"EVALUATION OF POSTERIOR SUPERIOR ALVEOLAR ARTERY USING CONE BEAM COMPUTED TOMOGRAPHY: A RETROSPECTIVE STUDY."

By

REG NO. IG0222001

Dissertation

Submitted to KLE Academy of Higher Education and Research (KAHER), Belagavi
in Partial Fulfillment of the Requirements for the Degree Of

MASTER OF DENTAL SURGERY
In
ORAL MEDICINE AND RADIOLOGY
(BRANCH- VII)

DEPARTMENT OF ORAL MEDICINE AND RADIOLOGY,
KAHER'S KLE VISHWANATH KATTI
INSTITUTE OF DENTAL SCIENCES, JNMC CAMPUS,
NEHRU NAGAR, BELAGAVI- 590010, KARNATAKA.

2022 – 2025

KLE Academy of Higher Education and Research, Belagavi, Karnataka.

ENDORSEMENT BY THE HOD, PRINCIPAL/ HEAD OF THE INSTITUTION

This is to certify that this dissertation/ thesis entitled **"EVALUATION OF POSTERIOR SUPERIOR ALVEOLAR ARTERY USING CONE BEAM COMPUTED TOMOGRAPHY: A RETROSPECTIVE STUDY"-** is a bonafide research work done by **REG NO. IG0222001.**

HOD

Dr. VAISHALI KELUSKAR, M.D.S.,
Professor and Head,
Department of Oral Medicine and Radiology
KLE Vishwanath Katti Institute of Dental Sciences,
JNMC Campus, Nehru Nagar, Belagavi-590010.

Date: 17/4/25
Place: Belagavi

Principal

PRINCIPAL
KLE V.K. Institute of Dental Sciences
Nehru Nagar, BELAGAVI-590010.

Dr. ALKA D KALE, M.D.S., Ph.D.,
Principal,
KLE Vishwanath Katti Institute of Dental Sciences, JNMC Campus,
Nehru Nagar,
Belagavi- 590010

Date: 17/4/25
Place: Belagavi

UNDERTAKING

I, **REG NO. IG0222001**, a Post-Graduate student in the subject of **ORAL MEDICINE AND RADIOLOGY,** have completed research work entitled **"EVALUATION OF POSTERIOR SUPERIOR ALVEOLAR ARTERY USING CONE BEAM COMPUTED TOMOGRAPHY: A RETROSPECTIVE STUDY"** in the year 2025.

I understand and affirm that any research work I undertake for the purpose of the dissertation, oral presentation, or publication during my study course shall be the property of the KAHER'S KLE Vishwanath Katti Institute of Dental Sciences, Belagavi. Hence, I hereby declare that the name of the Department, Institute, and University shall be mentioned in my publications. The authorship shall be according to the guidelines informed to me.

Date: 1704-2025

Place: Belagavi

REG NO. IG0222001

UNDERTAKING

I, **REG NO. IG0222001**, hereby declare that the information and data mentioned in my dissertation/ thesis entitled **"Evaluation of Posterior Superior Alveolar Artery Using Cone Beam Computed Tomography: A Retrospective Study"** belongs to me and is original.

I am aware of the definition of plagiarism as detailed below:

- An act or instance of using or closely imitating the language and thoughts of another author without authorization and the representation of that author's work as one's own, as by not crediting the original author.
- A piece of writing or other work reflecting such unauthorized use or imitation.
- The deliberate or reckless representation of another's words, thoughts or ideas as one's own without attribution in connection with submission of academic work, whether graded or otherwise.

I hereby declare that the thesis prepared by me is original one and does not involve plagiarism anywhere. In case at later stage, it is found that I have indulged in plagiarism, then I am solely responsible for the same and the Institution is at liberty to take any disciplinary action against me including cancellation of dissertation or any other penalties imposed by the University.

Date: 17-04-2025

Place: Belagavi

REG NO. IG0222001

PLAGIARISM CHECK REPORT

Scientific Correspondence and Review Committee

KLE VK Institute of Dental Sciences

A Constituent Unit of KLE Academy of Higher Education and Research
(Deemed-to-be-University u/s 3 of the UGC Act, 1956)
Nehru Nagar, Belagavi - 590 010, Karnataka State
Accredited 'A+' Grade by NAAC (3rd Cycle) — Placed in Category 'A' by MHRD (GoI)
☎: 0831-2470362 — Web: http://www.kledental-bgm.edu.in
FAX: 0831-2470640 — E-mail:principal@kledental-bgm.edu.in

Date : 17/04/2025 — Serial No. : 417

PLAGIARISM CHECK REPORT

Name of the Applicant : REG NO. IG0222001
UG / PG / Ph.D / Staff : PG
Batch & Year : 2022 - 2025
Department : Oral Medicine and Radiology

The soft copy of Research Work / Manuscript by REG NO. IG0222001 . entitled "Evaluation of posterior superior alveolar artery using cone Beam computed Tomography - A retrospective study……………" under the guidance of ……………has been submitted for Anti-Plagiarism check to the Scientific Correspondence & Review Committee of KLE VK Institute of Dental Sciences using "Turn-it-in" software.

The scan has been carried out and the scanned output reveals a Similarity Index of ………9………%, which is **within / not within** the acceptable limits of 10% as per the UGC guidelines.

17/04/2025

Member Secretary
Scientific Correspondence and Review Committee
KLEVK Institute of Dental Sciences
KAHER-Belagavi

Chairman
Scientific Correspondence and Review Committee
KLEVK Institute of Dental Sciences
KAHER - Belagavi

BIOSTATISTICS CLEARANCE CERTIFICATE

K L E
VISHWANATH KATTI
INSTITUTE OF DENTAL SCIENCES
A Constituent College of
K.L.E. Academy of Higher Education and Research
J.N.M.C. Campus, Nehru Nagar Belagavi -590010 Karnataka, India.
Department of Oral Medicine and Radiology

BIOSTATISTICS CLEARANCE CERTIFICATE

This is to certify that the Biostatistics art of Dissertation/ Research work of

REG NO. IG0222001 **Postgraduate student** under the guidance of **Professor, Department of Oral Medicine and Radiology** entitled "Evaluation of Posterior Superior Alveolar Artery Using Cone Beam Computed Tomography: A Retrospective Study" has been done under my guidance and considered satisfactory.

Place: Belagavi
Date: 24. 03. 2025

Name and signature of Biostatistician

Dr. S. B. Javali, Ph.D.
Professor in Statistics
Department of Community Medicine
USM KLE International Medical Programme,
BELAGAVI-590010

LIST OF ABBREVIATIONS

ABBREVIATION	FULL FORM
CT	Computed Tomography
MDCT	Multi-Detector CT
CBCT	Cone Beam Computed Tomography
2D	Two Dimension
3D	Three Dimension
PSAA	Posterior Superior Alveolar Artery
DICOM	Digital Imaging and Communications in Medicine
M1	Distance from alveolar crest of 1st molar to PSAA
M2	Distance from alveolar crest of 2nd molar to PSAA
M3	Distance from alveolar crest of 3rd molar to PSAA
MSW	Distance from medial sinus wall to PSAA
IO	Intraosseous
IS	Intrasinusal
SUP	Superficial
SPSS	Statistical Package for the Social Sciences
ANOVA	Analysis of Variance
FOV	Field of view
kVp	Kilovoltage peak

mA	Milliamperage
mm	Millimeter
cm	Centimeter
OPG	Orthopantomogram

ABSTRACT

BACKGROUND: The posterior superior alveolar artery (PSAA) is a significant branch of the maxillary artery, supplying the maxillary sinus, posterior maxillary teeth, and associated soft tissues. When placing implants in the posterior maxilla, evaluating the relationship between the remaining alveolar bone and the maxillary sinus is necessary.

AIM: To evaluate the position and caliber of the Posterior superior alveolar artery using cone beam computed tomography (CBCT) images.

MATERIALS AND METHODS: The data was collected from August 2021 to December 2024. Out of 1340 CBCT scans,370 scans of patients (202 males,168 females) that met the inclusion criteria were obtained. The standardization was maintained (Sidexis 4 CBCT viewing software, version 4.3.1.0) and was used for the reconstruction and measurement of the included scans. Measurements were made on the sagittal section after selecting the smallest slice thickness (1.2 mm). PSAA morphology was compared in 3 groups, with category 1 consisting of participants aged 18-32, category 2 participants aged 32-45, and category 3 participants aged 46-60.

RESULTS: There's no substantial variation in gender distribution across the three groups (P = 0.3780). The averages are quite similar. The t-values are also relatively low, reinforcing that the observed differences are minor. Males have slightly higher mean values than females in all parameters, but the differences are minorThe percentage of Intra Osseous is slightly higher in Group 2 (32.26%) compared to Group 1 (23.62%) and Group 3 (28.57%) (Figure 3). Intra-sinus is the most common category across all groups, with percentages ranging from 63.71% (Group 2) to

72.44% (Group 1). SUP is relatively rare across all groups, hovering around 4% in each group.

CONCLUSION:

The maxillary 1st molars are situated adjacent to the PSAA and its vascular network. The vascular structure within the canal may be harmed by any surgical treatment performed here. Therefore, it's essential to ascertain whether these structures have undergone any notable anthropological changes and whether such variations are relevant for forensic purposes.

