors have reported complications in the placement of zygomatic implants:

Bruno Ramos Chrcanovic et al (2015)[12], conducted a systematic review on Survival and complications of zygomatic implants. Complications reported in the review were 70 cases of sinusitis, 48 cases of soft tissue infection around the implants, 15 cases of paraesthesia, and 17 cases of formation of oro-antral fistulas.

Humberto Fernandez et al (2013)[30], conducted a retrospective analysis on Zygomatic Implants for the Management of the Severely Atrophied Maxilla in 244 implants. The data's for the study were retrieved from 95 patients. One hundred eleven zygomatic implants were placed in women and 133 were placed in men, with an overall complication rate of 9.9%, with sinusitis the most frequent complication (7.5%). Other complications included paresthesia of infra orbital nerve (0.4%) and oroantral fistula (0.4%).

Amrita Pandita et al (2016)[6], conducted a review on rehabilitation of resorbed maxilla with zygomatic implants, discussed about different technique in placement of implants both intra-sinus and extra sinus pathway. The complication stated were infections in the maxillary sinus, hyperplasia of soft tissues, paraesthesia and fistula formation

Bruno Ramos Chrcanovic et al (2016)[14], conducted a systematic review with the aim to assess the survival rate of zygomatic implants (ZIs) and the prevalence of complications in sixty eight studies, comprising 4556 Zygomatic implants in 2161 patients, with 103 failures. The postoperative complications with Zygomatic Implants were sinusitis 2.4% (1.8-3.0), soft tissue infection 2.0% (1.2-2.8), paresthesia 1.0% (0.5- 1.4), oro-antral fistulas 0.4% (0.1-0.6). The reason for sensitivity disorders after Zygomatic implants surgery were as a reflection of the soft tissues in the malar region, a damage of the zygomaticofacial and infra orbital nerves is likely to occur during the clinical procedure of implant placement

Fotios Tzerbos et al (2016)[25], conducted a review on complications of zygomatic implants in four clinical cases. The reported complications in placement of zygomatic implants were sinusitis, oroantral fistula formation, orbital penetration and injury, temporary sensory nerve deficits and vestibular cortical fenestration. Paraesthesia over the malar region is noted due to injury to the infra orbital nerve or zygomaticofacial nerve

Pedro Molinero-Mourelle et al (2016)[49], conducted a systematic review on Surgical complications in zygomatic implants. Paresthesia due to injury to the infra orbital nerve is noted by Chrcanovic *et al in* 15 cases, 36% of cases by Bedrossian et al, and with a prevalence of 5.4-4.6% by Aparicio et al respectively.

CRITICAL EVALUATION OF THE IMPLANT SITE:

For successful implant placement, pre- operative assessments of bone quality, quantity, bone width, length, height, approximation with vital structures at the prospective implant sites are crucial. Diagnostic imaging helps to develop and implement a cohesive and comprehensive treatment plan for the implant team. In case of rehabilitation of atrophic maxilla, the vital structures to be considered are orbit, maxillary sinus and infra orbital nerves and blood vessels. [28]

The infra orbital nerve is the direct extension of the maxillary division of trigeminal nerve exits the skull via infra orbital foramen. Along the course it innervates the skin over the cheek, mucosa of maxillary sinus, maxillary incisors, canine and premolars with adjacent gingiva. It also innervates the skin over the conjunctiva of the inferior eyelid, part of the nose and the skin and mucosa of the upper lip. [18, 20, 39]

Knowledge about the inter-individual morphometric variations of the infra orbital foramen helps to reduce iatrogenic injuries during local anesthesia and with various maxillofacial surgeries .Various studies had reported anthropometric measurement of infra orbital foramen from various anatomical landmarks on human dry skull.

VARIATIONS IN THE INFRA ORBITAL NERVE LOCATION:

Triandafilidi E et al (1990)[72], conducted a study to assess the location of the infra orbital foramen on in 55 crania and in 16 cadavers. The landmarks in the cadavers used were the lateral point of the wing of the nose, and the medial angulus oculi. The landmarks in the crania used were the inferior orbital rim, the zygomaticoalveolar crest and the anterior nasal spine. The result concluded that the infra orbital foramen was situated in equal distance from the medial angulus oculi and the zygomaticoalbeolar crest. The infra orbital foramen was situated 7.19 mm below the infra orbital rim.

Hindy AM et al (1993)[29], conducted a study with the aim to assess the variations in the infra orbital foramen on thirty Egyptian dry adult skull of unknown age and sex. The infra orbital foramen was single in 90% of cases and double in 10% of cases. The distance from the centre of the infra orbital foramen to the inferior orbital margin was 6.1mm and to the lateral nasal border was14.7 mm.

Chung MS et al (1995)[17], conducted a study to assess the relationship between supra orbital notch, infra orbital foramen and mental foramen on two hundred and twenty four dry skull of Korean population. The study concluded that the infra orbital foramen was on the sagittal plane passing through the supraorbital notch/foramen in 36.4%, or lateral to the plane in 63.6% of the

study population. The average distance from the infra orbital margin to the centre of the infra orbital foramen was 8.6 mm**.**

Jonathan T. Leo et al (1995)[33], presented a case of the infra orbital nerve bifurcation in the base of the orbit and subsequently passing through two infra orbital canals and exit by two foramen separated from each other by 2cm in the axial plane and by 1cm in the sagittal plane.

Canan S et al (1999)[15], conducted a study with the aim to locate the infra orbital foramen and to determine the frequency and location of any accessory foramen on 45 cadavers. The results showed that the infra orbital foramen was 10.9 mm and 8.3 mm under the infra orbital margin in men and women, respectively. Accessory foramen was found in 11.5% of the study sample.

Shahid R. Aziz et al (2000)[63], conducted a study to determine the variation in the position of the infra orbital foramen in relation to the facial midline, infra orbital rim, supraorbital notch, and maxillary teeth in ninety four maxillae dissected out from forty-seven cadavers of unknown age and sex.

The result concluded that the mean distance between the infra orbital foramen and the inferior orbital rim was 8.5 mm. In women, it was 7.81 mm. The distance between the infra orbital foramen from the facial midline was 27.7 mm in males and 26.2 mm in females. Accessory canals were noted in

15% of the sample. No statistical significant difference between right and left sides and sexes were documented.

Mustafa kazkayasi et al (2003)[46], conducted a study to investigate the morphologic and topographic anatomy, and variations of the infra orbital canal (IOC), infra orbital nerve (ION), and infra orbital foramen (IOF) on cadaver heads (20 sides). The result concluded that accessory infra orbital foramen is noted in 10% of the cases which is located medically to the infra orbital foramen**.**

Bressan C et al (2004)[11], conducted a study with a aim to determine the frequency and position of accessory infra orbital foramen on 1064 dry skulls of unknown age and sex. The result found that the accessory infra orbital foramen was found in 4.7% of the skulls (5.4% in male and 4.26% in female skulls) with a higher frequency on the left side.

Elias et al (2004)[19], conducted a study with the aim to assess the infra orbital foramen (IOF) location in the sagittal and transversal plan of the skull and to analyze the variations, as well as verify the symmetry with the contralateral side among Brazilian population with 210 adult dry skull. Bilateral sagittal measurements from infra orbital margin until the superior margin of the infra orbital foramen and transverse measurements of the lateral margin of piriform to the medial margin of the IOF are calculated.

The mean sagittal measures were 6.71 mm on the right side and 6.83 mm on the left side respectively. Transversal measures were 13.8mm on the right side and 13.31 mm for left side. Fifty double infra orbital foramen were noted in the specimen. The study concluded that the infra orbital foramen were not absolutely symmetrical and may present pair bilateral and or unilateral opening.

Santhanam Suresh et al (2005)[60], conducted a computerized tomographic study on 48 pediatric patients with the aim to derive a mathematical formula for the location of the infra orbital foramen. The CT scans were obtained at 2.5cuts in the axial plane with the slice thickness of 1mm.

The midline of the patient was determined by a line point drawn from the cristae galii to the midline of the hard palate. The foramen is measured only from slices that demonstrate a distinct foramen and the point where the foramen was prominent on the floor of the orbit. The measurements were obtained by a perpendicular line was drawn from the centre of the infra orbital foramen to the midline.

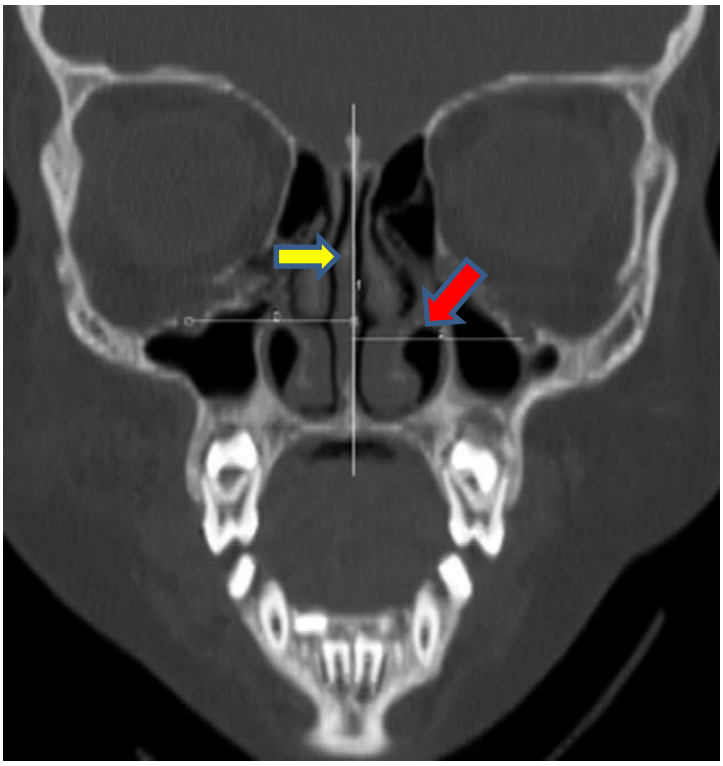


FIG 2 – CT SCAN WITH MEASUREMENTS OF IOF TO MIDLINE

The yellow arrow indicates the mid line drawn by the line joining the cristae galii and the midline of the hard palate. The red arrow indicates the horizontal distance between the centre of the infra orbital foramen to the midline

The result concluded that the distance of the infra orbital foramen is derived by:

Distance of the infra orbital foramen in mm from midline } = 21.3+0.5* age (in years)

Apinhasmit W et al (2006)[7], conducted a study to determine the morphology and the locations of the supra orbital notch/foramen, infra orbital foramen, and mental foramen on one hundred and six Thai adult skulls. The result concluded that the infra orbital foramen was 28.43 mm lateral to the maxillary midline, 9.23 mm below the infra orbital rim and 2.15 mm medial to the zygomaticomaxillary suture.

Kyung-Seok Hu et al (2006)[38], conducted a study by dissecting 43 hemifaces of Korean cadavers (26 males and 17 females) and investigated the branching pattern and topography of the infra orbital foramen were assessed. The location of the nerve in relation to the infra orbital artery and the variation in the terminal branches of the infra orbital nerve were assessed

Farah Ghaus et al (2009)[23], conducted a study to analysis the morphometric measurement of the infra orbital foramen, length of the infra orbital groove and canal, width of infra orbital groove, diameters of infra orbital foramen and the distances of infra orbital foramen from infra orbital margin and nasal notch on thirty two maxillae dissected from sixteen human foetus using vernier caliper. They were further divided into three groups based on age, group I (21-25 weeks), group II (26-30 weeks) and group III (> 3o weeks) respectively.

Result were concluded with range of measurement between the smallest foetal group to largest foetal group for length of infra orbital foramen

from the infra orbital rim were 1.34mm in group I, 1.40mm in group II and 1.75mm in group III. The distance of infra orbital foramen from the nasal notch in group I, group II and group III were 4.91mm, 5.86mm and 5.83mm respectively.

Macedo V.C et al (2009)[43], conducted a study with a aim to determine the mean distance between the infra orbital foramen to the infra orbital margin and the piriform aperture on both sides in two hundred ninety-five dry skulls were measured using double tip compass and a caliper instrument.

FIG 3 – MEASUREMENT OF DISTANCE FROM IOF TO DIFFERENT LANDMARKS

(The yellow arrow indicates the distance between the infra orbital foramen (IOF) most superior point and the infra orbital margin (IOM).)

The result concluded that the mean between the infra orbital foramen to the infra orbital margin was 6.37 mm. The mean obtained between the infra orbital foramen to the piriform aperture was 17.67 mm. Significant differences in the mean distance between the infra orbital foramen and the infra orbital margin was observed between the right and left side.

Maryam Rahman et al (2009)[45], conducted a study with the aim to determine the location of the infra orbital foramen from midline, lateral edge of the anterior nasal spine and infra orbital rim on eleven cadaveric skulls with twenty two infra orbital foramina on both right and left side on unknown age and sex. The distance of the foramen from the midline, lateral edge of the anterior nasal aperture, and inferior orbital rim were 26mm, 17 mm and 8 mm respectively. There was no significant difference between the measurements were noted on the right and left side.

Isurani Ilayperuma et al (2010)[31], conducted a study in an adult Sri Lankan population with 180 adult dry skull to determine the number, shape, orientation, vertical and transverse diameters of the infra orbital foramen, transverse distance from the infra orbital foramen to the maxillary midline and the zygomatico-maxillary suture and the vertical distance from the infra orbital foramen to the infra orbital rim and supraorbital foramen. The position of the infra orbital foramen was determined in relation to the maxillary teeth and the supraorbital foramen.

The mean distance of the infra orbital foramen to the maxillary midline was found to be 30.69mm in males and 28.40mm in females. The mean distance of the foramen to the infra orbital rim was 10.56mm and 9.02mm in males and females respectively.

The result concluded that there was a significant difference in the mean distances from the infra orbital foramen to the maxillary midline, infra orbital rim and supraorbital foramen among different race and gender .The values are significantly larger in males than in females.

Bruno Ramos Chrcanovic et al (2011)[13], conducted a study with the aim to examine the different morphometric variations of the supraorbital and infra orbital foramina of the facial skeleton among the right and left side and gender on 80 human skulls. Among the 54 males and 26 male crania, 21 measurements were assessed with all the mean values were larger in males than in females. The result concluded that the mean location of the infra orbital nerve was about 6.5 mm inferior to the inferior orbital rim (at the point where one can palpate the zygomatico-maxillary suture), about 25 mm from the midline, and about 43 mm below the supraorbital foramen in the same vertical line. When comparing the morphometric measurements between left and right sides of male and female crania, 6 of 22 measurements were statistically higher in men than in women. These findings suggested that gender should be taken into account when the foramina are located.

Mustafa Kazkayasi et al in (2011)[47], conducted a study to determine the morphometric variations of the infra orbital foramen, canal and groove in thirty five dry adult skull of unknown age and sex. The mean distance from the infra orbital foramen to the infra orbital margin, lateral nasal border were 7.19±1.39mm, 17.23±2.64mm respectively. 5.7% of accessory canals were reported in the study.

Teres .M et al (2011)[68], conducted a study to investigate the morphometric features of infra orbital foramen in 1122 adult dry skull of unknown age and sex. The result concluded that the frequency of accessory foramen is noted in 7% of the study sample, and the often located supero-medial to the infra orbital foramen.

Gour K.K et al (2012)[27], conducted a study to determine the mean distance between the infra orbital foramen and the infra orbital margin on both right and left side in 100 adult dry skull irrespective of age group. The distance was measured using digital vernier caliper and the shape, orientation, presence of accessory foramen and location of the foramen in relation to teeth are assessed. The result concluded that the mean distance of the foramen from the infra orbital margin measured 7.39mm. The majority of the foramen was oval in shape (54.7%) on right side and on the left side (52.8%). The foramen is vertically oriented to the 2nd premolar in 43% of both sexes and sides. Accessory canal were noted in 4% of the total sample size.

Przygocka. A et al (2012)[57], conducted a study with the aim to determine the localization of the infra orbital foramen in relation to nasion, rhinion, and fronto- malare orbitale, and to verify their symmetry on twenty three dry skull (46 foramen) of unknown age group and sex. The result concluded that the mean distance between the right infra orbital foramen and the nasion, rhinion, and right frontomalare orbitale were 45.23 mm, 39.84 mm, and 36.28 mm, and between the left infra orbital foramen and the nasion, rhinion, and left frontomalare orbitale were 44.38 mm, 38.88 mm, and 36.31 mm, respectively.

Rodella L.F et al (2012)[55], reviewed the anatomical variations and branching patterns of the trigeminal nerve.

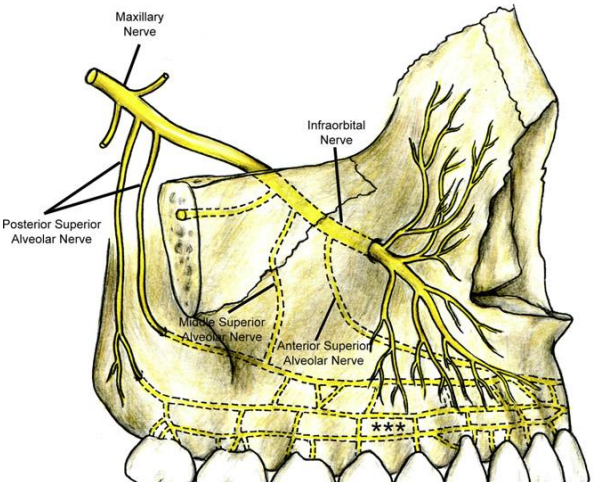


FIG 4 – SCHEMATIC REPRESENTATION OF MAXILLARY NERVE AND ITS BRANCHES

The variation of the course of the nerve was noted, and reported that the infra orbital foramen is usually (90–97%) single, and Aziz et al. reported a 15% incidence of accessory infra orbital foramina. In addition, an incidence of 1.3% was found by Gupta et al. The mean distance from the infra orbital foramen to the inferior border of the orbital rim ranges from 4.6 to 10.4 mm

Taeeun Lee et al (2012)[67], conducted a study in the East Asian population to examine the variation in the infra orbital foramen in retrospectively collected three dimensional computer tomographic images of two hundred forty patients of unknown age and sex. The distance from the infra orbital foramen to the vertical line dacryon (DC), the vertical distance from the infra orbital foramen to the infra orbital rim were analysed.

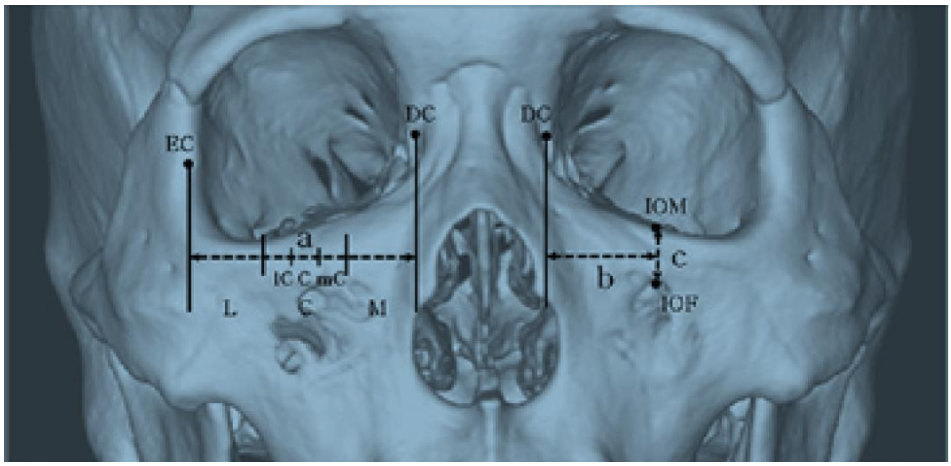


FIG 5 -MEASUREMENT OF LOCATION OF INFRA ORBITAL FORAMEN FROM VARIOUS ANATOMICAL LANDMARK

a- the total orbit width, b- distance from the IOF to the vertical line DC,

c- distance between IOF to IOR.

The mean distance between the infra orbital foramen to the infra orbital rim were

TABLE 1 – COMPARISON OF MEAN DISTANCE (mm) FROM IOF TO ANATOMICAL LANDMARKS IN CT

SEX	Mean distance b/w IOF to DC in mm		Mean distance b/w IOF to IOR in mm	
	Right	Left	Right	Left
Female	14.68± 1.4	14.76±1.3	8.33±1.5	8.34±1.4
Male	16.20±1.3	16.39±1.3	8.49±1.5	8.34±1.8

Significant difference in the mean distance from infra orbital foramen to infra orbital rim were noted between age groups and gender.

Amrita Bharti et al (2013)[5] , conducted a study to assess the precise location, shape and direction of infra orbital foramen in 100 dry human skulls of unknown gender using digital calliper , in relation to infra orbital margin, piriform aperture(PA) and upper alveolar margin(AM). The location, shape, size, direction and number of accessory foramina were observed.

The result concluded that the mean distance between the infra orbital margin (IOM) and infra orbital foramen (IOF) was 7.82mm. The mean distance between the infra orbital foramen and the piriform aperture (PA) was

16.01mm. There was a statically significant difference on right and left sides. Accessory foramina were found in 20% skulls.

Rohit Varshney et al (2013)[56], conducted a study with a aim to determine the morphometric characteristics of the infra orbital foramen, and to measure the distance from the infra orbital foramen to the infra orbital rim and to the lower border of the maxillary alveolus on the right and left side in 100 dry skulls (60 male and 40 female) using ruler and with double-tipped compass.

The result concluded that the mean distance from infra orbital foramen to infra orbital margin was 7.65mm on the right side and 7.11mm on the left side. The mean distance from infra orbital foramen to lower border of alveolus of maxilla on the right and left sides 25.98mm and 25.27 mm respectively.

Se Hwan Hwang et al (2013)[62], conducted a study to investigate the anatomy of the infra orbital canal, groove and foramen and relationship with different anatomic landmarks in 100 three dimensional reconstructed CT models. The mean distance from the infra orbital foramen to the supra orbital notch, infra orbital rim and midline and anterior nasal spine were

TABLE 2 – MEAN DISTANCE (mm) OF IOF TO VARIOUS LANDMARKS

Measurements in mm	Mean distance	Male	Female
IOF – SON	5.6± 3.1	5.3±3.2	5.7±3.0
IOF- midline	26.5±1.9	26.1±1.8	26.1±1.8
IOF-IOR	9.6±1.7	9.7±1.7	9.7±1.7
IOF –ANS	35.0±2.6	34.0±2.3	34.0±2.3

Dixit S.G et al (2014)[18], conducted a study to analyse the morphological variations by comparing the morphometric measurements of infra orbital foramen in 75 dry skull among the adult North Indian population. Straight distance of the infra orbital foramen from the infra orbital rim, supraorbital foramen and sagittal plane was measured. The position of the infra orbital foramen was determined in relation to maxillary teeth and supraorbital foramen.

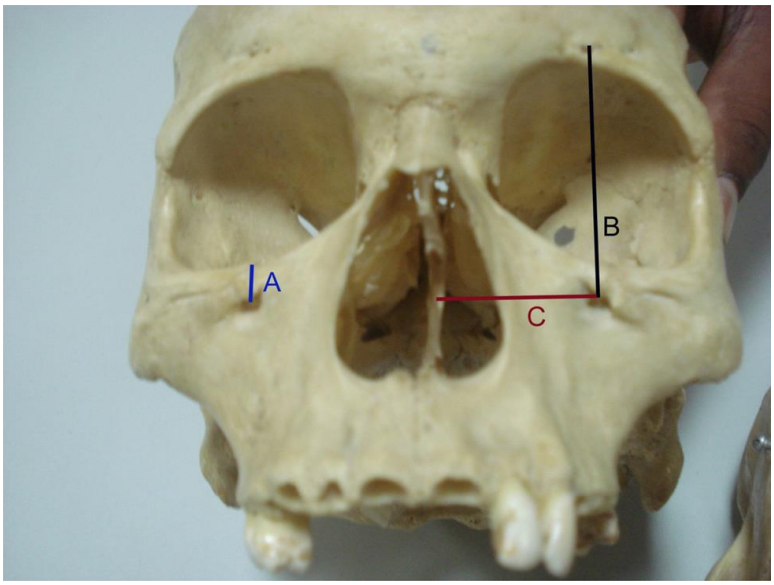


FIG 6- MEASUREMENT OF DISTANCE OF IOF TO ANATOMICAL LANDMARKS

A. Distance of infra orbital foramen from infra orbital rim. B. Distance of infra orbital foramen from supraorbital margin. C. Distance of infra orbital foramen from sagittal plane.

The result concluded that the mean distance of infra orbital foramen from infra orbital rim, supraorbital foramen, sagittal plane in the study was found to be 6.71mm, 42.02mm and 31.94mm respectively. No significant difference between sides were present .The position of infra orbital foramen was lateral in relation to supraorbital foramen (in 88% of cases). Infra orbital foramen was above the 1st premolar tooth in most of the cases. Accessory infra orbital foramen was found in 11.2% cases (double foramen).

Gnanagurudasan. E et al (2014)[26], conducted a study in the South Indian population to analyse the morphometric variations of the infra orbital foramen and measure the distance from various anatomical landmarks like nasion, anterior nasal spine, zygomatico- maxillary suture and infra orbital rim in 100 dry adult skull of unknown age and gender.

The result concluded that the mean distance of the infra orbital foramen from nasion, infra orbital rim , zygomatico- maxillary suture and anterior nasal spine among male and females were 38.45mm and 32.86mm,7.6mm and 7.11mm, 28.35 mm and 27.32mm, 36.30mm and 34.31mm respectively. Significant variation in the mean distance was noted among different sexes. Accessory canals were noted in 11% of the study sample**.**

Kopal Saini et al (2014)[36], conducted a study with a aim to determine the morphological and topographical anatomy of the infra orbital foramen (IOF) in relation to the infra orbital rim (IOR) and piriform aperture in 100 Indian dry adult human skulls of unknown age and gender using ruler and a divider. The result concluded that the mean distance between the infra orbital foramen to the infra orbital rim and the piriform aperture were 6.7 mm, 17.4mm respectively. Eleven accessory infra orbital foramina were observed.

Kun Hwang et al (2014)[37], conducted a study to analyse the frequency and location of the accessory infra orbital foramen assessed from 13 articles.The overall frequency of accessory infra orbital foramen ranges from 16.9% ± 8.6% and the foramen is found to be located superomedially to the infra orbital foramen in 92.2% cases

Sai pavithra R et al (2014)[59]**,** reviewed the variations in the maxillary nerve and its clinical significance. The infra orbital foramen is usually single but the percentage of accessory infra orbital foramen is reported to be of 4.7% in both males and females. The mean distance from the infra orbital foramen to the infra orbital rim ranges from 4.6 to 10.4mm

Tilak raj et al (2014)[69]**,** conducted a study in the North Indian population to evaluated the morphology of the infra orbital foramen, variation in the location, size and shape and its location from anatomical landmarks on 70 dry adult skull of unknown age and gender. The mean distance from the infra orbital foramen to the infra orbital rim, piriform aperture and zygomaticco maxillary suture were analysed and compared with other studies. The result concluded that the mean distance between the infra orbital foramen to the infra orbital rim were 6.92mm on the left side and 6.75mm on the right side. Distance of infra orbital foramen to the piriform aperture was 16.14mm on the left side and 15.79mm on the right side respectively . No significant difference between sides was noted.

TABLE 3- COMPARISON OF DISTANCE IOF FROM INFRA ORBITAL RIM

	Distance b/w IOF to the midpoint of IOM (mean ± SD) in mm	
	Right	Left
Hindy 1993 (30 skull and 15cadevers)	6.1±2.4	6.1±2.4
Singh et al 2011(55 skull)	6.12	6.19
Varshney et al 2013(100 skull)	7.65±1.35	7.11±1.73
Bharti et al 2013 (100 skull)	7.82	7.82
Present study(70 skull)	6.75±1.85	6.92±1.81

Ukoha Ukoha Ukoha et al (2014)[73], conducted a study with a aim to determine the location of the infra orbital foramen (IOF) in relation to the piriform aperture (PA), infra orbital margin (IOM) and the anterior nasal spine(ANS) on both right and left side with the help of vernier caliper in 130 skulls of unknown sex and age. The study concluded that the mean distance between the right infra orbital foramen to the piriform aperture, infra orbital margin and anterior nasal spine were 19.36mm, 6.94mm, and 30mm, respectively. On the left side the mean distance between the infra orbital foramen to the piriform aperture, infra orbital margin and anterior nasal spine

were 27mm, 7.83mm, and 29.01mm, respectively. There was significant difference ($p<0.05$) in the parameters noted between the right and left side.

Alok Kumar Singh et al (2015)[2], conducted the study in the North Indian population to determine the distance of infra orbital foramen from various anatomical landmarks and to note the frequency of accessory infra orbital in 64 adult dry human crania of unknown age and gender. The prevalence of unilateral and bilateral accessory canals was also calculated.

Shortest linear distance between the infra orbital foramen from midline, pyriform margin, nasion, infra orbital margin, anterior nasal spine and frontozygomatic suture was measured on both sides in each crania with Vernier caliper.

Result concluded that the mean shortest distance of infra orbital foramen from midline, pyriform margin and infra orbital margin were 34.78mm, 21.26mm and 6,58mm respectively. Significant difference in mean distance from infra orbital foramen to midline were noted with right and left side. Out of 64 crania, frequency of accessory infra orbital foramen was about 7.81% , and the was mostly seen in the left side.

Elisabeth H Ference et al (2015)[20], conducted a study to assess the variations in the anatomical course and location of the infra orbital nerve (ION) of 200 infra orbital nerve in 100 Computed Tomographic image obtained from a tertiary referral centre .The foramen located on an average of

11.96 mm below the infra orbital rim and were located at a mean distance of 8.66 mm below the sinus roof and traversed the sinus lumen diagonally for a mean length of 15.46mm.

Johncy Itty Panicker et al (2016)[32], conducted a study with aim to measure the mean distance from the infra orbital foramen to the infra orbital rim and piriform aperture on sixty adult dry skulls of unknown sex in both right and left side using a digital vernier caliper.

The result concluded that the mean distance from the infra orbital foramen to the infra orbital rim and piriform aperture were 5.96mm and 6.07mm, 16.70mm and 16.63mm on right and left side respectively. No much significant variations were noted in respect to sides.