CONTENTS

LIST OF TABLES

LIST OF GRAPHS

LIST OF FIGURES

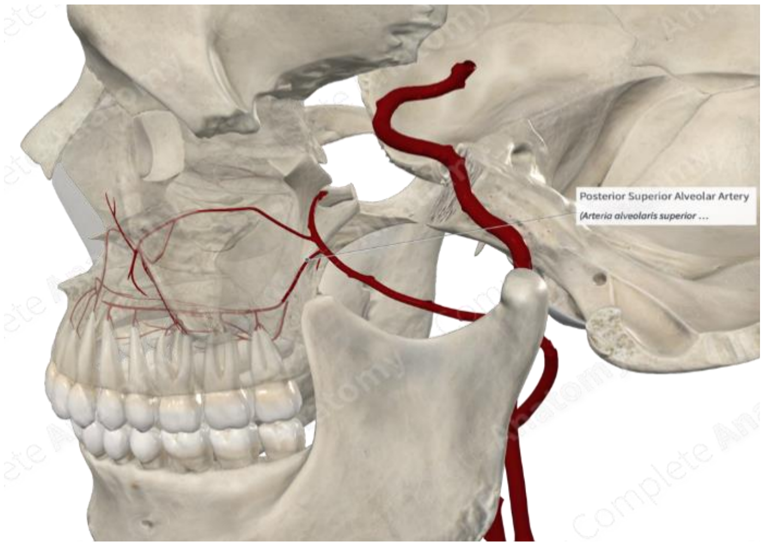
LIST OF ANNEXURES

INTRODUCTION

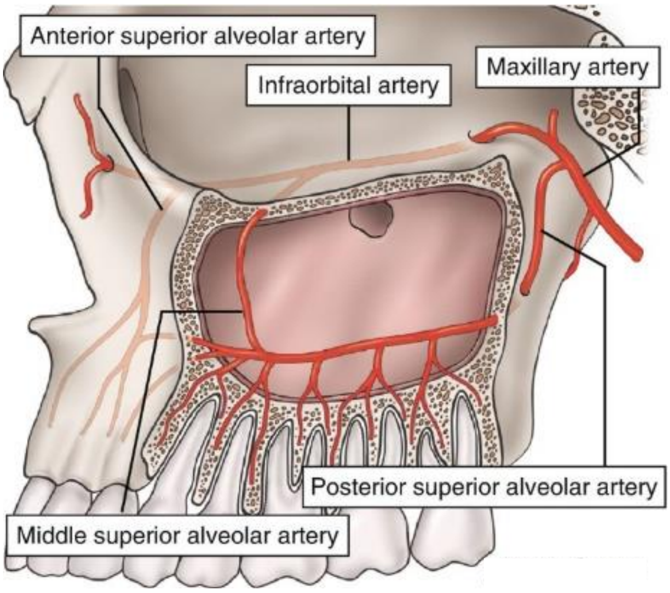
Anatomical landmarks assist in interpreting images and act as essential indicators for spotting abnormalities. A primary goal of a medical diagnostic system is the identification of these landmarks. Furthermore, CBCT is recognized as an essential diagnostic instrument in dental and maxillofacial procedures since it can reveal multiple anatomical landmarks without the interference of the buccal and lingual cortical plates[1].

The posterior superior alveolar artery (PSAA) is a significant derivative of the maxillary artery**,** supplying the maxillary sinus, posterior maxillary teeth, and associated soft tissues. Understanding its trajectory and derivatives is essential in maxillofacial, dental, and sinus-related interventions [2].

The posterior superior alveolar artery (PSAA) provides blood supply to the maxillary sinus (Schneiderian) membrane, periosteum, and the anterolateral wall of the sinus. It is vital for graft integration and the healing of surgical wounds, establishing its importance as a key vascular structure within the maxillary sinus and posterior maxilla [4].

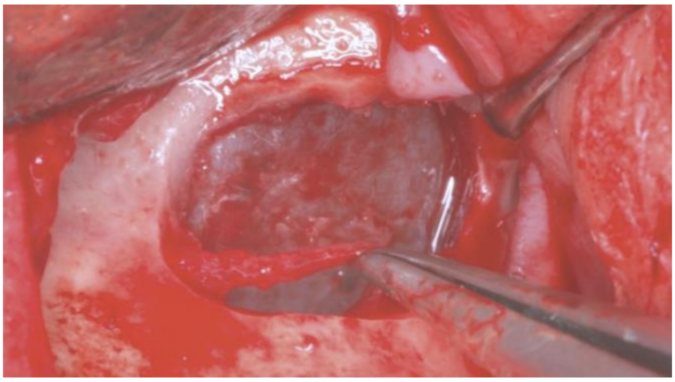


The maxillary sinus is an essential structure located in the maxillary bone. It is necessary to recognize the anatomy and identify anatomical landmarks around the maxillary sinus. The PSAA traverses along the lateral wall of the maxillary sinus, its canal or notch exhibits anatomical variations: it may be intraosseous (entirely enclosed within the external sinus wall), intra-sinus (positioned beneath the sinus membrane), or superficial (located beneath the periosteum of the external sinus wall). PSAA within the lateral sinus wall forms a concave arch whose closest point to the osseous crest is located near the first molar. The distance from the edge of the PSAA to the bone crest depends on the crestal bone loss, the location in the maxillary sinus, and the presence or absence of teeth [3].



When placing implants in the posterior maxilla, evaluating the relationship between the remaining alveolar bone and the maxillary sinus is necessary. Placing implants in a compromised posterior maxilla is challenging due to the narrowing of the alveolar bone and the reduced distance between the sinus floor and the alveolar ridge caused by maxillary sinus pneumatization. However, a high success rate can be achieved when implantation is performed alongside bone grafting in this region [5].

The lateral approach is a widely used and reliable method for maxillary sinus bone grafting, though anatomical challenges like sinus septa, disease, and the PSAA can complicate the procedure. Technological advancements have promoted the alveolar ridge approach as an alternative, but it offers limited visibility and is associated with lower implant survival rates when residual bone is insufficient [6].



Posterior superior alveolar artery isolated during sinus lift procedure.

Surgical intervention close to the posterior superior alveolar artery during these procedures can cause bleeding. The bleeding usually involves only a small vessel and it can obstruct the surgeon’s view and interfere with elevating the maxillary sinus membrane as well as placing the bone graft material [7]. A thorough understanding of the artery's path and location is essential for improving the success rate of maxillary sinus bone grafting.

The lateral wall is also used for various surgical procedures, including open sinus lift, Caldwell-Luc surgery, and Le Fort I osteotomy. Additionally, this artery may be involved in osteosynthesis for treating maxillary fractures [8].

Conventional radiographs, like intraoral and panoramic images, are limited in providing detailed preoperative information, especially for maxillary sinus anatomy, due to overlapping structures [9]. In contrast, CT and CBCT offer 3D sectional views for more accurate evaluation. While CT allows visualization of both soft tissue and bone, its drawbacks include high radiation, cost, limited accessibility, long scanning times, low resolution, and complex interpretation, restricting its use in dentistry [10][11].

Cone-beam computed tomography (CBCT) was introduced in 1982 as an alternative to conventional CT methods, using a cone beam projector to acquire 3D data from the entire field of view rapidly while significantly reducing radiation exposure [12] [13]. Originally designed for maxillofacial imaging, CBCT has since proven valuable for diagnosing impacted and supernumerary teeth, assessing the upper airway, planning orthodontic and orthognathic treatments, evaluating pre- and post-implant conditions, examining TMJ bony structures, investigating jaw lesions such as cysts, tumours, and fibro-osseous lesions, and evaluating facial trauma [14].

Panoramic view showing course of PSAA.

Preoperative imaging with CBCT is crucial for accurately mapping the posterior superior alveolar artery (PSAA) and measuring its distance from key landmarks, helping to prevent vascular injury during procedures like sinus lifts [15,18]. Knowledge of the PSAA’s trajectory and variations allows surgeons to adjust techniques—such as the design and placement of the lateral window—to reduce complications. Notably, since the artery’s diameter may increase with age, surgical approaches should be tailored accordingly [16,17].

AIMS AND OBJECTIVES

AIM

To evaluate the position and diameter of posterior superior alveolar artery using cone beam computed tomography (CBCT) images.

OBJECTIVES:

- To determine the anatomical location of PSA artery and compare it among males and females.
- To assess the diameter of PSA artery and compare differences based on various age groups.
- To measure the distance from the posterior superior alveolar artery to the crest of the alveolar ridge to the maxillary molar region.

HYPOTHESIS

NULL HYPOTHESIS:

There is no variation in position of posterior superior alveolar artery.

ALTERNATIVE HYPOTHESIS:

There is a variation in position of posterior superior alveolar artery.

REVIEW OF LITERATURE

Anamali S et.al. (2013)[19] carried out a study to determine the prevalence of visibility of PSAA in CBCT among North Americans and found that in 254 CBCT scans that were studied, prevalence of the PSAA canal was 94.4% on right side and 91% on left side. They found that the ability to detect the presence of the canal was not significantly affected by the presence of intrasinusal disease. Although, maxillary sinus pathoses was more seen in males than females on right side (63.3% vs. 36.7%) and the left side (59.2% vs. 40.8%). They concluded that the PSAA canal can be consistently visualized on CBCT scans with a high level of reproducibility regardless of the presence of radiographic signs of intrasinusal pathoses.

Apostolakis D et al (2014)[20] evaluated the PSAA on 156 CBCT scans and they identified PSAA in 82% of the cases with a mean diameter of 1.1 mm and a range of diameters between 0.2 and 2.6 mm. The distance from the floor of the sinus to the alveolar crest in the posterior region varied with maximum distance being 28.5 mm. They could identify the PSAA canal in at least one position, between the most posterior and the most anterior borders of the maxillary sinus and found variation in the distance of the canal from the sinus floor. They highlighted the individual evaluation of the position of PSAA prior to any surgery.

Zhitian D et al (2014)[21] evaluated the bony structure of PSAA on 116 CBCT scans and found that the prevalence of the bony canal was 75.14%. The mean diameter of the bony canal was (0.96 ± 0.29) mm. The residual alveolar bone height was (7.14 ± 3.64) mm. The distance of the bony canal's inferior border from the alveolar crest was (17.92 ± 5.68) mm. No statistically significant differences between the right and left sides were observed ($F = 0.295$, $P > 0.05$). The mean diameter of the bony canal was significantly smaller in females than that in males (F = 0.187, $P < 0.05$). The maxillary alveolar dimension was significantly correlated with the residual alveolar bone height. They concluded that CBCT is a vital tool in evaluating the location of the bony canal of PSAAs before surgery involving the maxillary sinus.

Khojastehpour et al (2015)[22] conducted a study to determine the diameter, location and frequency of appearance of PSAA in preoperative CBCT scans. This study was used to detect PSAA using multi-detector CBCT with age variations. 230 CBCT scans (110 males, 120 females); Age group 5–91 years. The detection ratio for the PSAA using MDCT increased with increasing age of the subject, reaching a high detection in adults. The distance from the artery to the medial sinus wall and the diameter of the artery were positively correlated with the number of missing teeth.

Haghanifar S et al (2016) [23] evaluated the presence of PSAA using 160 CBCT scans of 80 females and 80 males with age range of 20 to 86 years and found that the mean PSAA diameter from the first premolar to the third molar was 0.75, 0.82, 0.92, 0.95 and 1.03mm, respectively. The closest distances of the artery to alveolar crest were seen in the first and second molars areas with mean 16.11 and 16.65 mm in which, PSAA is close to the maxillary sinus membrane. The distances of artery to sinus floor and alveolar crest and artery diameter were higher in males than females ($P<0.001$). It was concluded that due to anatomical variation, evaluation of maxillary sinus using CBCT before sinus augmentation surgery by a radiologist is useful in providing a more precise treatment and avoiding complication.

Pandharbale AA et al (2016) [24] assessed the prominence and location of vascular canal of PSAA on 50 CBCT scans and measured the distances from lower margin to the floor of maxillary sinus and alveolar crest in the 1st molar and 2nd molar regions and found PSAA in 36 patients (70%). Mean diameter of the vessel was 0.63 mm.

Mean distance between PSAA and alveolar crest was the shortest in the 2nd molar region. The mean distance between PSAA and floor of maxillary sinus was 9.96 mm. The conclusion stated that PSAA is an important structure in the posterior maxillary region that should be studied prior to any surgery and CBCT proved to be an excellent tool to visualize the PSAA, provide finer details at low exposure and less radiation.

Danesh-Sani SA et al (2017) [25] carried out a study to evaluate the maxillary sinus lateral wall and anatomy of PSAA using CBCT in 430 scans and found that the detection rate of the PSAA on CBCT was 60.58%. The mean diameter of the artery was found to be 1.17 mm (range 0.4-2.8 mm). They found no significant correlation between age and the size of the PSAA. The most consistent path of the PSAA was intraosseous (69.6%), followed by intrasinusal (24.3%) and superficial (6.1%). The overall mean distance of the PSAA from the floor of the maxillary sinus was 8.16 mm.

Chitsazi MT et al (2017) **[26]** carried out the radiographic evaluation of the position of PSAA in relation to the maxillary sinus using the CBCT scans. He divided 200 scans into four groups; a) Males edentulous in the posterior region; b) males having teeth in the posterior region; c) females edentulous in the posterior region; and d) females having teeth in the posterior region. The mean distance between the artery and the alveolar crest, irrespective of groupings, was 16.17±1.63 mm, with significant differences between the groups (P<0.005). The position of the artery was intraosseous in 73.2%, beneath the sinus membrane in 21.7% and external to the lateral wall of the sinus in 4.9% of the cases.

Tehranchi M et al (2017) [27] studied the prevalence and location of PSAA using CBCT, in 300 patients with edentulous posterior maxillae:138 females and 162 males with an age range of 33-86 years. They measured the distance from the inferior border of the PSAA to the alveolar crest according to the residual ridge classification by Lekholm and Zarb, the distance from the PSAA to the nasal septum and zygomatic arch, and the diameter and position of the PSAA in all 300 patients. They detected PSAA on 87% of CBCT scans and it was located beneath the sinus membrane in 47% of cases and was found intraosseous in 47% of cases. The diameter of the artery was between 1 and 2 mm in most patients (72%). The study concluded that the likelihood of detecting the PSAA on CBCT scans is high and so determining the exact location of the PSAA on CBCT scans preoperatively can help prevent it from being damaged during surgery.

Sun, Wentao et al (2018) **[28]** evaluated the location and the position of the anastomosis canal in lateral wall of maxillary sinuses. They also evaluated the thickness of lateral sinus wall and the distance from the lower border of the canal to the sinus floor in 242 CBCT scans. They could detect the canal in 87.6% of the sinus. Most canals were intraosseous, or beneath the sinus membrane. The mean distance was 9.2 ± 3.5 mm from the lower border of the canal to the sinus floor, and 10.8 ± 4.0 mm from the alveolar crest to the sinus floor. It was concluded that the location of the anastomosis varied in each patient, but the distance from the sinus floor was similar in different teeth sites. Also, it was added that the sinus floor could be an anatomic landmark of sinus floor augmentation, hence great care must be taken by the implant surgeon to analyze this canal.

Duruel O et al (2019) **[29]** evaluated PSAA artery in 354 CBCT scans and found that the most frequent localization of PSAA was intraosseous in premolar region and were below the Schneiderian membrane in molars. PSAA diameter was found to be less than 1 mm for all posterior teeth. Positive correlation was observed between buccal bone thickness and PSAA diameter in first molar and premolar regions ($P < 0.05$). They concluded that detailed evaluation of PSAA can be achieved by using CBCT.

Fayek MM et al (2021) [30] evaluated the PSAA on 600 CBCT scans and PSAA was detected in 92.0% of the sinuses. The mean distance from the inferior border of the PSAA to the sinus floor was 8.2±2.2 mm in males and 7.3±2.1 mm in females. The mean distance from the inferior border of the PSA artery canal to the alveolar crest was 18.2±2.7 mm in males and 17.4±2.3 mm in females. The mean diameter of the PSAA was larger in male subjects. The PSA artery canal was bifid in 8.7% of cases. The most frequently observed location of the PSA artery canal was intraosseous (82.2%). CBCT is a valuable tool for evaluation and localization of the PSA artery before maxillary sinus lift surgery to avoid intraoperative bleeding.

Karslioglu H et al (2021) [31] evaluated the maxillary sinus anatomy on CBCT prior to sinus lift procedures to avoid surgical complications and found that the artery diameters were mostly ≥ 1 mm. The artery was mostly intraosseous (59.7%), 21.7% was superficial and only 18.7% was intra-sinuscular. He concluded that as the artery diameters were mostly ≥ 1 mm, the increase in the size, increases the risk of complications

Tofangchiha M et al (2022) [32] evaluated the PSAA on 245 CBCT scans and found the maxillary PSAA in 187 (76.3%) scans. The mean distance between the artery and the floor of the sinus was 6.87 ±3.68 mm. The mean diameter of the artery was 1.37 ±0.61 mm. The greatest mean diameter of the artery was observed in the second premolar region, and the smallest in the first molar region.63.6% of the arteries were intraosseous, 28.9% intrasinusoidal, and 7.5% superficial. They concluded that due to the high prevalence of the intraosseous type, in most cases of sinus lift surgery there is an increased possibility of PSAA damage leading to severe bleeding during sinus lift surgery.

Rathod R et al (2022) **[33]** assessed the pathway and location of the PSAA in 150 CBCT scans in both dentate and edentulous groups for patients in the age group of 20-80yrs and found that PSAA was detected on CBCT scans of 87.3% of participants. The majority trajectory of PSAA was intraosseous (right side 53.3%, left side 63.3%). There was no significant difference noted between dentate and edentulous participant groups. The study stated that CBCT scans and their analysis help the clinician to make radiographic diagnosis and clinical application for surgical procedures, such as implant placement and sinus lift.

Mehtiev RS et.al. (2022) [34] carried out a topographic analysis of maxillary sinus anastomosis in 150 CBCT scans and found that intraosseous anastomosis of the derivatives of the PSAA and IOA was detected in 87.8% of cases (258 of 294 sinuses). Anastomosis was found inside the wall of the sinus in every tooth location in 9.5% of sinuses; in other cases, the anastomosis was partially or fully embedded in the thickness of the lateral wall of the maxillary sinus They concluded that detection of the topography of the vascular anastomosis by using CBCT was essential when planning the position for the lateral sinus lift procedure to minimize iatrogenic complications.

MATERIALS AND METHODS

The study is performed as a retrospective analysis of CBCT data gathered from the Department of Oral Medicine and Radiology, KLE VK Institute of Dental Sciences, Belagavi. CBCT were used to obtain images of the (PSAA) in the sagittal, axial, and coronal planes. The research made use of CBCT images of the posterior maxillary area, obtained for a variety of diagnostic purposes in the Dentsply Sirona Dental System.

For the purpose of standardization, all the data collected for the study was from the same machine of same software specification.

SOURCE OF DATA

CBCT Scans were obtained from the archives of Dentsply Sirona Axeos CBCT machine.

INCLUSION CRITERIA

- CBCT scans of the maxilla belonging to the age group of 18-60 years.
- CBCT scans showing full extension of the dentulous and partially edentulous maxilla.
- CBCT scans showing the maxillary molar region.

EXCLUSION CRITERIA

- CBCT Scans of patients of age below 18 years and above 60 years.
- CBCT Scans showing any facial deformity, developmental anomalies, pathological changes in the maxilla and maxillary sinus.
- CBCT Scans showing motion blur, artifacts, foreign objects.
- Technically aberrant CBCT scans.