Lais Carolina Santos Cisneiros de Oliveira et al (2016)[46], conducted a study with aim in Brazilian population to assess the anatomical and morphometric variations of the infra orbital foramen with respect to distance of the foramen from the infra orbital rim and anterior nasal spine in Two hundred forty-two dry skull off unknown age and sex using digital vernier caliper.

The result concluded that the mean distance from the infra orbital foramen to the infra orbital rim and anterior nasal spine were 8.0mm and 36.0mm respectively. The accessory foramen was seen in 14 specimens (11in

males and 3 in females).No statistical variation is noted among the right and left side.

Rajeswari.K et al (2016)[53], conducted a study with a aim to assess the location, shape, sagittal and transverse diameter of infra orbital foramen using vernier calipers on fifty adult dry skull of unknown age and gender. The relation of infra orbital foramen to maxillary 1st premolar and presence of accessory foramina were also noted.

The result concluded that the mean distance of the infra orbital foramen from infra orbital rim was 3.628mmon the right side and left side was 3.822mm. The mean transverse and minimum distance from the lateral margin of piriform aperture to the medial margin of infra orbital foramen were 7.451mm , 11mm on the right side and 7.865mm ,16mm on the left side respectively. The accessory canal was noted in 2 skull out of 52 specimen.

Supriya Garapati et al (2016)[66], conducted a study to assess the morphology and morphometric variations in the infra orbital foramen in 100 dry adult skull of unknown age and gender using divider and ruler.

The result concluded that the mean distance of the infra orbital foramen from the infra orbital rim and piriform aperture in the right and left side were 7.9mm and 8.1mm, 18.3mm and, 17.8mm respectively. No accessory canals were noted in the study.

Materials and Methods

MATERIALS AND METHODS

The present study was an attempt to assess the variations in the location of the infra orbital foramen from different anatomical landmarks like mid sagittal plane, infra orbital rim and zygomatic buttress among different age groups and gender using CBCT.

Type of study: Retrospective study

Study period: June 2016-Oct 2016

Place conducted: Ragas Dental College & Hospital, Rajan Dental Hospital, Mylapore, Chennai.

STUDY POPULATION:

Randomly selected CBCT volumes of 200 patients referred for various purposes like routine implant evaluation, third molar surgery and orthodontic treatment.

INCLUSION CRITERIA:

- CBCT volumes with minimal field of view from supra orbital notch to the maxillary arch.

EXCLUSION CRITERIA:

- CBCT volumes with history of trauma, orthognathic surgeries, and other developmental anomalies of the maxilla were excluded

ETHICAL CLEARANCE:

Ethical clearance was obtained from the Institutional Review Board

MACHINE MODEL: Sirona – Orthophos XG 3D, Galileos Viewer Version 1.8.

METHODOLOGY:

- Randomly 200 CBCT volumes of normal patients were selected.
- These scans were performed with a standard 70kVp and 10mA with 3D head rest method in standard position.
- The volumes were analyzed by Galileos Viewer Software.
- The given 200 CBCT volumes were categorised based on gender into two groups, and based on age into three groups respectively. The groups include
    - Group 1- 10-30years
    - Group 2- 30-60years
    - Group 3 –above 60years

Four parameters were assessed.

PARAMETER 1:

- Measure the distance of infra orbital foramen from the mid sagittal plane to the centre of the foramen on both right and left side.

PARAMETER 2:

- Measure the distance of infra orbital foramen from the infra orbital rim to the centre of the foramen on both right and left side.

PARAMETER 3:

- Measure the distance of infra orbital foramen from the zygomatic buttress to the centre of the foramen on both right and left side.

PARAMETER 4: Location of accessory infra orbital foramen.

Before measuring, the location of the infra orbital foramen is determined.

LOCATION OF THE INFRA ORBITAL FORAMEN:

- From the given CBCT volumes , the infra orbital foramen is located separately for right and left side in the sagittal plane and matched with the other planes in multi-planar reconstruction.(FIG 7)

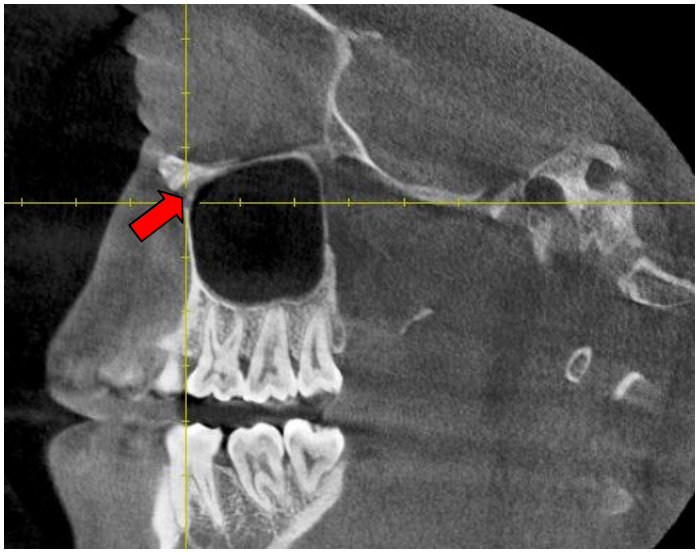


FIG 7 – (RED ARROW INDICATES) LOCATION OF THE OPENING OF THE IOF IN SAGITTAL PLANE

PARAMETER 1 ASSESSMENT: measure the distance of infra orbital foramen from the mid sagittal plane to the centre of the foramen on both right and left side

- The mid-sagittal plane for all the CBCT volumes were determined by the line joining the cristae galii to the anterior nasal spine.(FIG 8)
- A line was drawn from the centre of the infra orbital foramen to the mid sagittal plane.
- The distance of infra orbital foramen from the mid sagittal plane to the centre of the foramen were measured in the coronal plane on both right and left side. (FIG 9)

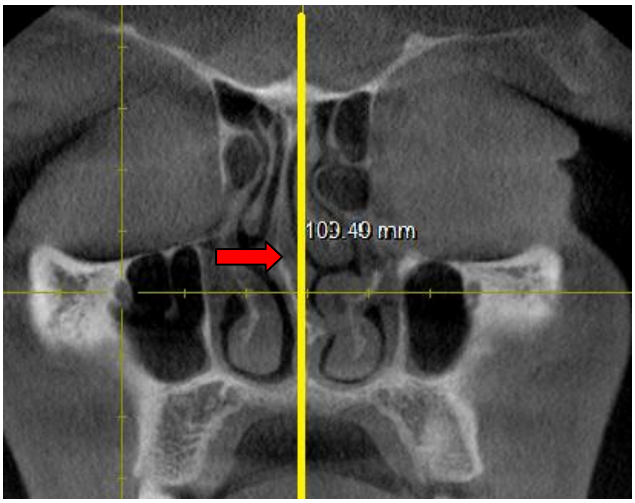


FIG 8 - (RED ARROW INDICATES) MID SAGITTAL PLANE - FORMED BY LINE JOINING THE CRISTAE GALII TO THE MIDPOINT OF THE HARD PALATE

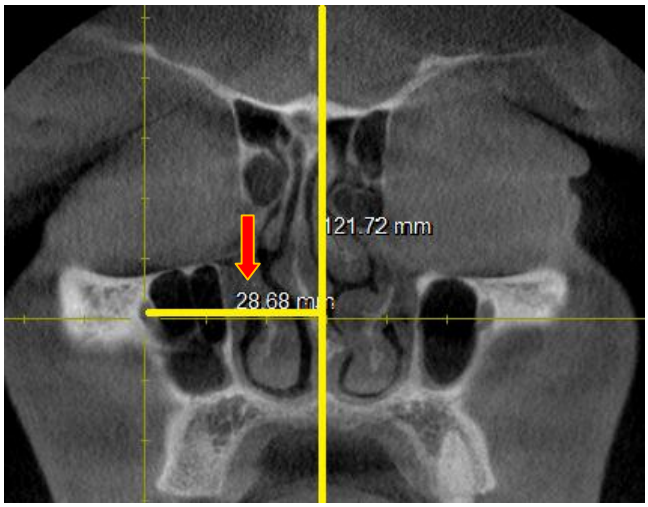


FIG 9- (RED ARROW INDICATES) HORIZONTAL DISTANCE BETWEEN THE MID SAGITTAL PLANE AND THE CENTRE OF THE INFRA ORBITAL FORAMEN IN THE CORONAL PLANE

PARAMETER 2 ASSESSMENT: measure the distance of infra orbital foramen from the infra orbital rim to the centre of the foramen on both right and left side

- The vertical distance between the centre of the infra orbital foramen to the infra orbital rim were measured in the coronal plane on both right and left side.(FIG 10)

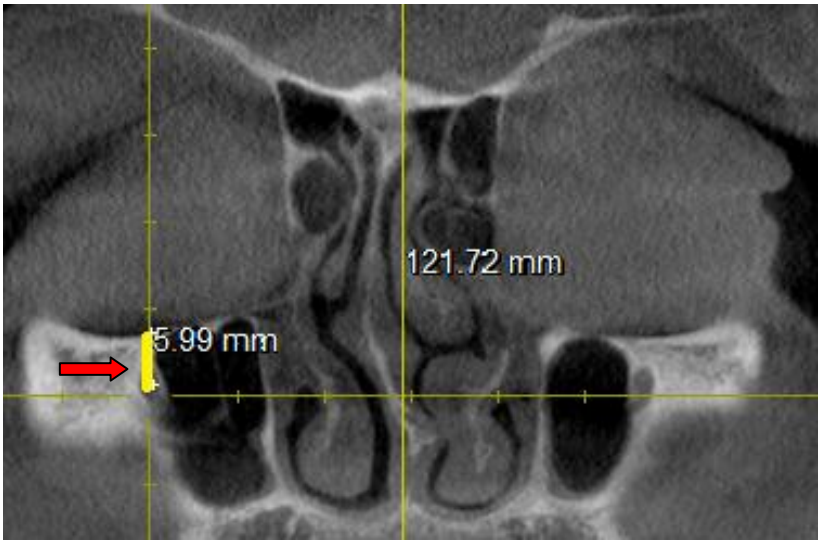


FIG 10 - (RED ARROW INDICATES) VERTICAL DISTANCE BETWEEN THE CENTRE OF THE INFRA ORBITAL FORAMEN TO THE INFRA ORBITAL RIM IN THE CORONAL SECTION

PARAMETER 3 ASSESSMENT: measure the distance of infra orbital foramen from the zygomatic buttress to the centre of the foramen on both right and left side

- A tangent line was drawn along the zygomatic buttress on both right and left side (FIG 11- a).
- Horizontal distance from the centre of infra orbital foramen to the line intersecting the tangent drawn to the zygomatic buttress were measured in the axial plane on both right and left side. (Fig 11-b)

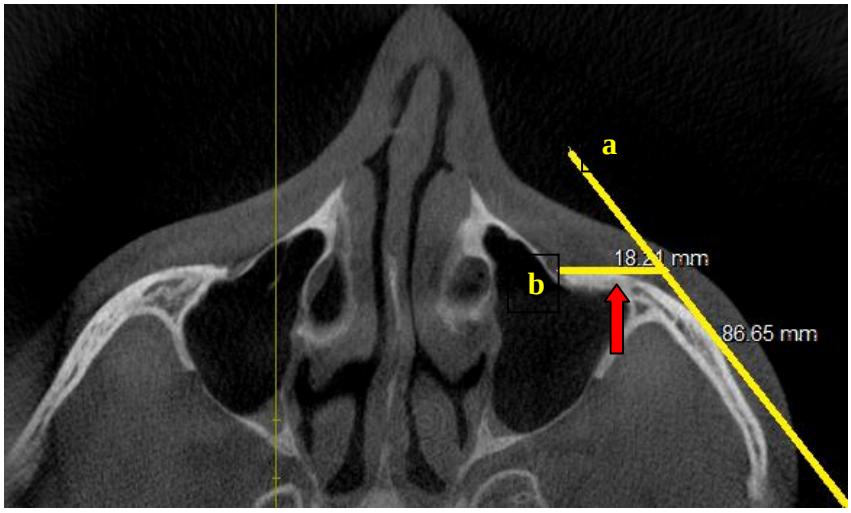


FIG11 - (RED ARROW INDICATES) HORIZONTAL DISTANCE FROM THE CENTRE OF THE INFRA ORBITAL FORAMEN TO THE LINE INTERSECTING THE TANGENT DRAWN TO THE ZYGOMATIC BUTTRESS IN THE AXIAL PLANE

PARAMETER 4 ASSESSMENT: location of the accessory infra orbital foramen:

- Locate for an accessory opening with respect to infra orbital foramen in the sagittal plane.

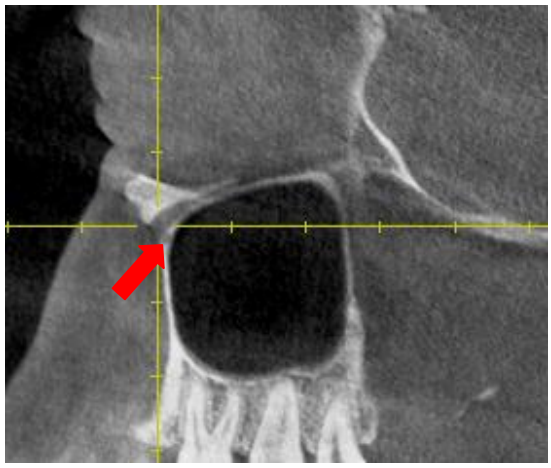


FIG 12- (RED ARROW INDICATES) THE OPENING OF THE ACCESSORY INFRA ORBITAL FORAMEN

STATISTICS ANALYSIS:

All the data were entered in Microsoft excel sheet. The presence of anatomical variation in the location of the foramen were assessed, statistical analysis was done using descriptive statistics. One way ANNOVA, Post Hoc tukey test was done to compare the variations in each parameter with respect to age groups. Independent t-test was done to compare the variations in each parameter with respect to gender. All statistical analysis was performed using SPSS, VERSION 20.0

Results

RESULTS

The present study is a retrospective study conducted in the Department of Oral Medicine and Radiology of Ragas Dental College and Hospital, Uthandi, Chennai. Aim of the study is "To assess the variation and location of the infra orbital foramen with its neighbouring structures using CBCT." Total of 200 retrospective CBCT images were collected. The images were categorised based on gender into two groups, and based on age into three groups (Group 1- 10-30years, Group 2- 30-60years, Group 3 –above 60year) respectively. From the given CBCT images, the infra orbital foramen is located separately for right and left side in the sagittal plane and matched with the other planes in multi-planar reconstruction. Four parameters were assessed.

Parameter 1:

Measure the distance of infra orbital foramen from the mid sagittal plane to the centre of the foramen on both right and left side.

Parameter 2:

Measure the distance of infra orbital foramen from the infra orbital rim to the centre of the foramen on both right and left side.

Parameter 3:

Measure the distance of infra orbital foramen from the zygomatic buttress to the centre of the foramen on both right and left side.

Parameter 4:

Locate the presence of accessory infra orbital foramen.

Variations in the mean distance of the three parameters were analysed between different age groups and gender.

Results of the present study documents the following data:

TABLE 4: DISTRIBUTION OF GENDER IN GROUP

- Group 1(0 – 30 years) had a total of 84 patients (58.3% of male and 41.7% of female).
- Group 2(30 -60 years) had a total of 98 patients (67.35% of male and 32.65% of female).
- Group 3(above 60 years) had a total of 18 patients (77.8% of male and 22.2 % of female).