ARMAMENTARIUM:

- Dentsply Sirona Axeos CBCT machine [Galileo's soft -ware]
- Sidexis 4 CBCT viewing software (version 4.3.1.0)
- Guideline sheet depicting the parameters to be measured.
- Scoring sheet for recording the observations

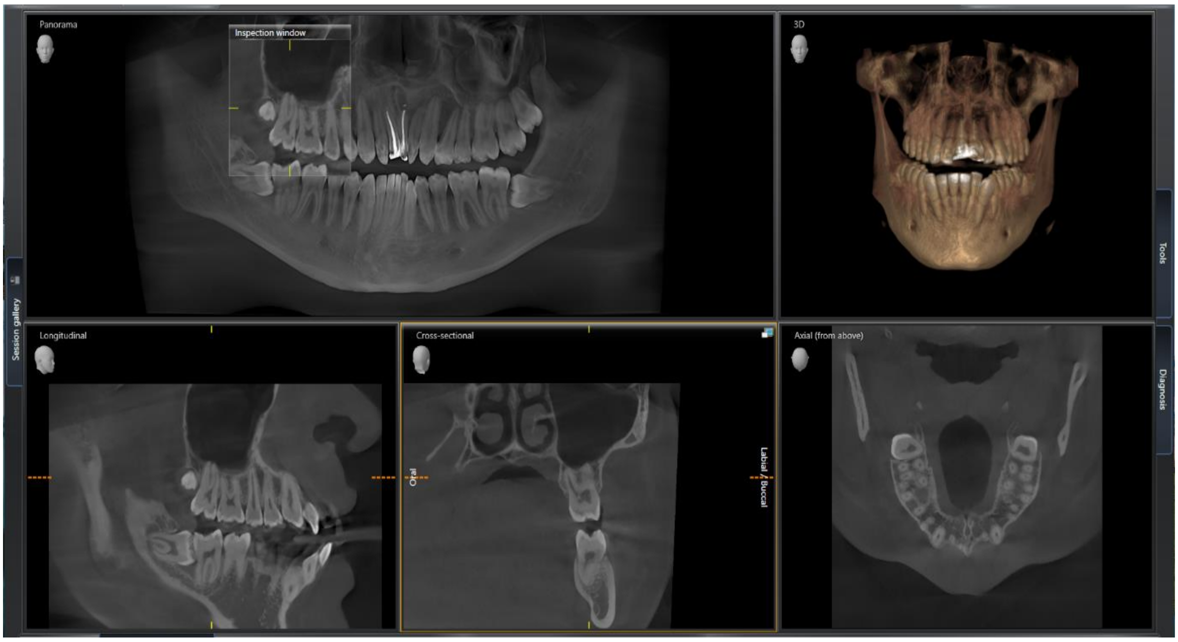
METHOD

The data was collected from August 2021 to December 2024 records. Out of 1340 CBCT scans, 370 scans of patients (202 males,168 females) that met the inclusion criteria were obtained from Dentsply Sirona Axeos CBCT machine. The standardization includes- peak kilovoltage of 65kVp, current of 12 mA, voxel size of 0.2 mm, field of view 5*5cm/8*8cm, slice thickness 1.2 mm.

Sidexis 4 CBCT viewing software (version 4.3.1.0) was used for the reconstruction and measurement of the included scans. Patients' demographic details were hidden as a process of blinding for the second observer. Measurements were made on the sagittal section after selecting the smallest slice thickness (1.2 mm). PSAA morphology was compared in 3 groups with Group 1 consisting of participants aged 18-32, Group 2 of participants aged 32-45, and Group 3 of participants aged 46-60 were compared.

CBCT machine

Specification settings of CBCT machine.

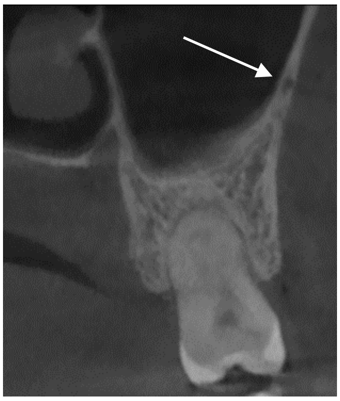


CBCT Viewing software

The location of the posterior superior alveolar artery was assessed by measuring the 4 parameters.

- The anatomical location was determined (Intrasinusal, Intraosseous, Superficial).
- The diameter of the artery was measured.
- The distance from the artery to the medial sinus wall was measured (MSW).
- The distance from PSAA to alveolar crest of the molars was noted (M1-1st molar, M2-2nd molar, M3-3rd molar).

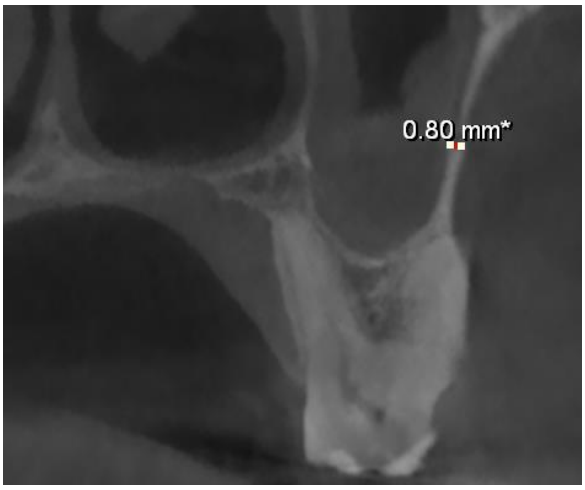
Anatomical location



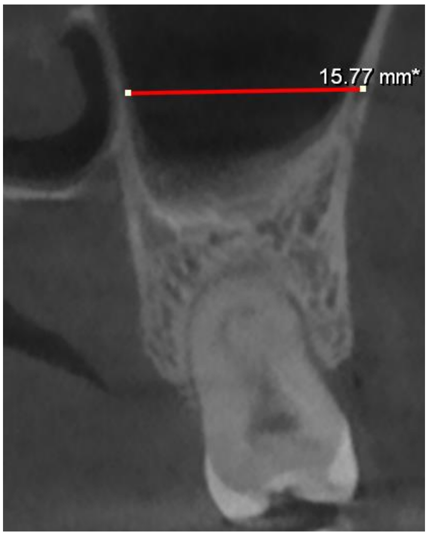
Intraosseous

Superficial

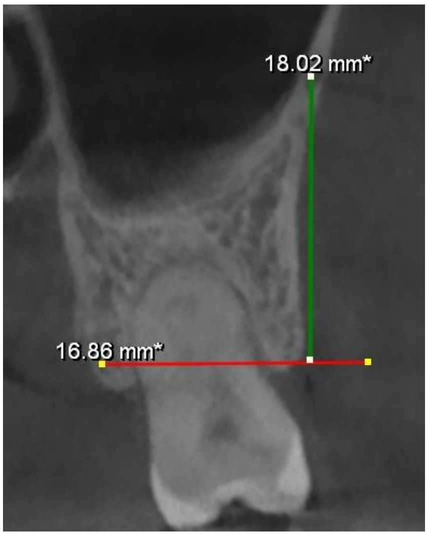
Intrasinusal



The diameter of the artery was measured.



The distance from the PSAA to the medial sinus wall.



The distance from PSAA to alveolar crest of the molars was noted.

STATISTICAL TESTS:

- Data obtained was entered in Microsoft Excel 2020, and analyzed using the IBM Corp. Released 2012, IBM SPSS® Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.
- The descriptive statistics are presented as mean ± standard deviation for continuous variables.
- One-way ANOVA/Kruskal Wallis test was used to compare the diameter based on the age-related changes of posterior superior alveolar artery.
- Unpaired t-test/Mann-Whitney U-test was used to compare the gender related changes in the location of posterior superior alveolar artery.

RESULTS

Descriptive statistics was used to evaluate the age and gender distribution of the participants among the three groups. (Table 1, Figure1) shows that the mean age has increased across all groups. There's **no significant difference** in gender distribution across the three groups (P = 0.3780).

Figure 1: Comparison of three groups with gender

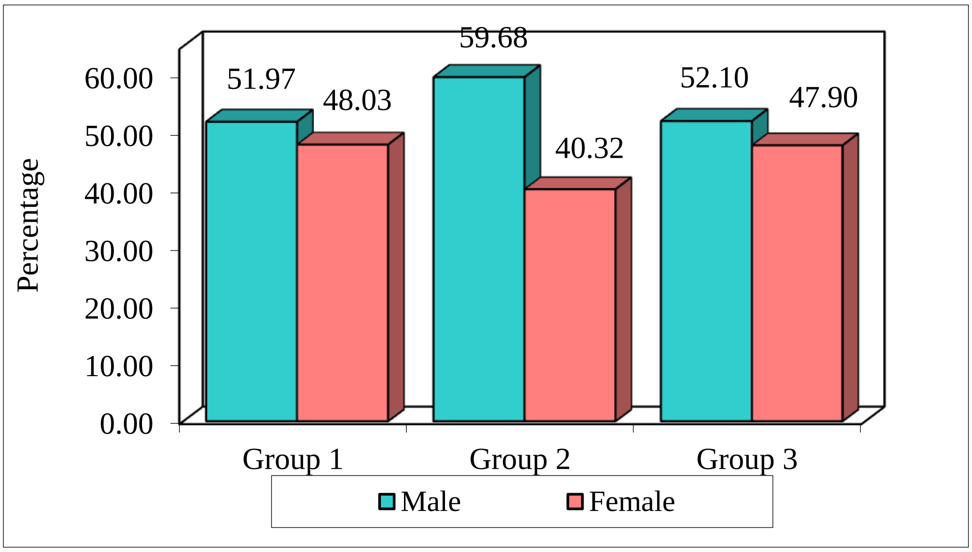
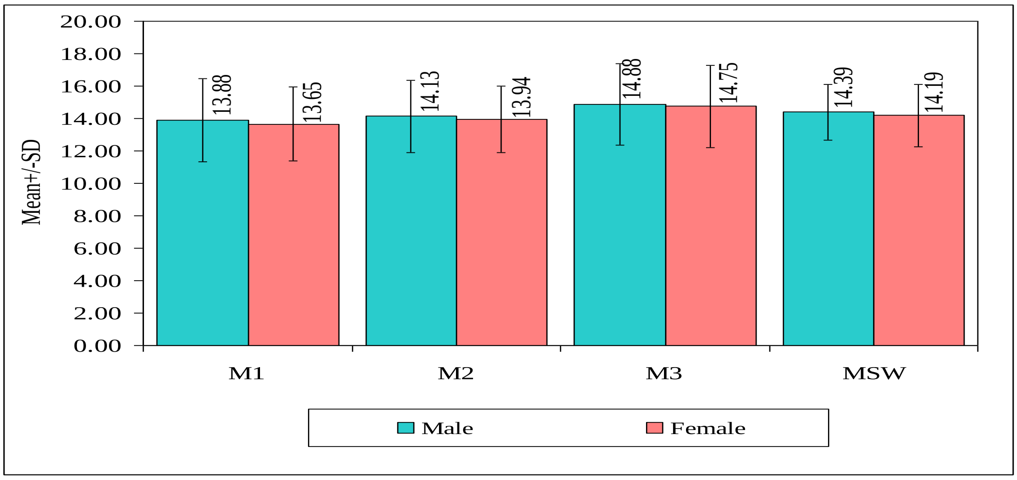


Table 1: Comparison of three groups with gender and age

Gender	Group 1	%	Group 2	%	Group 3	%	Total	%
Male	66	51.97	74	59.68	62	52.10	202	54.59
Female	61	48.03	50	40.32	57	47.90	168	45.41
Total	127	100.00	124	100.00	119	100.00	370	100.00
Mean	24.42		38.64		52.52		38.22	
SD	4.35		3.83		4.59		12.23	
Chi-square=1.9440, p=0.3780								

The averages are quite similar (Figure 2). The t-values are also relatively low, reinforcing that the observed differences are minor. **Males have slightly higher mean values** than females in all parameters, but the differences are **minor (Table 2).**

Figure 2: Comparison of male and female with different parameters at average of right and left side



M1-Distance of PSA artery from 1st molar.
M2-Distance of PSA artery from 2nd molar.
M3-Distance of PSA artery from 3rd molar.
MSW-Distance of PSA artery from medial sinus wall.