TABLE 5: MEAN VALUE (mm) OF EACH PARAMETER WITH RESPECT TO DIFFERENT AGE GROUP:

PARAMETER 1: measurement of distance infra orbital foramen from the mid sagittal plane to the centre of the foramen on both right and left side. The result among different age groups were :

In Group 1(0 -30 years):

- The mean distance of infra orbital foramen from the mid sagittal plane to the centre of the foramen on the right and left side were **26.25±2.85mm and 25.99±2.69mm**.

In group 2 (30 – 60years):

- The mean distance of infra orbital foramen from the mid sagittal plane to the centre of the foramen on the right and left side were **26.26±2.57mm and 26.07±2.80mm**.

In group 3(above 60 years):

- The mean distance of infra orbital foramen from the mid sagittal plane to the centre of the foramen on the right and left side were group 3- **26.87±3.26mm and 26.64±2.61mm**.

Parameter 2: measure the distance of infra orbital foramen from the infra orbital rim to the centre of the foramen on both right and left side. The result among different age groups were :

In group 1(0 – 30years)

- The mean distance of infra orbital foramen from the infra orbital rim to the centre of the foramen on the right and left side were **6.38±1.78mm and 6.27±1.73mm.**

In group 2(30 -60years):

- The mean distance of infra orbital foramen from the infra orbital rim to the centre of the foramen on the right and left side were **6.16±1.77mm and 6.22±1.78mm.**

In group 3(above 60 years):

- The mean distance of infra orbital foramen from the infra orbital rim to the centre of the foramen on the right and left side were **5.08±1.65mm and 5.26±1.77mm**

Parameter 3: measure the distance of infra orbital foramen from the zygomatic buttress to the centre of the foramen on both right and left side. The result among different age groups were :

In group 1 (30 -60 years):

- The mean distance between of infra orbital foramen from the zygomatic buttress to the centre of the foramen on both right and left side were **17.00±2.21mm and 17.44±2.36mm.**

In group 2(30 -60years):

- The mean distance between of infra orbital foramen from the zygomatic buttress to the centre of the foramen on both right and left side were **17.07±2.32mm and18.10±2.79mm**

In group 3(above 60 years):

- The mean distance between of infra orbital foramen from the zygomatic buttress to the centre of the foramen on both right and left side were **17.78±3.52mm and 18.15±2.54mm**

TABLE 6: MEAN VALUE (mm) OF EACH PARAMETER WITH RESPECT TO GENDER

Parameter 1: measurement of distance infra orbital foramen from the mid sagittal plane to the centre of the foramen on both right and left side. The result among male and female were:

In group 1 (0-30years):

- The mean distance of infra orbital foramen from the mid sagittal plane to the centre of the foramen on the right side among male and female were **26.21±2.66mm and 26.31±3.13mm**.
- The mean distance of infra orbital foramen from the mid sagittal plane to the centre of the foramen on the left side among male and female were **26.04±2.68mm and 25.91±2.74mm**.

In group 2 (30-60 years):

- The mean distance of infra orbital foramen from the mid sagittal plane to the centre of the foramen on the right side among male and female were **26.31±2.57mm and 26.16±2.63mm.**
- The mean distance of infra orbital foramen from the mid sagittal plane to the centre of the foramen on the left side among male and female were **26.09±2.71mm and 26.03±3.03mm.**

In Group 3(above 60 years):

- The mean distance of infra orbital foramen from the mid sagittal plane to the centre of the foramen on the right side among male and female were **27.46±3.23mm and 24.81±2.79mm.**
- The mean distance of infra orbital foramen from the mid sagittal plane to the centre of the foramen on the left side among male and female were **26.99±2.62mm and 25.4±2.49mm.**

Parameter 2: measure the distance of infra orbital foramen from the infra orbital rim to the centre of the foramen on both right and left side. The result among male and female were

In group 1(0-30years):

- The mean distance of infra orbital foramen from the infra orbital rim to the centre of the foramen on the right side among male and female were **6.30±1.50mm and 6.50±2.12mm.**
- The mean distance of infra orbital foramen from the infra orbital rim to the centre of the foramen on the left side among male and female were **6.18 ±1.17mm and 6.39 ±2.31mm**.

In group 2(30 -60 years):

- The mean distance of infra orbital foramen from the infra orbital rim to the centre of the foramen on the right side among male and female were **6.17±1.78mm and 6.14 ±1.77mm.**
- The mean distance of infra orbital foramen from the infra orbital rim to the centre of the foramen on the left side among male and female were **6.43 ±1.73mm and 5.75 ±1.83mm**.

In group 3(above 60 years):

- The mean distance of infra orbital foramen from the infra orbital rim to the centre of the foramen on the right side among male and female were **4.91 ±1.71mm and 5.65 ±1.47mm.**
- The mean distance of infra orbital foramen from the infra orbital rim to the centre of the foramen on the left side among male and female were **5.22 ±1.96mm and 5.4 ±1.03mm.**

Parameter 3: measure the distance of infra orbital foramen from the zygomatic buttress to the centre of the foramen on both right and left side. The result among male and female were:

In group 1(0-30years):

- The mean distance of infra orbital foramen from the zygomatic buttress to the centre of the foramen on the right side among male and female were **17.19±2.29mm and 16.72±2.10mm.**
- The mean distance of infra orbital foramen from the zygomatic buttress to the centre of the foramen on the left side among male and female were **17.73±2.56mm and 17.04±2.10mm.**

In group 2(30-6- years):

- The mean distance of infra orbital foramen from the zygomatic buttress to the centre of the foramen on the right side among male and female were **17.38±2.22mm and 16.41±2.42mm.**
- The mean distance of infra orbital foramen from the zygomatic buttress to the centre of the foramen on the left side among male and female were **18.41±2.85mm and 17.45±2.56mm.**

In group 3(above 60 years):

- The mean distance of infra orbital foramen from the zygomatic buttress to the centre of the foramen on the right side among male and female were **18.12±3.25mm and 16.6 ±4.7mm.**
- The mean distance of infra orbital foramen from the zygomatic buttress to the centre of the foramen on the left side among male and female were **18.12±2.76mm and 18.25±1.9mm**

TABLE 7: COMPARISON OF EACH PARAMETER WITH RESPECT TO GENDER AMONG AGE #

- ANNOVA test was done to test which parameter was significant among different age groups**.**
- It was found that the **parameter 2** (distance of infra orbital foramen from the infra orbital rim to the centre of the foramen) on the **right side** were significant with **p- value of 0.02.**
- The remaining parameters had p-value>0.05, and showed no significant difference among different age groups.

Table 8: POST HOC TEST

- Since there was a significant difference in the **parameter 2** (distance of infra orbital foramen from the infra orbital rim to the centre of the foramen) on the **right side,** Post Hoc test was done to analyse which group had significant difference.
- The results shows that the significant difference in **group 3 (age above 60 years) with the p-value 0.02.**

TABLE 9: COMPARISON OF EACH PARAMETER WITH RESPECT TO AGE AMONG GENDER#

- Independent t- test was done to assess which parameter was significant with respect to age among male and female.
- It was found that there was a significant difference among **group 2 (30-60years) with parameter 3** (distance of infra orbital foramen from the zygomatic buttress to the centre of the foramen) on both **right and left side** with **p- value of 0.04 and 0.03**
- The remaining parameters had p-value>0.05, and showed no significant difference among male and female

Tables and Graphs

TABLE 4: DISTRIBUTION OF GENDER IN GROUP

Group	Male		Female		Total	
	Number	**%**	**Number**	**%**	**Number**	**%**
Group 1 (0-30years)	49	58.3	35	41.7	84	42
Group 2 (30 -60years)	66	67.35	32	32.65	98	49
Group 3 (above 60years)	14	77.8	4	22.2	18	9
Total	129	64.5	71	35.5	200	100

TABLE 5: MEAN VALUE (mm) OF EACH PARAMETER WITH RESPECT TO AGE GROUP

Age group	Parameter 1 (Mean ± SD)		Parameter 2 (Mean ± SD)		Parameter 3 (Mean ± SD)	
	Right	**Left**	**Right**	**Left**	**Right**	**Left**
Group1 (0 – 30 years)	26.25 ±2.85	25.99 ±2.69	6.38 ±1.78	6.27 ±1.73	17.00 ±2.21	17.44 ±2.36
Group 2 (30 – 60years)	26.26 ±2.57	26.07 ±2.80	6.16 ±1.77	6.22 ±1.78	17.07 ±2.32	17.78 ±3.52
Group 3 (above 60 years)	26.87 ±3.26	26.64 ±2.61	5.08 ±1.65	5.26 ±1.77	18.10 ±2.79	18.15 ±2.54

TABLE 6: MEAN VALUE (mm) OF EACH PARAMETER WITH RESPECT TO GENDER

Parameters	Side	Group 1 (Mean ± SD)		Group 2 (Mean ± SD)		Group 3 (Mean ± SD)	
		Male	**Female**	**Male**	**Female**	**Male**	**Female**
Parameter 1	Right	26.21 ±2.66	26.31 ±3.13	26.31 ±2.57	26.16 ±2.63	27.46 ±3.23	24.81 ±2.79
	Left	26.04 ±2.68	25.91 ±2.74	26.09 ±2.71	26.03 ±3.03	26.99 ±2.62	25.4 ±2.49
Parameter 2	Right	6.30 ±1.50	6.50 ±2.12	6.17 ±1.78	6.14 ±1.77	4.91 ±1.71	5.65 ±1.47
	Left	6.18 ±1.17	6.39 ±2.31	6.43 ±1.73	5.75 ±1.83	5.22 ±1.96	5.4 ±1.03
Parameter 3	Right	17.19 ±2.29	16.72 ±2.10	17.38 ±2.22	16.41 ±2.42	18.12 ±3.25	16.6 ±4.7
	Left	17.73 ±2.56	17.04 ±2.10	18.41 ±2.85	17.45 ±2.56	18.12 ±2.76	18.25 ±1.9

TABLE 7: COMPARISON OF EACH PARAMETER WITH RESPECT TO GENDER AMONG AGE #

Parameter	Side	p-value
Parameter 1	Right	0.66
	Left	0.65
Parameter 2	**Right**	**0.023***
	Left	0.32
Parameter 3	Right	0.45
	Left	0.20

#ANNOVA TEST, *statistically significant (p value < 0.05)

TABLE 8: POST HOC TESTS

Tukey B [a,b]

Since there was a significant difference only **parameter 2 – right side**, so post hoc were done to analyse which group had significant difference.

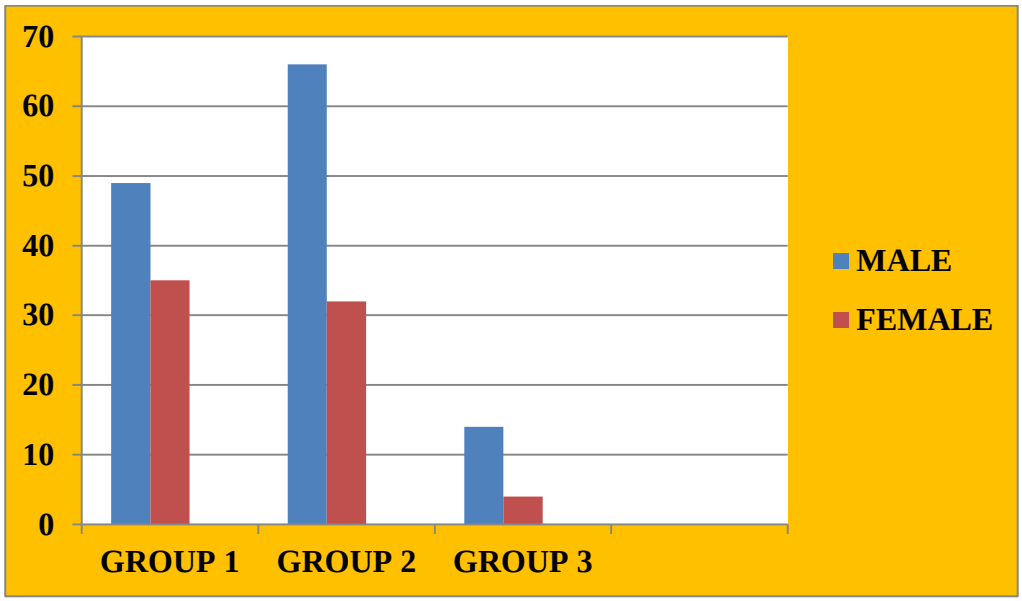
	Group comparison		**p-value**
Parameter 2(Right)	1	2	0.917
		3	**0.02**
	2	3	**0.032**

TABLE 9: COMPARISON OF EACH PARAMETER WITH RESPECT TO AGE AMONG GENDER#

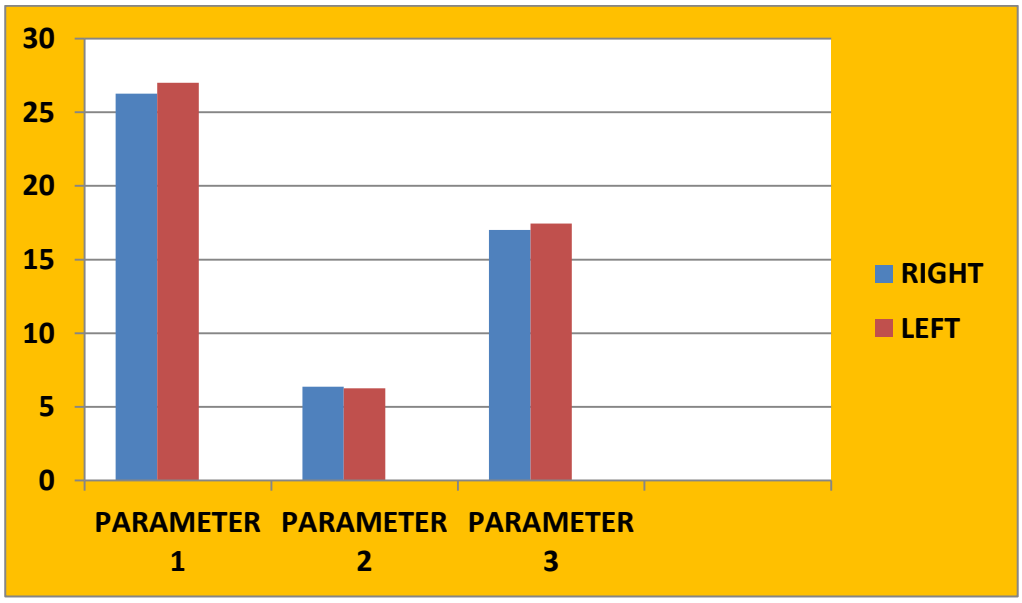
Parameters	Side	p-value		
		Group 1	**Group 2**	**Group 3**
Parameter 1	Right	0.88	0.79	0.15
	Left	0.82	0.92	0.29
Parameter 2	Right	0.61	0.93	0.44
	Left	0.57	0.08	0.86
Parameter 3	Right	0.33	**0.04***	0.46
	Left	0.18	**0.03***	0.93

#Independent t test, *statistically significant (p value < 0.05)