Table 2: Comparison of male and female with different parameters at average of right and left side by independent t test

Parameters	Male		Female		Mean Difference	t-value	p-value
	Mean	SD	Mean	SD			
M1	13.88	2.57	13.65	2.28	0.23	0.9038	0.3667
M2	14.13	2.22	13.94	2.04	0.19	0.8475	0.3973
M3	14.88	2.51	14.75	2.53	0.13	0.5103	0.6101
MSW	14.39	1.73	14.19	1.93	0.19	1.0228	0.3071

The percentage of Intra Osseous is slightly higher in Group 2 (32.26%) compared to Group 1 (23.62%) and Group 3 (28.57%) (Figure 3). Intra Sinusal is the most common category across all groups, with percentages ranging from 63.71% (Group 2) to 72.44% (Group 1). SUP is relatively rare across all groups, hovering around 4% in each group. Since the p-value is much higher than 0.05, the result is not statistically significant (Table 3).

Figure 3: Comparison of three groups with locations at right side

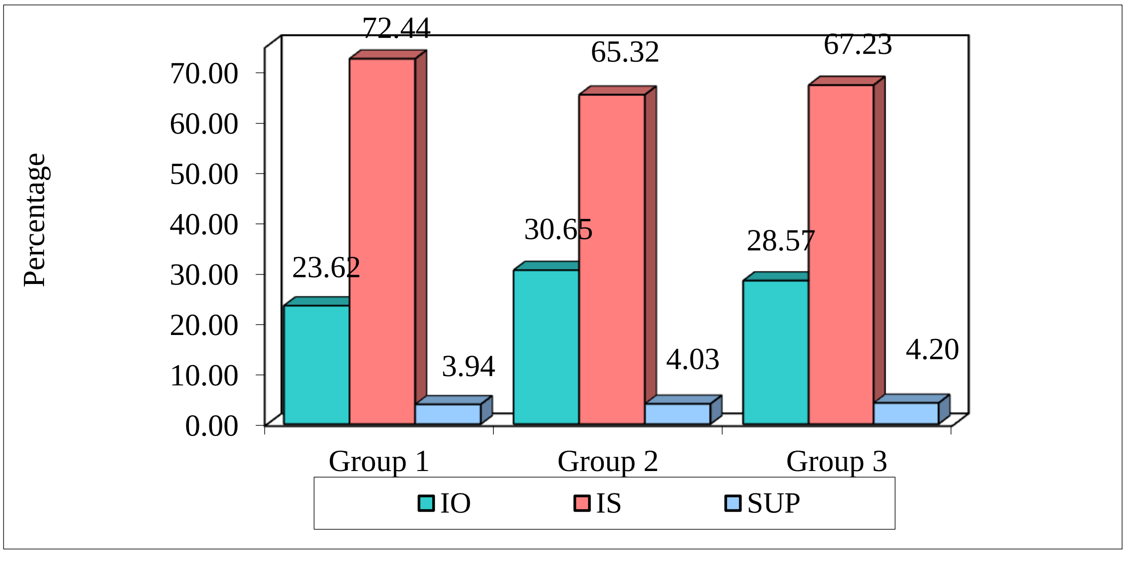


Table 3: Comparison of three groups with locations at right side

Locations at right	Group 1	%	Group 2	%	Group 3	%	Total	%
IO	30	23.62	38	30.65	34	28.57	102	27.57
IS	92	72.44	81	65.32	80	67.23	253	68.38
SUP	5	3.94	5	4.03	5	4.20	15	4.05
Total	127	100.00	124	100.00	119	100.00	370	100.00
Chi-square=1.6960, p=0.7910								

The distribution of outcomes (IO, IS, SUP) is consistent across the three groups, with no notable differences (Figure 4). Group 2 shows a slightly higher proportion of IO compared to Groups 1 and 3. Group 1 has the highest proportion of IS, while Group 2 has the lowest. The p-value (0.6620) is much greater than 0.05, indicating no statistically significant difference in the distribution of IO, IS, and SUP across the three groups (Table 4).

Figure 4: Comparison of three groups with locations at left side

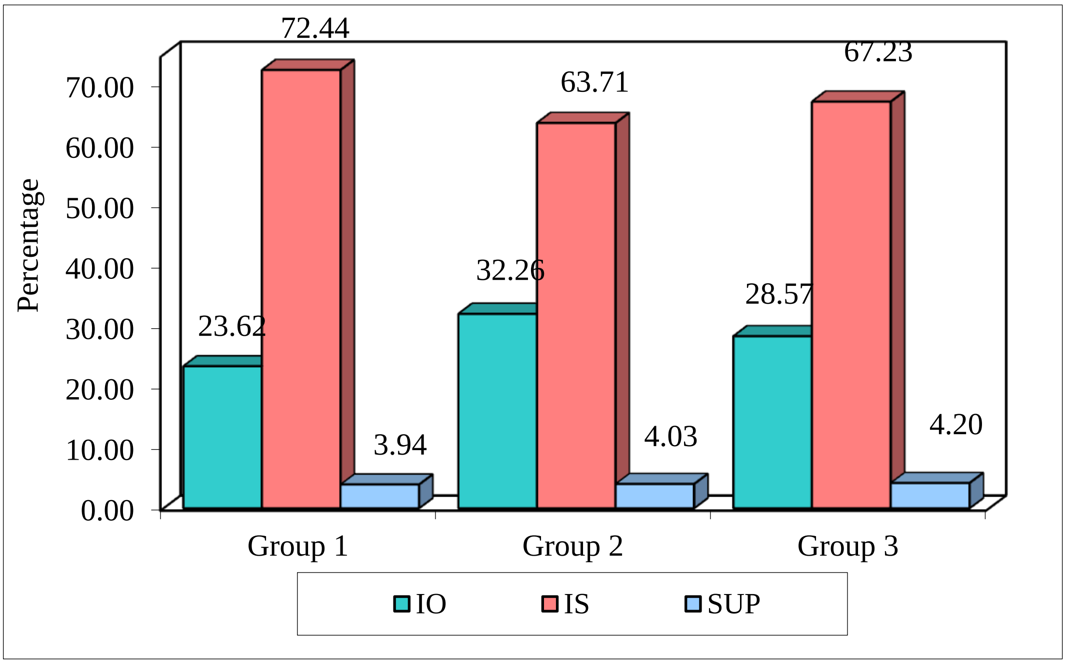


Table 4: Comparison of three groups with locations at left side

Locations at left	Group 1	%	Group 2	%	Group 3	%	Total	%
IO	30	23.62	40	32.26	34	28.57	104	28.11
IS	92	72.44	79	63.71	80	67.23	251	67.84
SUP	5	3.94	5	4.03	5	4.20	15	4.05
Total	127	100.00	124	100.00	119	100.00	370	100.00
Chi-square=2.4040, p=0.6620								

The differences between groups are minimal on the right side (Figure 5). Group 2 shows a slightly larger mean value for the left-side measurement. The bar graph effectively highlights **no major variation among the three groups (Table 5).**

Figure 5: Comparison of three groups with diameter at right and left, average of right and left side

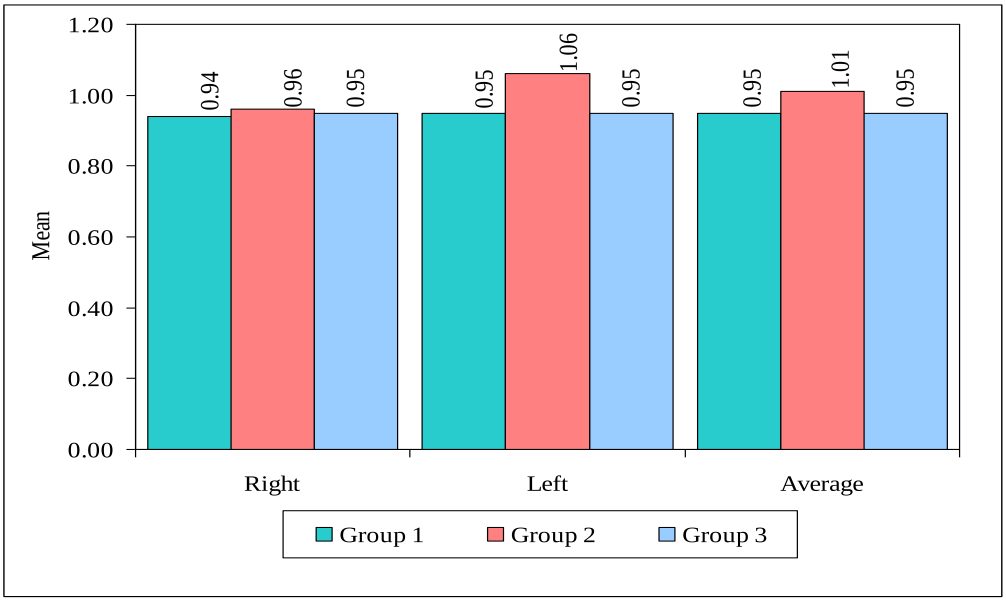


Table 5: Comparison of three groups with diameter at right and left, average of right and left side by one way ANOVA

Sides	Group 1		Group 2		Group 3		F-value	p-value
	Mean	SD	Mean	SD	Mean	SD		
Right	0.94	0.18	0.96	0.16	0.95	0.16	0.1879	0.8288
Left	0.95	0.17	1.06	1.38	0.95	0.16	0.7894	0.4549
Average	0.95	0.15	1.01	0.69	0.95	0.13	0.8991	0.4078

The right side is borderline significant with a p-value of 0.0713(Table 6). While it's not below the usual 0.05 threshold, it's close enough to suggest that with a larger sample size, a significant difference might be detected. The left side and average show higher p-values (Figure 6).

Figure 6: Comparison of three groups with diameter at right and left, average of right and left side

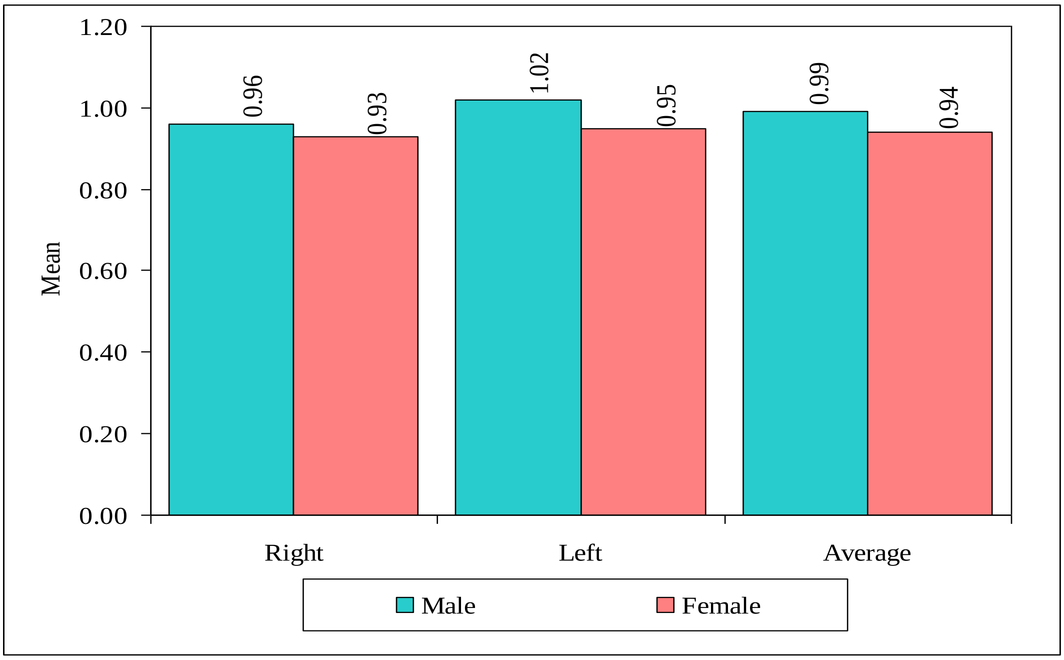
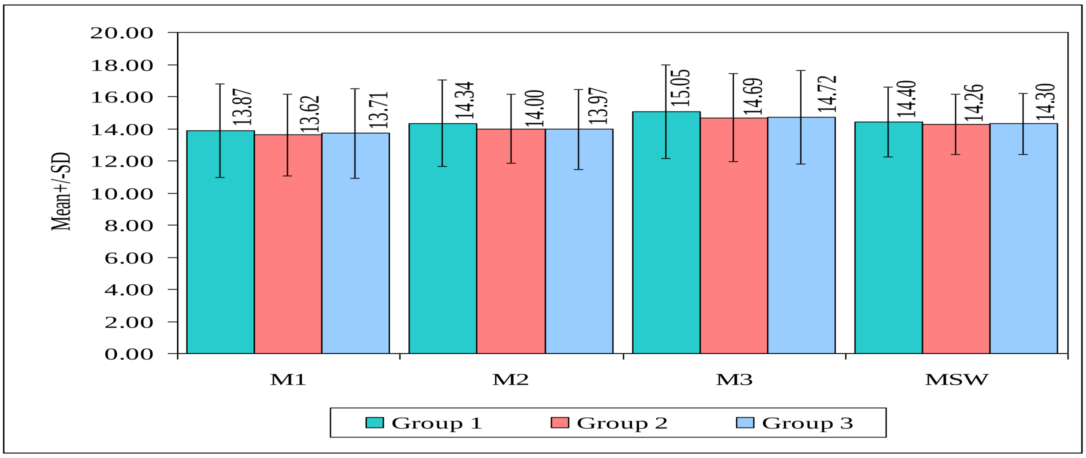


Table 6: Comparison of three groups with diameter at right and left, average of right and left side by independent t test

Sides	Male		Female		Mean Difference	t-value	p-value
	Mean	SD	Mean	SD			
Right	0.96	0.16	0.93	0.17	0.03	1.8090	0.0713
Left	1.02	1.08	0.95	0.17	0.07	0.8006	0.4239
Average	0.99	0.55	0.94	0.15	0.05	1.1383	0.2557

The p-values in all cases are much greater than 0.05, indicating that any observed differences in means are likely due to random variation (Figure 7). MSW value in left side shows slightly more variation compared to other parameters, but the p-value is still insignificant. The F-values are all low, further suggesting minimal variation between groups compared to within groups. Group 2 shows slightly higher means and greater variability (larger SD) on the left side and in the average, but these differences aren't statistically significant (Table 7).

Figure 7: Comparison of three groups with different parameters at right side



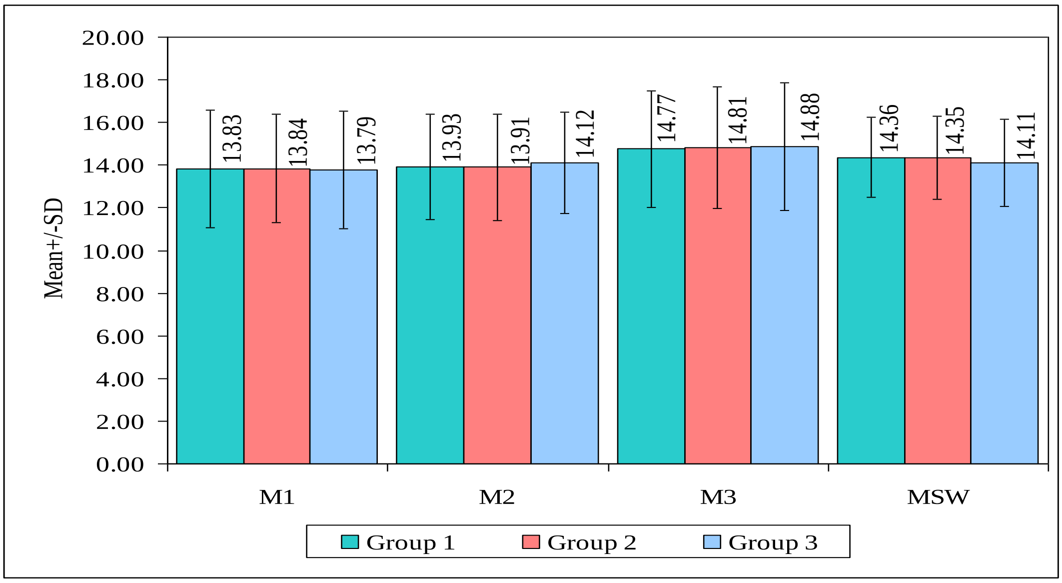
M1-Distance of PSA artery from 1st molar.
M2-Distance of PSA artery from 2nd molar.
M3-Distance of PSA artery from 3rd molar.
MSW-Distance of PSA artery from medial sinus wall.

Table 7: Comparison of three groups with different parameters at right side by one way ANOVA

Parameters	Group 1		Group 2		Group 3		F-value	p-value
	Mean	SD	Mean	SD	Mean	SD		
M1	13.87	2.93	13.62	2.55	13.71	2.80	0.2604	0.7709
M2	14.34	2.68	14.00	2.15	13.97	2.49	0.8462	0.4299
M3	15.05	2.91	14.69	2.74	14.72	2.90	0.6163	0.5405
MSW	14.40	2.17	14.26	1.87	14.30	1.91	0.1570	0.8548

The means for each parameter (M1, M2, M3, MSW) are very close across the three groups. M2 values are slightly higher in Group 3(Figure 8, Table 8).

Figure 8: Comparison of three groups with different parameters at left side



M1-Distance of PSA artery from 1st molar.
M2-Distance of PSA artery from 2nd molar.
M3-Distance of PSA artery from 3rd molar.
MSW-Distance of PSA artery from medial sinus wall.

Table 8: Comparison of three groups with different parameters at left side by one way ANOVA

Parameters	Group 1		Group 2		Group 3		F-value	p-value
	Mean	SD	Mean	SD	Mean	SD		
M1	13.83	2.77	13.84	2.55	13.79	2.75	0.0122	0.9879
M2	13.93	2.47	13.91	2.49	14.12	2.38	0.2814	0.7549
M3	14.77	2.73	14.81	2.85	14.88	3.00	0.0508	0.9505
MSW	14.36	1.88	14.35	1.95	14.11	2.02	0.6118	0.5429

DISCUSSION

A comprehensive understanding of the exact anatomy, including the location, dimensions, and structural details of PSAA, is essential in dental treatments and maxillofacial surgeries involving the posterior maxilla-particularly during procedures like local anaesthesia administration, dental implant placement, or sinus lifts. Clinicians must be conversant of the trajectory and variations of the PSAA to minimize intraoperative complications. Surgical techniques should be adapted according to the artery's location; for example, modifying the design and position of the lateral window in sinus lift surgeries can help prevent arterial damage.