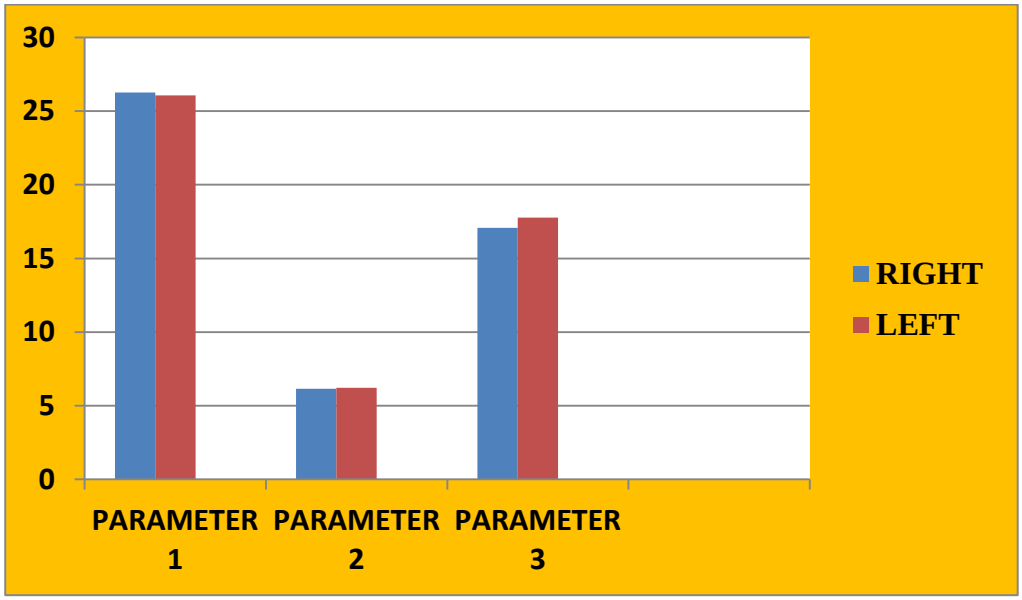
GRAPH 1: DISTRIBUTION OF GENDER IN GROUP



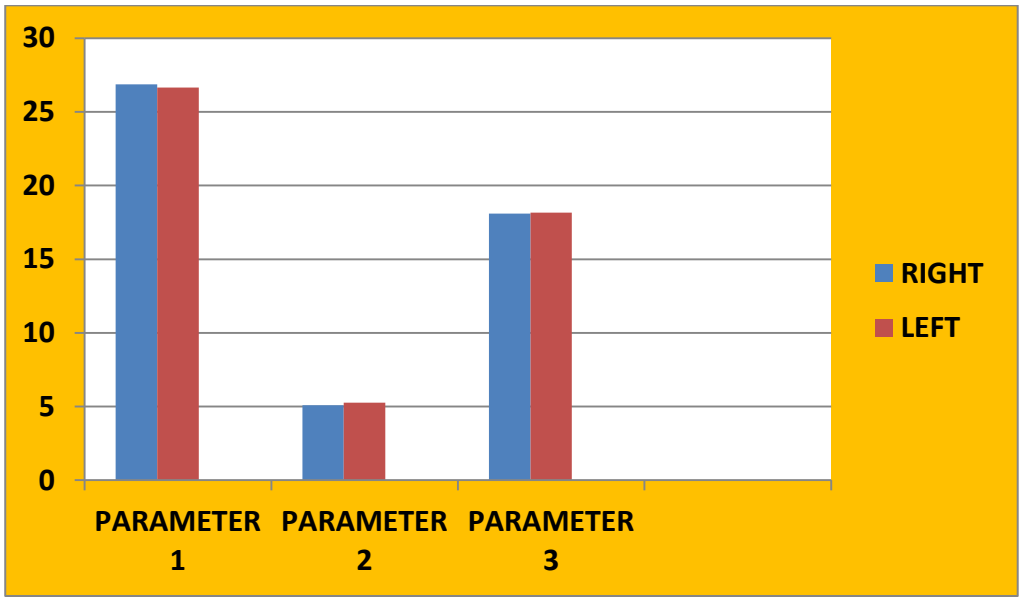
GRAPH 2: MEAN VALUE (mm) OF PARAMETER -1, 2, 3 WITH RESPECT GROUP 1(0-30 YEARS)



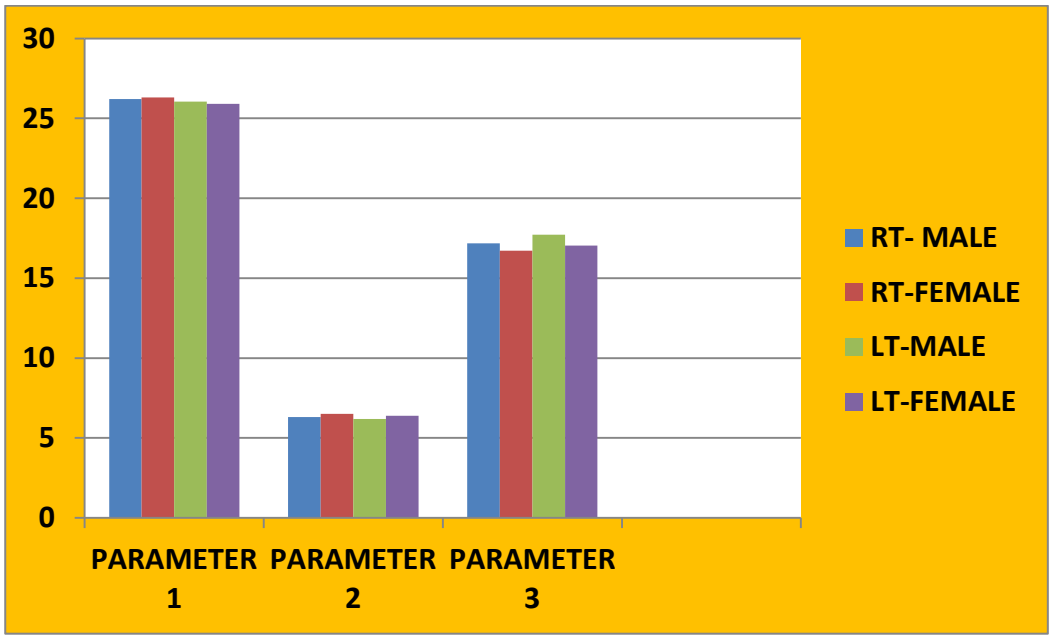
GRAPH 3: MEAN VALUE (mm) OF PARAMETER -1, 2, 3 WITH RESPECT GROUP 2(30- 60 YEARS)



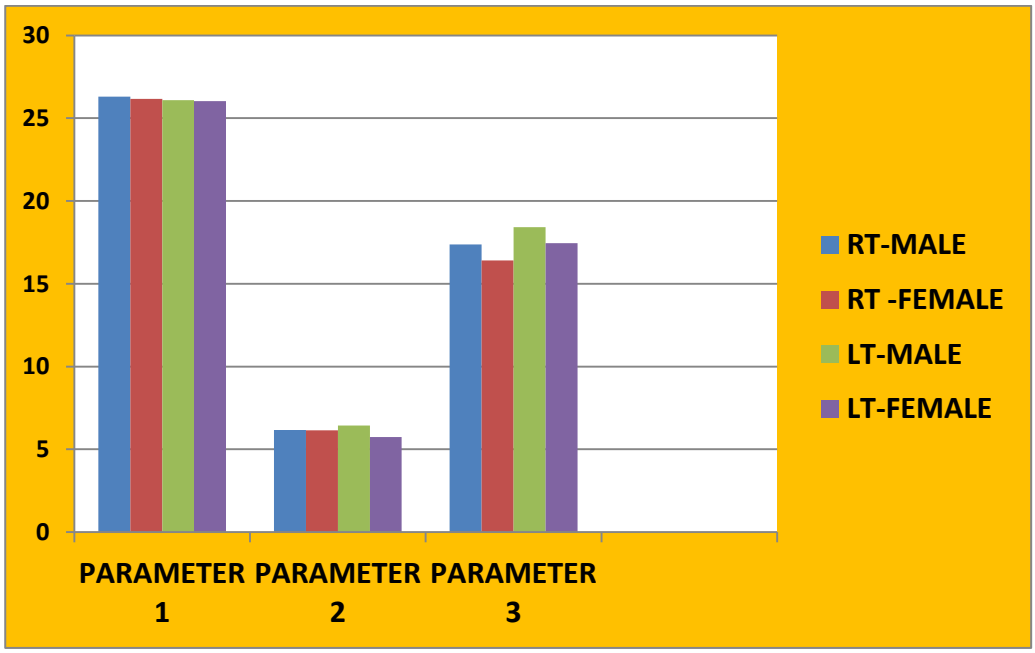
GRAPH 4: MEAN VALUE (mm) OF PARAMETER -1, 2, 3 WITH RESPECT GROUP 3 (ABOVE 60 YEARS)



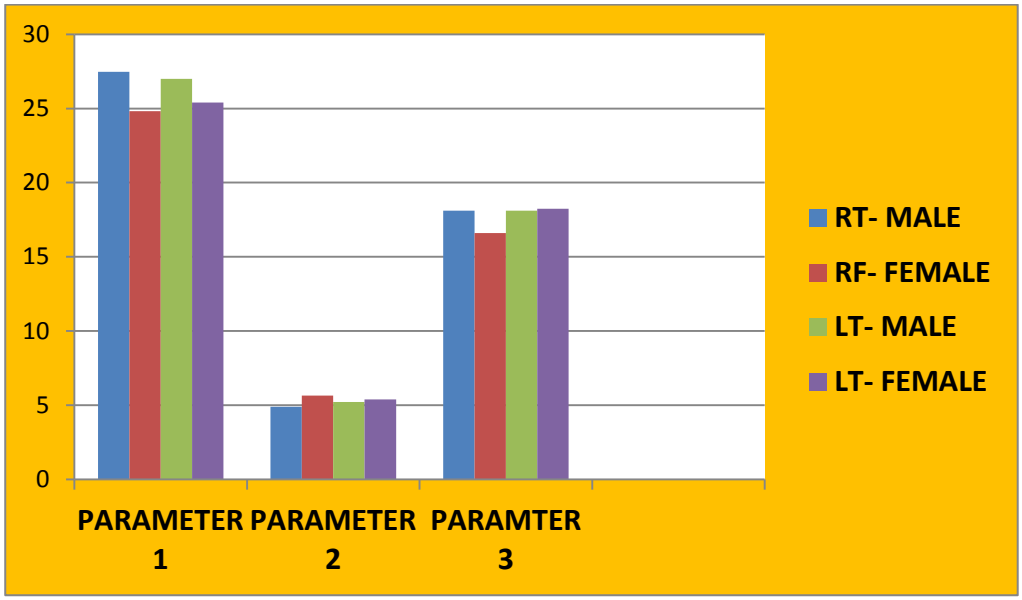
GRAPH 5: MEAN VALUE (mm) OF PARAMETER -1, 2, 3 WITH RESPECT GENDER AMONG GROUP 1(0-30YEARS)



GRAPH 6: MEAN VALUE (mm) OF PARAMETER -1, 2, 3 WITH RESPECT GENDER AMONG GROUP 2(30 -60YEARS)



GRAPH 7: MEAN VALUE (mm) OF PARAMETER -1, 2, 3 WITH RESPECT GENDER AMONG GROUP 3(ABOVE 60YEARS)



Discussion

DISCUSSION

Atrophic maxilla can be due to various factors such as bone loss, tumour resection or other genetic disorders and syndromes. Fabrication of prosthesis with adequate retention and stability for these patients presents a significant challenge.[28] Due to insufficient bone for implant anchorage from these sites, extra alveolar anchorage from various sites like zygoma, pterygoid plates are considered.[16]

Zygomatic implants are introduced as an alternative technique for bone augmentation, dental implants with sinus lift procedures, Le Fort I osteotomy with inter-positional bone grafting. Patients with severe atrophy with associated sinus pneumatisation, combination of conventional implants with zygomatic implants or multiple zygomatic implants (quad zygomatic implants) are preferred.[50,64] For a successful outcome, comprehensive pre-surgical evaluation of the implant site, bone quality and quantity, assessment of vital structures like orbit, infra orbital nerve and blood vessels around the implant site are mandatory.[6]

Infra orbital nerve, a direct extension of the maxillary division of trigeminal nerve is purely sensory in nature, supplying the skin and mucous membrane of the mid face region.[57,70] Infra orbital foramen transmitting corresponding nerve and blood vessels play an important anatomical landmark for maxillofacial surgeons in both implant placement and local anaesthesia.

Surgical complications like transient or permanent (hypoesthesia, paraesthesia, neuralgia) could be avoided with exact location of the foramen.[39,50] Various postoperative complications with zygomatic implants like sinusitis 2.4% (1.8-3.0), soft tissue infection 2.0% (1.2-2.8), paraesthesia 1.0% (0.5- 1.4), oroantral fistulas 0.4% (0.1-0.6) were reported by **Bruno Ramos Chrcanovic et al (2015)[12], Amrita Pandita et al (2016)[6]**, **Fotios Tzerbos et al (2016)[25]**, **Pedro Molinero-Mourelle et al (2016)[49].**

Previous literatures have discussed about the location of the infra orbital foramen on various instances on human dry skull. Owing to limited radiological study reported in the past, the present study was an attempt to determine the location and variation of the foramen with respect to different anatomical landmarks using CBCT.

In the present study a total of 200 CBCT volumes of patients aged between 10 – 80 years were randomly selected, with the minimum field of view of supra –orbital notch to the maxillary arch. The images were categorised based on gender into two groups, and based on age into three groups respectively. The present study had a total of **129 males and 71 females** with age group ranging from **13- 80 years**. **Group 1** includes samples with age group between **0-30years**. **Group 2** includes samples with age group between **30- 60years**. **Group 3** includes samples with age group **above 60 years**. The infra orbital foramen is located separately for right and left side in

the sagittal plane and matched with the other planes in multi-planar reconstruction.

Four parameters were assessed. **Parameter 1**- measure the distance of infra orbital foramen from the mid sagittal plane to the centre of the foramen on both right and left side. **Parameter 2** - measure the distance of infra orbital foramen from the infra orbital rim to the centre of the foramen on both right and left side. **Parameter 3**- measure the distance of infra orbital foramen from the zygomatic buttress to the centre of the foramen on both right and left side. **Parameter 4**- assess for the location of accessory infra orbital foramen. After measuring all three parameters the data were subjected to statistical analysis by SPSS version 20.00.

The mean distance of all three parameters were analyzed and compared among different age groups and gender on both right and left side respectively. Using ANNOVA and Post Hoc test, the parameters were assessed for variations among different age group. There was a significant difference in **group 3(above 60 years)** in **parameter 2** (the distance of infra orbital foramen from the infra orbital rim to the centre of the foramen) on the **right side** with a **p-value of 0.02**. By using independent t- test, the parameters were analyzed for variations among male and female. There was a significant difference in **parameter** 3(distance of infra orbital foramen from the zygomatic buttress to the centre of the foramen) on both **right and left** side with the **p-value of 0.04 and 0.03** respectively.

The values of all four parameters were higher in males than in females. This was in accordance with study conducted by **Dixit .S.G et al (2014)[18], Alok Kumar Singh et al (2015)[2]**

The values of all four parameters measured in the present study using CBCT were found in accordance with previous anthropometric studies done in human skull.

PARAMETER 1: TO MEASURE THE DISTANCE OF INFRA ORBITAL FORAMEN FROM THE MID SAGITTAL PLANE TO THE CENTRE OF THE FORAMEN ON BOTH RIGHT AND LEFT SIDE

In the present study the average distance between the mid sagittal plane to the centre of the foramen range among different age group ranges from **22 to 30mm**. No significant difference with respect to age was noted in the present study. The results were in accordance with the results of the study conducted by **Dixit .S.G et al (2014)[18].**

In males, this value ranges from **26.21 ±2.6mm to 27.46±3.23mm** on **right side** and **26.04 ±2.68mm to 26.99 ± 2.62mm** on **left side**.

In females, the average distance ranges from **24.81 ±2.79mm to 26.31 ± 3.13mm** on **right side** and **25.4 ± 2.49mm to 26.03 ±3.03mm** on **left side.**

The results of the present study were in accordance with the results of the study conducted by **Shahid. R et al (2000)[63]** (27.±4.3mm in males and

26.2±3.2mm in females) and **Bruno Ramos Chrcanovic et al (2011)[13]** (26.48 ± 2.58mm in males and 24.67 ± 2.41mm) on dry skull.

Alok Kumar Singh et al (2015)[2](34.78±3.19mm) and **Dixit .S.G et al (2014)[18]** (31.94±4.88mm) showed values with higher range than other studies.

No significant difference with respect to gender was noted in the present study. The results are in accordance with the results of the study conducted by **Shahid. R et al (2000)[63], Maryam Rahman et al (2009)[45].**

PARAMETER 2: TO MEASURE THE DISTANCE OF INFRA ORBITAL FORAMEN FROM THE INFRA ORBITAL RIM TO THE CENTRE OF THE FORAMEN ON BOTH RIGHT AND LEFT SIDE.

With respect to groups the mean distance from the centre of the infra orbital foramen to the infra orbital rim among different age groups ranges from **3 to 9mm**. Group 3 (above 60 years) shows lesser values ranging 3 to 7mm.The results of the present study were in accordance with the results of the study conducted by **Elias M.G et al (2004)[19], Tezer et al (2011)[68], Gour K.K et al (2012)[27].**

The present study showed statistically significant difference in the distance from the infra orbital rim to the centre of the foramen on the **right side** in **Group 3(above 60 years)** with **the p-value of 0.02**.

In the present study, the mean distance from the centre of the infra orbital foramen to infra orbital rim for male ranges from **4.91 ±1.71mm to 6.30 ±1.50mm** on **right side** and **5.22 ±1.96mm to 6.18 ±1.17mm** on **left side.**

In females the mean value ranges from **16.41±2.42mm to 16.72±2.10mm** on **right side** and **17.04±2.10mm to 18.25±1.9mm** on **left side.**

The present study no significant difference in the mean distance from infra orbital foramen to the infra orbital rim between male and female which is in contradiction with results conducted by **Isurani Ilayperuma et al (2010)[31], Taeeun Lee et al (2012)[31]**.

The results are in accordance with the results of the study conducted by **Macedo V.C et al (2009)[43], Isurani Ilayperuma et al (2010)[31], Taeeun Lee et al (2012)[67], Amrita Bharti et al (2013)[5], Rohit Varshney et al (2013)[56], Gnanagurudasan. E et al (2014)[26]**, **Ukoha Ukoha Ukoha et al (2014)[73], Alok Kumar Singh et al (2015)[2], Lais Carolina Santos Cisneiros de Oliveira et al (2016**)[40]

Although, **Shahid R. Aziz et al (2000)[63], Gour KK, Nair et al (2012)[27], Bruno Ramos Chrcanovic et al (2011)[13] Dixit S.G, et al (2014)[18], Tilak Raj et al (2014)[69], Johncy Itty Panicker et al (2016)[32],** reported no significant difference between the right and left side.

PARAMETER 3: TO MEASURE THE DISTANCE OF INFRA ORBITAL FORAMEN FROM THE ZYGOMATIC BUTTRESS TO THE CENTRE OF THE FORAMEN ON BOTH RIGHT AND LEFT SIDE

In the present study the average distance from the centre of the infra orbital foramen to the zygomatic buttress ranges from **14 to 22mm** in males and **12 to 20mm** in female.

In male, this average value ranges from **17.19±2.29mm to 18.12±3.25mm** on **right side** and **17.73±2.56mm to 18.41±2.85mm** on **left side.** In females the mean distance ranges from **16.6±4.7mm to 16.72±2.10mm** on **right side** and **17.04± 2.10mm to 18.25±1.9mm** on **left side.**

Significant difference with respect to gender was reported in both **right and left side** with **p-value of 0.04 and 0.04** respectively.

Since the distance from the infra orbital foramen to the zygomatic buttress is crucial during zygomatic implant placements, and no previous literature were done to measure, we made an attempt to measure the average distance between them. Further studies are recommended to find the variation among different age groups and gender.

PARAMETER 4: TO ASSESS FOR THE LOCATION OF THE INFRA ORBITAL FORAMEN

In the present study no accessory infra orbital foramen was seen as in accordance with the study conducted by **Supriya Garapati et al (2016)[66]**. The results were in contradiction to the study conducted by **Hindy AM et al (1993)[29,] Canan S et al (1999)[15], Shahid R. Aziz et al (2000)[63] , Bressan C et al (2004)[11] , Mustafa Kazkayasi et al in (2011)[47]**, **Amrita Bharti et al (2013)[5], Gour K.K, et al (2012)[27], Kopal Saini et al (2014)[36],** were 5 – 20 % of incidence were reported.

Summary and Conclusion

SUMMARY AND CONCLUSION

The present study was conducted to assess the variations in the location of the infra orbital foramen among different age groups and gender using CBCT.

200 CBCT volumes of patients aged between 10 – 80 years were included as study samples. The CBCT volumes were categorized based on gender into two groups, and based on age into three groups as group 1(0-30years), group 2(30-60years) and group 3 (above 60years). Galileos 3D imaging software was used to assess the variations in the distance of infra orbital foramen from the mid sagittal plane, infra orbital rim and zygomatic buttress to the centre of the foramen were determined and compared with age groups and gender.

The study could be summarised as

- Parameter 1- the mean distance of infra orbital foramen from the mid sagittal plane to the centre of the foramen ranges from **26.04±2.68mm** to **27.46±3.23mm** for males and **24.81±2.79mm** to **26.31±3.13mm** for females.
- Parameter 2- the mean distance of infra orbital foramen from the infra orbital rim to the centre of the foramen ranges from **4.91 ±1.71mm** to **6.43 ±1.73mm** for males and **5.4 ±1.03mm** to **6.50±2.12mm** for females.

- Parameter 3- the mean distance of infra orbital foramen from the zygomatic buttress to the centre of the foramen ranges from **17.19±2.29mm** to **18.12±3.25mm** for males and **16.41±2.42mm** to **18.25±1.9mm** for females.
- With respect to age, significant difference were found among **group 3** (age above 60 years) **with parameter 2**(distance of infra orbital foramen from the infra orbital rim to the centre of the foramen) on **right side** with **p-value** of **0.02.**
- With respect to gender, significant difference were found among **group 2 (30-60years) with parameter 3** (distance of infra orbital foramen from the zygomatic buttress to the centre of the foramen) on both **right and left side** with **p- value of 0.04 and 0.03.**

The present study attempted to show the radiological variations in the location of the infra orbital foramen with respect to different anatomical landmarks. No previous studies were done to measure the distance from the foramen to the zygomatic buttress which is crucial during zygomatic implant placements. Complications due to iatrogenic injuries to the nerve could be minimized with through anatomical knowledge about the infra orbital foramen between different age groups and gender. So further studies are recommended in different ethnic groups.

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Annexures

ANNEXURE I

RAGAS DENTAL COLLEGE & HOSPITAL
(Unit of Ragas Educational Society)
Recognized by the Dental Council of India, New Delhi
Affiliated to The Tamilnadu Dr. M.G.R. Medical University, Chennai
2/102, East Coast Road, Uthandi, Chennai - 600 119. INDIA.
Tele : (044) 24530002, 24530003-06. Principal (Dir) 24530001 Fax : (044) 24530009

TO WHOMSOEVER IT MAY CONCERN

Date: 29/12/2016

From

The Institutional Ethics Board,

Ragas Dental College and Hospital,

Uthandi,

Chennai- 600119

The dissertation topic titled **"ASSESSMENT OF VARIATION AND LOCATION OF THE INFRA ORBITAL FORAMEN WITH ITS NEIGHBOURING STRUCTURES USING CONE BEAM COMPUTED TOMOGRAPHY"** submitted by **Dr.Niranjana.B**, has been approved by the Institutional Ethics Board of Ragas Dental College and Hospital.

Dr. N.S. Azhagarasan, MDS.,

Member secretary, Institutional Ethics Board,

Head of the Institution,

Ragas Dental College and Hospital,

Uthandi,

Chennai-600119

PRINCIPAL
RAGAS DENTAL COLLEGE AND HOSPITAL
UTHANDI, CHENNAI-600 119.

ANNEXURE II

S/NO	PATIENT NAME	AGE/SEX	RT- IOF to MID SAGITTAL PLANE	LF- IOF to MID SAGITTAL PLANE	RT- IOF to IOR	LF- IOF to IOR	RT - IOF to ZYGOMATIC BUTTRESS	LF- IOF to ZYGOMATIC BUTTRESS
1	ANATHANAYAGI	57/F	25.85	24.69	5.24	3.24	18.71	22.2
2	BHAVNA	49/F	28.19	20.43	5.49	6.24	18.21	18.46
3	CHITRA	48/F	27.94	24.71	3.99	4.5	14.07	19.21
4	DANIEL	26/M	28.68	28.18	5.74	3.99	15.72	13.47
5	ELANGOVAN	29/M	26.19	29.49	4.5	4.49	14.43	12.98
6	FARIDA	67/F	23.7	25.94	6.48	5.01	21.95	20.46
7	GOPINATH	23/M	29.93	34.14	8.98	9.23	14.97	17.96
8	IRIN PUSHPA	39/F	27.94	20.7	4.75	2.74	12.47	22.7
9	JANAKIRAMAN	48/M	27.69	30.18	7.99	8.23	21.7	22.45
10	JASHAR	33/M	25.94	26.44	8.73	9.23	16.47	19.95
11	JAYABHOOSHANAM	29/M	27.69	31.43	6.73	6.48	18.21	13.94
12	JAYANTHI UMAPATHI	36/F	29.19	28.93	3.75	3.24	13.03	16.35
13	JAYA RAMAN	73/M	27.19	25.2	7.24	9.48	15.22	19.21
14	KALAISELVAN	30/M	31.18	29.93	4.99	6.24	20.74	17.71
15	KAREEM	67/M	30.18	27.69	3.49	4.5	14.47	20.7
16	KASHI NARAYAN MISHRA	56/M	28.18	29.43	4.99	5.49	12.97	20.2
17	KEERTHANA	13/F	23.95	23.7	6.74	4.24	15.22	15.71
18	KURIAN ABRAHAM	67/M	29.43	31.43	5.99	5.79	20.7	20.22

19	MAHESH	20/M	27.19	24.44	5.24	6.24	20.21	22.7
20	MAHESH KUMAR	24/M	25.12	26.75	4.37	4.99	16.77	17.67
21	MANJULA RADHA	66/F	26.44	26.44	5.99	5.24	10.48	17.96
22	RAMYA	18/F	26.19	24.69	7.24	4.52	12.47	14.72
23	AKSHAYAH	24/F	28.69	26.94	3.24	3.25	15.72	16.71
24	MOHAMMED ISHRAD MAZOOR	38/M	28.68	28.43	5.68	5.49	18.78	19.46
25	JANAKI RAMAN	48/M	28.44	29.18	7.24	9.73	21.45	22.2
26	JAYANTHI UMAPATHI	37/F	28.93	28.93	4.74	3.25	14.47	16.71
27	KASHI NARAYANA	57/M	28.43	29.43	4.24	5.74	11.23	21.96
28	MURUGAN	48/M	31.23	29.93	2.97	7.9	15.22	19.46
29	MADHANADHANUSHKODI	55/M	25.19	22.95	5.74	4.99	16.22	22.45
30	NIVIDITHA ARVIND	18/F	28.43	26.94	8.98	9.98	14.72	16.71
31	PANDIAN	41/M	25.94	24.69	8.23	9.98	17.71	23.56
32	PETER	56/M	28.19	29.43	4.99	4.67	18.71	19.45
33	SARAVANA NATASEN	29/M	26.64	27.19	7.48	5.49	16.21	23.22
34	SELVAMANI	49/M	29.43	29.94	9.98	8.73	19.71	20.45
35	SHAFALI KAR	14/F	23.7	21.43	8.49	6.99	14.47	20.46
36	SHANTHI	43/F	28.69	32.18	8.98	10.72	13.72	15.72
37	SRIMATHI	78/F	21.43	21.78	6.67	6.89	16.78	15.87
38	SUNDARAMBI	49/F	25.69	28.18	10.23	6.73	18.46	19.21
39	SURESH	28/M	28.18	28.45	5.99	5.74	19.71	18.71
40	SUDARSHINI	46/F	24.95	27.19	6.49	4	20.95	21.96
41	SWATHI SRI	28/F	26.69	29.68	8.49	7.24	18.21	17.46

42	UMA MAHESHWARI	40/F	26.44	24.95	8.73	5.99	16.47	19.96
43	VIGISH	34/M	25.19	27.19	10.72	7.24	16.46	22.95
44	VINOTH	29/M	23.12	24.12	7.67	6.89	15.56	14.97
45	ASMATH UNNISA	38/M	23.67	21.45	6.78	5.89	14.67	14.78
46	BALASUBRAMANIUM	28/M	22.47	21.46	7.89	7.45	17.89	16.87
47	DESAI	55/M	27.44	25.94	6.98	6.73	17.96	18.96
48	DWARADISH	22/M	29.43	28.93	7.24	8.48	17.46	15.47
49	ARUN KUMAR	26/M	21.34	22.45	5.67	4.67	14.67	13.89
50	GIBERTO	55/M	34.17	33.17	6.74	7.49	19.45	17.21
51	GOPINATH	24/M	26.78	24.78	11.72	7.89	17.89	16.89
52	HEMANTH KUMAR	37/M	29.18	28.19	11.72	10.73	18.96	16.21
53	JAYASUDHA	28/F	37.67	26.78	12.54	12.78	19.01	18.79
54	KRIPA PALANIAPPAN	18/M	30.43	27.94	4.92	4.78	15.71	21.2
55	Munuyasamy	56/M	29.18	27.19	7.49	7.49	18.21	15.22
56	Narayana Babu	72/M	23.67	24.81	2.98	3.01	17.84	16.96
57	Nerurkar	63/M	24.69	24.7	4.39	4.91	18.95	19.81
58	Omar arok	24/M	27.67	24.67	5.71	5.49	18.82	18.46
59	Ram prakash lenka	33/M	25.44	25.19	6.99	7.98	16.96	15.71
60	Sundar Khatri	46/M	26.19	27.19	6.49	8.23	17.96	23.45
61	Tapas Ghosh	33/M	25.78	26.12	7.12	7.98	14.12	15.32
62	Thirupathi	28/M	28.69	27.94	3.53	5.29	17.46	20.2
63	Venkatachalam	67/M	31.43	27.93	4.99	7.74	20.46	20.7
64	Vineetha shree	26/F	25.69	24.69	6.98	5.24	15.47	16.71