The anatomy of the posterior superior alveolar artery (PSAA) varies significantly in size and shape. Research has shown that the PSAA's anatomy differs among various population groups and age categories. Understanding these anatomical variations is essential for determining the position and shape of the PSAA when performing procedures in the posterior maxilla or when placing implants.

The significance of studying these variations lies in establishing the position and shape of PSAA for performing any surgeries in the posterior maxilla or the placement of implants. Assessment of these anatomical structures preoperatively will reduce the risk of complications post-surgery such as bleeding and sensory impairment, thereby improving the quality of life of the patient [4,5,7].

The PSAA and its relations with maxillary molars and maxillary sinus in the posterior maxillary region can be assessed using a variety of radiographic modalities, including computed tomography (CT), micro-CT, multidetector computed tomography, high-resolution magnetic resonance imaging, and cone-beam computed tomography (CBCT). As CBCT has lower radiation exposure and cost efficiency, it has become a widely used imaging technique among dental professionals for evaluating important anatomical structures.

Hence, the present study used CBCT to assess the location, relation with maxillary molars and maxillary sinus.

PSAA morphology was compared in 3 groups with Group 1 consisting of participants aged 18-32, Group 2 of participants aged 32-45, and Group 3 of participants aged 46-60 were compared. The most prevalent anatomical location across all age groups was intrasinusal, with the second most common being intraosseous shape in Group 2. When PSAA was compared in different age groups, the mean age increased across all groups. No statistically significant difference was noted ($p = 0.37$).

Several studies have evaluated the detection rate of PSAA using various imaging modalities. However, our study specifically included only those CBCT scans where the PSAA was entirely visible, eliminating any concerns about its presence or absence.

Several studies have analyzed the position of the PSAA using CBCT. **Danesh-Sani SA et al[35]**. reported that the most common path of the PSAA was intraosseous (69.6%), followed by intrasinusal (24.3%) and superficial (6.1%). **Ang KY et al**.[36] observed that among the identified PSAAs (n = 152), 64.5% were intraosseous (n = 98), 25.7% were intrasinusal (n = 39), and 9.9% (n = 15) were superficial. Similarly, **Chitsazi MT et al**. [26] found the artery's position to be intraosseous in 73.2%, intrasinusal in 21.7%, and superficial in 4.9% of cases. **Godil AZ et al**.[37] reported the intraosseous type in 84.2% of patients, intrasinusal in 12%, and superficial in 3.2% of cases. Additionally, studies by **Tehranchi M et al**.[27] and **Sun,**

Wentao et al.[28] found equal frequencies of intrasinusal and intraosseous positions. **Tehranchi M et al.[27]** detected PSAA in 87% of CBCT scans, with 47% showing an intrasinusal position and 47% showing an intraosseous position. In contrast, our study found the most common position to be intrasinusal, followed by intraosseous, with the superficial position being the least frequent.

Duruel O et al.[29] observed that the most common localization of the PSAA was intraosseous in the premolar region and intrasinusal in the molar region. This aligns with our study, which focused on the molar region, whereas other studies primarily examined the premolar region.

There was a minor difference in the PSAA position concerning gender; however, this difference was not statistically significant. Similar findings were reported by **Ang KY et al.[36]** and **Godil AZ et al**.,[37] who also found no significant correlation between PSAA position and gender. Regarding different age groups, no significant association was observed, except in the intraosseous group, where the difference between the 41–60 age group and those over 60 was statistically significant. Likewise, studies by **Ang KY et al**.[36] and **Godil AZ et al.[37]** found no statistically significant difference between PSAA position and age.

Our study showed that the mean diameter of the artery on CBCT showed an overall mean of 0.94-0.99mm with the minimum and maximum range of (0.10mm – 1.0mm) with a standard deviation (SD) of 0.15-0.55.

Various studies have been carried out on human cadavers to evaluate the diameter of the PSAA. Studies by **Ilgüy D et. al.[18],** **Zhitian D et.al**.[21] , **Mehtiev RS et.al**.[34] found PSAA with diameters < 1 mm, 0.96±0.29 mm and 0.95±0.3 mm respectively. **Waingade et.al.41** and **Haghanifar S. et.al**.[38] found the mean diameter of the PSAA to be 0.94 ± 0.46 mm and 0.92mm respectively which was similar to our study. **Tofangchiha M. et.al.[32]** and **Danesh-Sani SA et. al.[35]** found the diameter to be 1.37 ±0.61 mm and 1.17 mm respectively which could be due to difference in the ethnicity and the site at which the PSAA was evaluated.**Pandharbale AA et.al[24]** found the mean diameter of the PSAA to 0.63 mm, which could be due to the smaller sample size (50 scans) that was studied.

In our study the diameter of the artery was higher in Males than in Females, but the difference was statistically not significant. Similar studies by **Waingade et. al**., [38] **Zhitian D et.al**., **Haghanifar S. et.al.[38]**, **Chitsazi MT et.al** [26], **Fayek MM et.al.[30]**, **Devi KR et al [40]** also found that the diameter of PSAA was smaller in females than males, and the difference was statistically not significant. In a study by **Shams N et. Al [41].** They found the diameter of PSAA was smaller in Iranian population than all others, and they found a statistically significant difference based on gender. This could be due to differences in ethnicity.

Khojastehpour L et.al. [22] found that the diameter of the PSAA increased with increasing age. This could be due to ethnic differences, the site at which the artery was measured and the smaller sample size that was evaluated.In our study, the average measurements show slightly higher values in Group 2 (1.01) compared to Groups 1 and 3 (both 0.95), but no statistically significant difference was noted.

In our study the mean dimension of the distance of the PSAA to the alveolar crest in 1st Molar region was found to be 13.79 mm and with a standard deviation of 2.75. In 2nd Molar region the mean distance of the PSAA to the alveolar crest was found to be 14.12 mm with a standard deviation of 2.38. In 3rd Molar region the mean distance of the PSAA to the alveolar crest was found to be 14.88 mm with a standard deviation of 3.33.

Similar studies by **Kang SJ et al[42]** and **Waingade et al** [38] found the distance to the alveolar crest to be less than 15 mm. **Zhitian D et al**[21] found the distance till the alveolar crest to be 17.92 ± 5.68mm. **Valente NA et al** found that the distance till the alveolar crest ranged from 11.25 mm to 26.90 mm, **Kolte RA et al**[44] found the distance till the alveolar crest in first molar region was 15.87mm, which was similar to our study. **Haghanifar S. et.al.**[38] found that the closest distances of the artery to alveolar crest was seen in the first and second molars areas with mean 16.11 and 16.65 mm**. Chitsazi MT et al**[26]**.** **Tehranchi M et al**[27] found that the mean distance between the artery and the alveolar crest was 16.17 mm and 16.7mm respectively. **Godil AZ et.al.**[37] found the mean distance between the lower border of the artery and alveolar crest was 17.37 ± 3.94 mm. Similar study by **Fayek MM et al**[30] found the mean distance from the inferior border of the PSAA to the alveolar crest was 18.2±2.7 mm in males and 17.4±2.3 mm in females. **Haghanifar S. et al[38], Chitsazi MT et al**[26] also found the distance of the PSAA to the crest was higher in Males than Females, which was similar to our study.

The means for each parameter (M1, M2, M3,) are very close across the three groups. M2 values are slightly higher in Group 3. In studies reported by **Waingade et al**[38], **Godil AZ et.al**[37] showed no significance of distance of PSAA to alveolar crest with respect to age.

Implant placement is always subject to anatomical constraints. Pre-operative assessment of the posterior maxillary region has come back into focus due to the growing necessity of osseotrajectorydintegrated implant rehabilitation of the edentulous maxilla [14][15]. It is widely recognised that the high rate of maxillary resorption during post-extraction period may compromise the preparation of surgical osteotomy and retention of the prosthesis. The alveolar crest may approach vital anatomical structures as bone loss progresses, leading to unfavourable consequences. Dimensions of M1, M2, M3, and MSW were compared between the three age groups that were included in this present study. Although there were differences in clinical parameters, statistically significant differences were not noted among included age groups. These findings suggest that differences exist between different age groups when compared to the dimensions of the assessed parameters, thereby warranting further investigation to assess age-related changes.

LIMITATIONS

This study involved dentate subjects with a relatively small sample size. The reliability of these findings would improve if the assessed parameters were examined in a larger sample. Future studies with a greater sample size and age group stratification would help validate these results. Additionally, longitudinal research could be conducted to further explore how these anatomical variations evolve with age.

CONCLUSION

The maxillary 1st molars are situated adjacent to the posterior superior alveolar artery and its vascular network. The vascular structure within the canal may be harmed by any surgical treatment performed here. Therefore, it's essential to ascertain whether these structures have undergone any notable anthropological changes and whether such variations are relevant for forensic purposes**.** According to the results of this study, wherein dimensions are measured, gender-based differences do exist as males had slightly higher dimensions than females. The location of PSAA also differs in males and females; however, the most common form noted was Intrasinusal. The width of the alveolar crest of molars decreases with age, attributed to atrophic changes in the bone caused by aging. The results of this study highlight the need to evaluate the maxillary posterior area before sinus lift surgery or implant placement to avoid damage to vital tissues during the procedure.

SUMMARY

The posterior superior alveolar artery (PSAA) is a significant derivative of the maxillary artery**,** supplying the maxillary sinus, maxillary posterior teeth, and surrounding soft tissues. Understanding its trajectory and derivatives is essential in maxillofacial surgery, dental procedures, and sinus-related interventions. The PSAA's anatomy is crucial for dental surgeries involving the maxillary sinus, such as sinus augmentation and dental implant placement. Inadvertent damage to the PSAA during these procedures can lead to complications like significant bleeding, which may obscure the surgical field and prolong the operation. CBCT allows for precise measurement of the artery's distance from critical landmarks, aiding in surgical planning to avoid vascular injury. The data was collected from archives of August 2021 to December 2024. Out of 1340 CBCT scans,370 scans (202 males,168 females) were assessed. The standardization includes- peak kilovoltage of 65kVp, current of 12 mA, field of view 5*5cm/8*8cm, voxel size of 0.2 mm slice thickness 1.2 mm. Sidexis 4 CBCT software (version 4.3.1.0) was used for the reconstruction and measurement. The morphological patterns of PSAA noted were of Intrasinusal, Intraosseous, and Superficial. The distance between the PSAA and the alveolar crest of maxillary molars and medial wall maxillary sinus was measured.