65	Ganesan senthil kanna	36/M	26.94	27.44	7.99	9.73	21.2	17.72
66	Haribaskar	48/M	27.19	27.69	7.48	8.23	21.95	23.45
67	Imran Khan	19/M	29.18	29.68	7.24	6.24	14.47	16.22
68	Isha Tarun salot	23/M	24.44	24.19	6.49	5.99	17.21	21.17
69	Madhumalati	68/F	27.67	27.44	3.49	4.49	17.21	18.71
70	Manik Jain	61/M	25.19	26.69	5.49	3.24	19.46	19.46
71	Mari Muthu Murugan	42/M	25.2	26.69	7.73	4.25	18.46	22.45
72	Master Shubam oza	20/M	25.44	25.94	5.54	4.99	17.21	18.21
73	Tanveer	35/M	29.68	24.94	7.24	9.23	13.72	16.97
74	Mohniandi Hari krishnasamy	42/M	25.94	24.69	6.48	6.99	16.71	14.97
75	Raymond amrithraj	28/M	24.19	24.44	6.74	6.49	15.47	21.7
76	Rajendran M V	75/M	29.44	30.68	5.99	6.74	15.22	20.2
77	Shahidul islam	46/M	27.44	27.44	6.24	8.23	19.71	20.95
78	Soledad nuno	55/M	28.68	26.46	6.24	5.09	16.71	18.96
79	Vedanarayanan	80/M	27.69	29.18	4.99	2.99	15.96	19.21
80	Dr Madhan	48/M	27.44	24.69	3.5	3.54	18.46	14.47
81	Kainuma	43/M	28.93	23.74	10.23	9.98	19.71	22.45
82	Keerthivasan	17/M	25.44	25.19	7.73	4.99	14.72	17.46
83	Lalith kumar	45/M	26.69	28.43	5.74	7.48	19.95	22.2
84	Kaviya	23/F	27.44	25.44	11.97	12.22	19.21	17.96
85	Umesh	40/M	27.72	29.68	6.63	6.17	18.71	23.2
86	Dhanalakshmi	36/M	25.76	24.39	6.13	5.91	18.72	19.32
87	Renil daphney	21/F	26.94	27.69	10.48	11.25	14.47	17.21
88	Murugesan	68/M	31.93	27.94	2	4.24	23.19	13.06

89	R V Ramana	71/M	30.93	28.19	3.5	3.75	23.19	13.06
90	Sakthivel	33/M	26.69	27.44	2.74	4.99	19.21	20.7
91	Shanthi	47/M	26.94	27.93	4.75	5.49	18.21	23.45
92	Sivarasa	34/M	25.45	25.94	8.48	7.49	18.71	17.96
93	Srinivasan	25/M	31.93	23.94	8.48	8.49	8.73	13.99
94	Vijeyendran reddy	56/M	31.43	27.44	4.49	5.24	20.2	21.2
95	Vikram	46/M	26.19	25.94	5.99	5.26	17.2	17.46
96	vikram	39/m	25.78	27.76	6.51	7.12	17.6	18.21
97	jayaraman	73/m	24.65	25.13	8.61	7.43	12.45	14.54
98	jayanthi umapathy	36/F	23.67	24.87	6.78	5.9	12.11	11.98
99	jayanthi umapathy 2	36/F	25.68	24.56	6.78	7.67	12.78	13.54
100	swathi sri	28/F	27.89	28.12	4.67	5.23	16.65	17.51
101	raju	56/M	21.45	21.34	5.91	6.78	14.83	15.91
102	karthick	19/M	22.78	22.56	3.56	4.31	16.78	16.01
103	jeevan	36/M	26.78	27.89	3.81	4.01	16.93	16.84
104	daurairaj	28/M	28.76	28.92	4.06	4.95	20.91	20.13
105	kavitha	46/F	26.28	26.76	3.56	4.78	13.45	13.87
106	pramila	35/F	23.54	21.45	5.92	6.87	15.9	15.81
107	gopalakrishnan	76/M	26.79	26.91	4.65	4.71	16.81	16.71
108	haridoss	43/M	21.43	21.56	4.72	4.92	17.89	17.82
109	prasanna	27/f	21.56	21.56	6.78	6.78	18.76	18.71
110	rita	38/f	30.31	31.21	4.71	4.73	18.73	18.72
111	rohit	23/m	22.45	22.71	5.67	5.78	20.12	21.03
112	laksman	28/m	22.91	21.56	5.32	5.53	21.98	22.54

113	jayapal	36/m	22.65	22.87	3.68	4.01	15.76	15.89
114	suresh	46/m	24.87	24.78	6.2	5.99	16.87	16.05
115	jyothi	66/m	21.34	21.45	4.56	4.65	19.76	19.87
116	mohanrao	58/m	31.87	32.65	4.67	4.76	17.83	17.96
117	radha	46/f	29.78	28.98	4.76	4.67	19.87	19.87
118	pushpalatha	48/f	29.76	29.76	5.84	5.78	16.89	15.79
119	nivedita	32/f	28.76	28.76	6.87	6.71	17.67	17.61
120	vishnupriya	29/f	27.07	27.82	4.92	4.6	19.21	18.81
121	abisheg	23/m	26.81	26.82	5.76	5.92	17.87	17.89
122	sangeetha	46/f	21.34	21.34	4.67	5.01	19.87	19.03
123	ramesh	23/m	22.61	22.87	6.82	6.91	18.76	19.87
124	jaya krishnan	43/m	27.67	26.05	4.76	4.63	18.91	18.76
125	pandian	34/m	28.95	29.31	4.69	4.67	20.54	20.65
126	abhinaya	23/f	30.21	31.61	5.87	7.32	21.87	21.98
127	suryanarayanan	24/m	30.45	30.87	7.09	8.01	19.76	20.87
128	ramcharan	24/m	28.78	26.87	7.89	7.67	18.43	18.76
129	shweta	23/f	21.98	21.9	5.05	5.98	17.54	17.67
130	sundaram	21/m	22.89	22.76	4.98	4.92	16.86	16.45
131	narmada	27/f	22.03	21.78	4.49	4.32	17.43	17.43
132	kalaivani	39/f	25.89	25.93	8.01	7.93	16.56	17.01
133	ilavarasi	56/f	22.45	22.54	5.92	5.32	16.54	16.98
134	jagadesh	43/m	24.87	24.43	6.54	6.31	15.43	15.94
135	nirmal	27/m	23.45	23.39	4.67	5.12	17.76	17.82
136	ramchandran	53/m	25.76	25.76	6.26	6.12	19.76	19.87

137	pricilla	27/f	26.76	26.87	4.65	4.81	16.76	16.71
138	sirisha	24/f	28.76	28.65	5.83	5.91	18.85	18.65
139	vishal	29/m	27.76	27.23	7.65	7.34	16.54	16.01
140	srini	45/m	23.76	22.76	6.39	6.86	18.29	18.76
141	kazhimohini	48/f	29.72	29.83	7.65	7.21	16.63	16.92
142	pranav	27/m	26.81	26.71	7.19	7.51	17.03	17.61
143	lokesh	24/m	22.34	22.92	6.43	6.32	16.61	16.81
144	sandeep	29/m	26.02	25.76	7.92	7.43	17.96	17.82
145	raviteja	28/m	27.54	27.91	7.65	7.54	16.76	16.91
146	banu chander	27/m	26.97	26.81	6.92	6.71	18.93	18.76
147	sofia	47/f	26.12	26.81	4.72	4.84	17.77	17.92
148	lingavel	25/m	25.91	25.65	5.72	5.79	18.76	18.95
149	ram narayan	55/m	22.91	22.59	4.76	4.01	16.71	16.96
150	venkat	49/m	22.96	22.76	6.13	6.02	16.84	16.95
151	kumaravel	42/m	23.67	24.12	4.65	4.87	15.76	14.02
152	siddharth	27/m	28.76	28.92	5.09	5.76	17.99	18.87
153	pallavi	33/f	25.76	25.8	8.76	7.98	16.65	16.84
154	albert	46/m	23.87	24.09	6.43	6.87	15.87	15.65
155	santhosh	32/m	23.65	23.76	7.87	7.62	17.65	17.87
156	abishek	27/m	27.85	26.76	6.92	5.76	19.59	19.87
157	iswar	25/m	22.45	23.76	5.31	5.6	16.77	16.91
158	saritha	47/f	22.16	22.23	7.42	7.9	18.93	18.98
159	arun	34/m	25.71	25.85	5.43	5.21	15.54	15.7
160	rajkumar	33/m	23.66	23.54	4.33	4.65	14.76	13.54

161	vishnu	26/f	25.67	24.76	7.65	7.55	14.54	15.01
162	nisha	21/f	25.43	23.44	5.43	5.64	15.32	14.65
163	kishore kumar	27/m	26.54	26.88	5.55	5.98	13.43	13.3
164	rabicca	29/f	25.87	25.65	6.98	6.6	16.88	16.69
165	preetha	38/f	23.54	23.87	5.54	5.32	15.66	15.32
166	raj	42/m	23.02	22.23	4.01	4.6	18.21	18.65
167	ragav	29/m	26.54	25.54	4.56	4.76	14.43	15.21
168	RAMANA	33/m	27.87	28.66	6.02	6.91	14.01	14.59
169	sruthi	27/f	24.67	24.81	4.69	4.5	15.69	14.98
170	abinav	28/m	22.76	23.32	6.1	6.88	17.7	17.81
171	aravind	27/m	27.8	26.98	6.91	6.82	15.76	15.41
172	rupa	26/f	24.61	24.39	4.31	4.6	14.92	14.4
173	sridevi	28/f	22.19	22.69	3.9	4.05	15.02	15.62
174	arjun	22/m	22.98	23.5	6.21	6.7	19.71	19.8
175	aruna	38/f	27.6	26.8	4.21	4.87	16.51	16.92
176	anitha	26/f	25.12	25.72	6.12	6.5	21.01	20.2
177	muthu	45/m	22.59	22.78	5.71	5.98	19.81	18.76
178	janani	46/f	23.01	23.72	4.65	4.3	14.98	14.6
179	nithya	29/f	22.54	22.12	5.7	5.12	16.7	16.43
180	raghu	36/m	25.92	25.71	4.99	5.92	15.39	15.43
181	praveen kumar	28/m	27.61	27.8	7.08	7.31	19.87	19.2
182	kannan	37/m	24.78	23.6	5.9	6.51	15.81	16.44
183	deepika	34/f	21.29	21.78	4.6	4.9	17.87	17.45
184	akshaya	26/f	27.2	28.71	8.01	8.4	16.1	16.88

185	madhu	32/m	25.65	25.91	6.71	6.12	14.61	14.98
186	navya	23/f	23.12	24.12	5.71	5.21	15.61	14.98
187	gayathri	27/f	25.9	25.6	4.9	4.31	13.98	13.5
188	vinoth	38/m	22.89	22.12	3.5	3.91	14.3	14.98
189	kavitha	32/f	27.92	28.71	7.91	7.5	19.71	19.85
190	saranya	27/f	28.7	28.62	6.31	6.72	18.73	18.63
191	giri	39/m	22.81	22.72	6.78	6.12	17.71	17.21
192	malathi	19/f	28.81	29.7	7.21	7.9	15.89	14.32
193	pochammal	20/f	23.3	24.03	5.6	5.12	16.51	16.21
194	baskar	37/m	27.02	27.98	4.92	4.39	14.32	14.51
195	caroline	42/f	25.12	25.15	5.7	5.21	17.32	18.21
196	rani	22/f	29.02	28.91	6.01	6.87	17.21	17.92
197	nalini	27/f	26.65	26.61	4.6	4.2	15.41	15.41
198	sathish	30/m	24.91	25.71	6.21	6.5	15.21	14.21
199	manikandan	34/m	23.76	23.87	5.41	5.71	16.81	16.99
200	kanishka	35/f	25.71	25.61	8.51	8.71	14.02	13.79

S/NO	PATIENT NAME	AGE/ SEX	RT- IOF to MID SAGITTAL PLANE	LF- IOF to MID SAGITTAL PLANE	RT- IOF to IOR	LF- IOF to IOR	RT - IOF to ZYGOMATIC BUTTRES	LF- IOF to ZYGOMATIC BUTTRESS
1	ANATHANAYAGI	57/F	25.85	24.69	5.24	3.24	18.71	22.2
2	BHAVNA	49/F	28.19	20.43	5.49	6.24	18.21	18.46
3	CHITRA	48/F	27.94	24.71	3.99	4.5	14.07	19.21
4	DANIEL	26/M	28.68	28.18	5.74	3.99	15.72	13.47
5	ELANGOVAN	29/M	26.19	29.49	4.5	4.49	14.43	12.98
6	FARIDA	67/F	23.7	25.94	6.48	5.01	21.95	20.46
7	GOPINATH	23/M	29.93	34.14	8.98	9.23	14.97	17.96
8	IRIN PUSHPA	39/F	27.94	20.7	4.75	2.74	12.47	22.7
9	JANAKIRAMAN	48/M	27.69	30.18	7.99	8.23	21.7	22.45
10	JASHAR	33/M	25.94	26.44	8.73	9.23	16.47	19.95
11	JAYABHOOSHANAM	29/M	27.69	31.43	6.73	6.48	18.21	13.94
12	JAYANTHI UMAPATHI	36/F	29.19	28.93	3.75	3.24	13.03	16.35
13	JAYA RAMAN	73/M	27.19	25.2	7.24	9.48	15.22	19.21
14	KALAISELVAN	30/M	31.18	29.93	4.99	6.24	20.74	17.71
15	KAREEM	67/M	30.18	27.69	3.49	4.5	14.47	20.7
16	KASHI NARAYAN MISHRA	56/M	28.18	29.43	4.99	5.49	12.97	20.2
17	KEERTHANA	13/F	23.95	23.7	6.74	4.24	15.22	15.71
18	KURIAN ABRAHAM	67/M	29.43	31.43	5.99	5.79	20.7	20.22
19	MAHESH	20/M	27.19	24.44	5.24	6.24	20.21	22.7
20	MAHESH KUMAR	24/M	25.12	26.75	4.37	4.99	16.77	17.67
21	MANJULA RADHA	66/F	26.44	26.44	5.99	5.24	10.48	17.96
22	RAMYA	18/F	26.19	24.69	7.24	4.52	12.47	14.72
23	AKSHAYAH	24/F	28.69	26.94	3.24	3.25	15.72	16.71
24	MOHAMMED ISHRAD MAZOOR	38/M	28.68	28.43	5.68	5.49	18.78	19.46
25	JANAKI RAMAN	48/M	28.44	29.18	7.24	9.73	21.45	22.2
26	JAYANTHI UMAPATHI	37/F	28.93	28.93	4.74	3.25	14.47	16.71
27	KASHI NARAYANA	57/M	28.43	29.43	4.24	5.74	11.23	21.96
28	MURUGAN	48/M	31.23	29.93	2.97	7.9	15.22	19.46
29	MADHANADHANUSHKODI	55/M	25.19	22.95	5.74	4.99	16.22	22.45
30	NIVIDITHA ARVIND	18/F	28.43	26.94	8.98	9.98	14.72	16.71
31	PANDIAN	41/M	25.94	24.69	8.23	9.98	17.71	23.56
32	PETER	56/M	28.19	29.43	4.99	4.67	18.71	19.45
33	SARAVANA NATASEN	29/M	26.64	27.19	7.48	5.49	16.21	23.22
34	SELVAMANI	49/M	29.43	29.94	9.98	8.73	19.71	20.45
35	SHAFALI KAR	14/F	23.7	21.43	8.49	6.99	14.47	20.46
36	SHANTHI	43/F	28.69	32.18	8.98	10.72	13.72	15.72
37	SRIMATHI	78/F	21.43	21.78	6.67	6.89	16.78	15.87
38	SUNDARAMBI	49/F	25.69	28.18	10.23	6.73	18.46	19.21
39	SURESH	28/M	28.18	28.45	5.99	5.74	19.71	18.71
40	SUDARSHINI	46/F	24.95	27.19	6.49	4	20.95	21.96
41	SWATHI SRI	28/F	26.69	29.68	8.49	7.24	18.21	17.46
42	UMA MAHESHWARI	40/F	26.44	24.95	8.73	5.99	16.47	19.96
43	VIGISH	34/M	25.19	27.19	10.72	7.24	16.46	22.95
44	VINOTH	29/M	23.12	24.12	7.67	6.89	15.56	14.97
45	ASMATH UNNISA	38/M	23.67	21.45	6.78	5.89	14.67	14.78
46	BALASUBRAMANIUM	28/M	22.47	21.46	7.89	7.45	17.89	16.87
47	DESAI	55/M	27.44	25.94	6.98	6.73	17.96	18.96
48	DWARADISH	22/M	29.43	28.93	7.24	8.48	17.46	15.47
49	ARUN KUMAR	26/M	21.34	22.45	5.67	4.67	14.67	13.89
50	GIBERTO	55/M	34.17	33.17	6.74	7.49	19.45	17.21
51	GOPINATH	24/M	26.78	24.78	11.72	7.89	17.89	16.89
52	HEMANTH KUMAR	37/M	29.18	28.19	11.72	10.73	18.96	16.21
53	JAYASUDHA	28/F	37.67	26.78	12.54	12.78	19.01	18.79
54	KRIPA PALANIAPPAN	18/M	30.43	27.94	4.92	4.78	15.71	21.2
55	Munuyasamy	56/M	29.18	27.19	7.49	7.49	18.21	15.22
56	Narayana Babu	72/M	23.67	24.81	2.98	3.01	17.84	16.96

57	Nerurkar	63/M	24.69	24.7	4.39	4.91	18.95	19.81
58	Omar arok	24/M	27.67	24.67	5.71	5.49	18.82	18.46
59	Ram prakash lenka	33/M	25.44	25.19	6.99	7.98	16.96	15.71
60	Sundar Khatri	46/M	26.19	27.19	6.49	8.23	17.96	23.45
61	Tapas Ghosh	33/M	25.78	26.12	7.12	7.98	14.12	15.32
62	Thirupathi	28/M	28.69	27.94	3.53	5.29	17.46	20.2
63	Venkatachalam	67/M	31.43	27.93	4.99	7.74	20.46	20.7
64	Vineetha shree	26/F	25.69	24.69	6.98	5.24	15.47	16.71
65	Ganesan senthil kanna	36/M	26.94	27.44	7.99	9.73	21.2	17.72
66	Haribaskar	48/M	27.19	27.69	7.48	8.23	21.95	23.45
67	Imran Khan	19/M	29.18	29.68	7.24	6.24	14.47	16.22
68	Isha Tarun salot	23/M	24.44	24.19	6.49	5.99	17.21	21.17
69	Madhumalati	68/F	27.67	27.44	3.49	4.49	17.21	18.71
70	Manik Jain	61/M	25.19	26.69	5.49	3.24	19.46	19.46
71	Mari Muthu Murugan	42/M	25.2	26.69	7.73	4.25	18.46	22.45
72	Master Shubam oza	20/M	25.44	25.94	5.54	4.99	17.21	18.21
73	Tanveer	35/M	29.68	24.94	7.24	9.23	13.72	16.97
74	Mohniandi Hari krishnasamy	42/M	25.94	24.69	6.48	6.99	16.71	14.97
75	Raymond amrithraj	28/M	24.19	24.44	6.74	6.49	15.47	21.7
76	Rajendran M V	75/M	29.44	30.68	5.99	6.74	15.22	20.2
77	Shahidul islam	46/M	27.44	27.44	6.24	8.23	19.71	20.95
78	Soledad nuno	55/M	28.68	26.46	6.24	5.09	16.71	18.96
79	Vedanarayanan	80/M	27.69	29.18	4.99	2.99	15.96	19.21
80	Dr Madhan	48/M	27.44	24.69	3.5	3.54	18.46	14.47
81	Kainuma	43/M	28.93	23.74	10.23	9.98	19.71	22.45
82	Keerthivasan	17/M	25.44	25.19	7.73	4.99	14.72	17.46
83	Lalith kumar	45/M	26.69	28.43	5.74	7.48	19.95	22.2
84	Kaviya	23/F	27.44	25.44	11.97	12.22	19.21	17.96
85	Umesh	40/M	27.72	29.68	6.63	6.17	18.71	23.2
86	Dhanalakshmi	36/M	25.76	24.39	6.13	5.91	18.72	19.32
87	Renil daphney	21/F	26.94	27.69	10.48	11.25	14.47	17.21
88	Murugesan	68/M	31.93	27.94	2	4.24	23.19	13.06
89	R V Ramana	71/M	30.93	28.19	3.5	3.75	23.19	13.06
90	Sakthivel	33/M	26.69	27.44	2.74	4.99	19.21	20.7
91	Shanthi	47/M	26.94	27.93	4.75	5.49	18.21	23.45
92	Sivarasa	34/M	25.45	25.94	8.48	7.49	18.71	17.96
93	Srinivasan	25/M	31.93	23.94	8.48	8.49	8.73	13.99
94	Vijeyendran reddy	56/M	31.43	27.44	4.49	5.24	20.2	21.2
95	Vikram	46/M	26.19	25.94	5.99	5.26	17.2	17.46
96	vikram	39/m	25.78	27.76	6.51	7.12	17.6	18.21
97	jayaraman	73/m	24.65	25.13	8.61	7.43	12.45	14.54
98	jayanthi umapathy	36/F	23.67	24.87	6.78	5.9	12.11	11.98
99	jayanthi umapathy 2	36/F	25.68	24.56	6.78	7.67	12.78	13.54
100	swathi sri	28/F	27.89	28.12	4.67	5.23	16.65	17.51
101	raju	56/M	21.45	21.34	5.91	6.78	14.83	15.91
102	karthick	19/M	22.78	22.56	3.56	4.31	16.78	16.01
103	jeevan	36/M	26.78	27.89	3.81	4.01	16.93	16.84
104	daurairaj	28/M	28.76	28.92	4.06	4.95	20.91	20.13
105	kavitha	46/F	26.28	26.76	3.56	4.78	13.45	13.87
106	pramila	35/F	23.54	21.45	5.92	6.87	15.9	15.81
107	gopalakrishnan	76/M	26.79	26.91	4.65	4.71	16.81	16.71
108	haridoss	43/M	21.43	21.56	4.72	4.92	17.89	17.82
109	prasanna	27/f	21.56	21.56	6.78	6.78	18.76	18.71
110	rita	38/f	30.31	31.21	4.71	4.73	18.73	18.72
111	rohit	23/m	22.45	22.71	5.67	5.78	20.12	21.03
112	laksman	28/m	22.91	21.56	5.32	5.53	21.98	22.54
113	jayapal	36/m	22.65	22.87	3.68	4.01	15.76	15.89
114	suresh	46/m	24.87	24.78	6.2	5.99	16.87	16.05
115	jyothi	66/m	21.34	21.45	4.56	4.65	19.76	19.87
116	mohanrao	58/m	31.87	32.65	4.67	4.76	17.83	17.96
117	radha	46/f	29.78	28.98	4.76	4.67	19.87	19.87

118	pushpalatha	48/f	29.76	29.76	5.84	5.78	16.89	15.79
119	nivedita	32/f	28.76	28.76	6.87	6.71	17.67	17.61
120	vishnupriya	29/f	27.07	27.82	4.92	4.6	19.21	18.81
121	abisheg	23/m	26.81	26.82	5.76	5.92	17.87	17.89
122	sangeetha	46/f	21.34	21.34	4.67	5.01	19.87	19.03
123	ramesh	23/m	22.61	22.87	6.82	6.91	18.76	19.87
124	jaya krishnan	43/m	27.67	26.05	4.76	4.63	18.91	18.76
125	pandian	34/m	28.95	29.31	4.69	4.67	20.54	20.65
126	abhinaya	23/f	30.21	31.61	5.87	7.32	21.87	21.98
127	suryanarayanan	24/m	30.45	30.87	7.09	8.01	19.76	20.87
128	ramcharan	24/m	28.78	26.87	7.89	7.67	18.43	18.76
129	shweta	23/f	21.98	21.9	5.05	5.98	17.54	17.67
130	sundaram	21/m	22.89	22.76	4.98	4.92	16.86	16.45
131	narmada	27/f	22.03	21.78	4.49	4.32	17.43	17.43
132	kalaivani	39/f	25.89	25.93	8.01	7.93	16.56	17.01
133	ilavarasi	56/f	22.45	22.54	5.92	5.32	16.54	16.98
134	jagadesh	43/m	24.87	24.43	6.54	6.31	15.43	15.94
135	nirmal	27/m	23.45	23.39	4.67	5.12	17.76	17.82
136	ramchandran	53/m	25.76	25.76	6.26	6.12	19.76	19.87
137	pricilla	27/f	26.76	26.87	4.65	4.81	16.76	16.71
138	sirisha	24/f	28.76	28.65	5.83	5.91	18.85	18.65
139	vishal	29/m	27.76	27.23	7.65	7.34	16.54	16.01
140	srini	45/m	23.76	22.76	6.39	6.86	18.29	18.76
141	kazhimohini	48/f	29.72	29.83	7.65	7.21	16.63	16.92
142	pranav	27/m	26.81	26.71	7.19	7.51	17.03	17.61
143	lokesh	24/m	22.34	22.92	6.43	6.32	16.61	16.81
144	sandeep	29/m	26.02	25.76	7.92	7.43	17.96	17.82
145	raviteja	28/m	27.54	27.91	7.65	7.54	16.76	16.91
146	banu chander	27/m	26.97	26.81	6.92	6.71	18.93	18.76
147	sofia	47/f	26.12	26.81	4.72	4.84	17.77	17.92
148	lingavel	25/m	25.91	25.65	5.72	5.79	18.76	18.95
149	ram narayan	55/m	22.91	22.59	4.76	4.01	16.71	16.96
150	venkat	49/m	22.96	22.76	6.13	6.02	16.84	16.95
151	kumaravel	42/m	23.67	24.12	4.65	4.87	15.76	14.02
152	siddharth	27/m	28.76	28.92	5.09	5.76	17.99	18.87
153	pallavi	33/f	25.76	25.8	8.76	7.98	16.65	16.84
154	albert	46/m	23.87	24.09	6.43	6.87	15.87	15.65
155	santhosh	32/m	23.65	23.76	7.87	7.62	17.65	17.87
156	abishek	27/m	27.85	26.76	6.92	5.76	19.59	19.87
157	iswar	25/m	22.45	23.76	5.31	5.6	16.77	16.91
158	saritha	47/f	22.16	22.23	7.42	7.9	18.93	18.98
159	arun	34/m	25.71	25.85	5.43	5.21	15.54	15.7
160	rajkumar	33/m	23.66	23.54	4.33	4.65	14.76	13.54
161	vishnu	26/f	25.67	24.76	7.65	7.55	14.54	15.01
162	nisha	21/f	25.43	23.44	5.43	5.64	15.32	14.65
163	kishore kumar	27/m	26.54	26.88	5.55	5.98	13.43	13.3
164	rabicca	29/f	25.87	25.65	6.98	6.6	16.88	16.69
165	preetha	38/f	23.54	23.87	5.54	5.32	15.66	15.32
166	raj	42/m	23.02	22.23	4.01	4.6	18.21	18.65
167	ragav	29/m	26.54	25.54	4.56	4.76	14.43	15.21
168	RAMANA	33/m	27.87	28.66	6.02	6.91	14.01	14.59
169	sruthi	27/f	24.67	24.81	4.69	4.5	15.69	14.98
170	abinav	28/m	22.76	23.32	6.1	6.88	17.7	17.81
171	aravind	27/m	27.8	26.98	6.91	6.82	15.76	15.41
172	rupa	26/f	24.61	24.39	4.31	4.6	14.92	14.4
173	sridevi	28/f	22.19	22.69	3.9	4.05	15.02	15.62
174	arjun	22/m	22.98	23.5	6.21	6.7	19.71	19.8
175	aruna	38/f	27.6	26.8	4.21	4.87	16.51	16.92
176	anitha	26/f	25.12	25.72	6.12	6.5	21.01	20.2
177	muthu	45/m	22.59	22.78	5.71	5.98	19.81	18.76
178	janani	46/f	23.01	23.72	4.65	4.3	14.98	14.6

179	nithya	29/f	22.54	22.12	5.7	5.12	16.7	16.43
180	raghu	36/m	25.92	25.71	4.99	5.92	15.39	15.43
181	praveen kumar	28/m	27.61	27.8	7.08	7.31	19.87	19.2
182	kannan	37/m	24.78	23.6	5.9	6.51	15.81	16.44
183	deepika	34/f	21.29	21.78	4.6	4.9	17.87	17.45
184	akshaya	26/f	27.2	28.71	8.01	8.4	16.1	16.88
185	madhu	32/m	25.65	25.91	6.71	6.12	14.61	14.98
186	navya	23/f	23.12	24.12	5.71	5.21	15.61	14.98
187	gayathri	27/f	25.9	25.6	4.9	4.31	13.98	13.5
188	vinoth	38/m	22.89	22.12	3.5	3.91	14.3	14.98
189	kavitha	32/f	27.92	28.71	7.91	7.5	19.71	19.85
190	saranya	27/f	28.7	28.62	6.31	6.72	18.73	18.63
191	giri	39/m	22.81	22.72	6.78	6.12	17.71	17.21
192	malathi	19/f	28.81	29.7	7.21	7.9	15.89	14.32
193	pochammal	20/f	23.3	24.03	5.6	5.12	16.51	16.21
194	baskar	37/m	27.02	27.98	4.92	4.39	14.32	14.51
195	caroline	42/f	25.12	25.15	5.7	5.21	17.32	18.21
196	rani	22/f	29.02	28.91	6.01	6.87	17.21	17.92
197	nalini	27/f	26.65	26.61	4.6	4.2	15.41	15.41
198	sathish	30/m	24.91	25.71	6.21	6.5	15.21	14.21
199	manikandan	34/m	23.76	23.87	5.41	5.71	16.81	16.99
200	kanishka	35/f	25.71	25.61	8.51	8.71	14.02	13.79