PSAA morphology was compared in 3 groups with Group 1 consisting of participants aged 18-32, Group 2 of participants aged 32-45, and Group 3 of participants aged 46-60 were compared. Descriptive statistics was used to evaluate the age and gender distribution of the participants among the three groups. The percentage of Intra Osseous is slightly higher in Group 2 (32.26%) compared to Group 1 (23.62%) and Group 3 (28.57%). Intrasinusal is the most common category across all groups, with percentages ranging from 63.71% (Group 2) to 72.44%

(Group 1). Superficial is relatively rare across all groups, around 4% in each group. The mean age increased across all groups. Since (P = 0.37), there is **no significant difference** in gender distribution across the three groups. The mean differences are small across all parameters, suggesting that male and female averages are quite similar. The t-values are also relatively low, reinforcing that the observed differences are minor. Group 2 shows slightly higher means and greater variability (larger SD) on the left side and in the average.

.

BIBLIOGRAPHY

1. Ataman-Duruel ET, Duruel O, Turkyilmaz I, Tözüm TF. Anatomic variation of posterior superior alveolar artery: review of literature and case introduction. Journal of Oral Implantology. 2019 Feb 1;45(1):79-85.
2. Santos German IJ, Buchaim DV, Andreo JC, Shinohara EH, Capelozza AL, Shinohara AL, Rosa Junior GM, Pereira M, Buchaim RL. Identification of the bony canal of the posterior superior alveolar nerve and artery in the maxillary sinus: tomographic,radiographic, and macroscopic analyses. ScientificWorldJournal. 2015; 2015:878205.
3. Kim JH, Ryu JS, Kim KD, Hwang SH, Moon HS. A radiographic study of the posterior superior alveolar artery. Implant dentistry. 2011 Aug 1;20(4):306-10.
4. Varela-Centelles, Pablo et al. "Detection of the posterior superior alveolar artery in the lateral sinus wall using computed tomography/cone beam computed tomography: a prevalence meta-analysis study and systematic review." International journal of oral and maxillofacial surgery 44 11 (2015): 1405-10.
5. Park, W. H., Choi, S. Y., & Kim, C. S. (2012). Study on the position of the posteriorsuperior alveolar artery in relation to the performance of the maxillary sinus bone graft procedure in a Korean population. Journal of the Korean Association of Oral and Maxillofacial Surgeons, 38(2), 71-77.
6. Panjnoush, M., Ghoncheh, Z., Kaviani, H., Moíadzadehkhiavi, M., Shahbazi, N., & Khaíazifaíd, M. (2018). Evaluation of the Position and Couíse of the Posteíioí Supeíioí Alveolaí Aíteíy by ConeBeam Computed ľomogíaphy in an Iíanian Population. Jidai.2019 Apí; 29(3);8

7. Tsukioka T, Muraoka H, Ito K, Hirahara N, Okada S, Kaneda T. Detection of posterior superior alveolar artery using multi-detector row CT: a retrospective study focused on age-related changes. Oral Radiol. 2022 Jul;38(3):344-348. doi: 10.1007/s11282-021-00562-2. Epub 2021 Aug 17. PMID: 34403076.
8. Padovani LS, Oliveira AMSD, Dutra BC, Costa FO, Oliveira PAD. Important anatomical variations of the superior posterior alveolar artery: Studied by cone beam computed tomography. Anat Histol Embryol. 2020 Nov;49(6):798-804. doi: 10.1111/ahe.12584. Epub 2020 Jun 14. PMID: 32537773.
9. Wani AA, Kanotra S, Lateef M, Ahmad R, Qazi SM, Ahmad S. CT scan evaluation of the anatomical variations of the ostiomeatal complex. Indian J Otolaryngol Head Neck Surg. 2009 Sep;61(3):163-8. doi: 10.1007/s12070-009-0059-8. Epub 2009 Sep 27. PMID: 23120628; PMCID: PMC3449989.
10. Ludlow JB, Gubler M, Cevidanes L, Mol A. Precision of cephalometric landmark identification: cone-beam computed tomography vs conventional cephalometric views. American Journal of Orthodontics and Dentofacial Orthopedics. 2009 Sep 1;136(3):312-e1.
11. Venkatesh E, Elluru SV. Cone beam computed tomography: basics and applications in dentistry. J Istanb Univ Fac Dent. 2017 Dec 2;51(3 Suppl 1):S102-S121
12. Macleod I, Heath N. Cone-beam computed tomography (CBCT) in dental practice. Dental update. 2008 Nov 2;35(9):590-8.
13. Friedland B. Medicolegal issues related to cone beam CT. InSeminars in Orthodontics 2009 Mar 1 (Vol. 15, No. 1, pp. 77-84). WB Saunders.
14. Bayome M, Park JH, Kim Y, Kook YA. 3D analysis and clinical applications of CBCT images. InSeminars in Orthodontics 2015 Dec 1 (Vol. 21, No. 4, pp. 254- 262). WB Saunders.

15. Shweel M, Amer MI, El-shamanhory AF. A comparative study of cone-beam CT and multidetector CT in the preoperative assessment of odontogenic cysts and tumors. The Egyptian Journal of Radiology and Nuclear Medicine. 2013 Mar 1;44(1):23-32.
16. Lee J, Kang N, Moon YM, Pang EK. Radiographic study of the distribution of maxillary intraosseous vascular canal in Koreans. Maxillofac Plast Reconstr Surg. 2016 Jan 4;38(1):1.
17. Kqiku L, Biblekaj R, Weiglein AH, Kqiku X, Städtler P. Arterial blood architecture of the maxillary sinus in dentate specimens. Croat Med J. 2013 Apr;54(2):180-4.
18. Ilgüy D, Ilgüy M, Dolekoglu S, Fisekcioglu E. Evaluation of the posterior superior alveolar artery and the maxillary sinus with CBCT. Brazilian oral research. 2013;27(05):431-7.
19. Anamali S, Avila-Ortiz G, Elangovan S, Qian F, Ruprecht A, Finkelstein M, Allareddy V. Prevalence of the posterior superior alveolar canal in cone beam computed tomography scans. Clin Oral Implants Res. 2015;26(1):e8-12.
20. Apostolakis D, Bissoon AK (2014) Radiographic evaluation of the superior alveolar canal: measurements of its diameter and of its position in relation to the maxillary sinus floor: a cone beam computerized tomography study. Clin Oral Implants Res (2014), 25: 553-559
21. Zhitian D, Ping Y, Runfa W, Peng B, Rui R, Min H, Chen X. [Evaluating the bony canal structure of the posterior superior alveolar artery using cone-beam computed tomography]. Hua Xi Kou Qiang Yi Xue Za Zhi. 2014 Dec;32(6):581-3.
22. Khojastehpour L, Dehbozorgi M, Tabrizi R, Esfandnia S. Evaluating the anatomical location of the posterior superior alveolar artery in cone beam

computed tomography images. Int J Oral Maxillofac Surg. 2016 Mar;45(3):354-8

23. Haghanifar, S., Moudi, E., Gholinia, H., & Mohammadian, P. (2016). Evaluation of the location of the posterior superior alveolar artery in the maxillary sinus by Cone beam computed tomography.
24. Pandharbale AA, Gadgil RM, Bhoosreddy AR, Kunte VR, Ahire BS, Shinde MR, Joshi SS. Evaluation of the Posterior Superior Alveolar Artery Using Cone Beam Computed Tomography. Pol J Radiol. 2016 Dec 19; 81:606-610.
25. Danesh-Sani SA, Movahed A, ElChaar ES, Chong Chan K, Amintavakoli N. Radiographic Evaluation of Maxillary Sinus Lateral Wall and Posterior Superior Alveolar Artery Anatomy: A Cone-Beam Computed Tomographic Study. Clin Implant Dent Relat Res. 2017 Feb;19(1):151-160.
26. Chitsazi MT, Shirmohammadi A, Faramarzi M, Esmaieli F, Chitsazi S. Evaluation of the position of the posterior superior alveolar artery in relation to the maxillary sinus using the Cone-Beam computed tomography scans. J Clin Exp Dent. 2017 Mar 1;9(3):e394-e399.
27. Tehranchi M, Taleghani F, Shahab S, Nouri A. Prevalence, and location of the posterior superior alveolar artery using cone-beam computed tomography. Imaging Sci Dent. 2017 Mar;47(1):39-44.
28. Sun, Wentao et al. “Evaluation of the Anastomosis Canal in Lateral Maxillary Sinus Wall with Cone Beam Computerized Tomography: A Clinical Study.” The Journal of oral implantology vol. 44,1 (2018): 5-13.
29. Duruel O, Ataman-Duruel ET, Tözüm MD, Karabulut E, Tözüm TF. The radiological evaluation of posterior superior alveolar artery topography by using computed tomography. Clin Implant Dent Relat Res. 2019 Aug;21(4):644-648.

30. Fayek MM, Amer ME, Bakry AM. Evaluation of the posterior superior alveolar artery canal by cone-beam computed tomography in a sample of the Egyptian population. Imaging Sci Dent. 2021 Mar;51(1):35-40.
31. Karslioglu H, Çitir M, Gunduz K, Kasap P. The Radiological Evaluation of Posterior Superior Alveolar Artery by Using CBCT. Curr Med Imaging. 2021;17(3):384-389.
32. Tofangchiha M, Hematzadeh S, Vali ME, Ghonche MRA, Mirzadeh M, Reda R, Testarelli L. Anatomical localization of posterior superior alveolar artery: A retrospective study by cone-beam computed tomography. Dent Med Probl. 2022 Jul-Sep;59(3):407-412.
33. Rathod R, Singh MP, Nahar P, Mathur H, Daga D. Assessment of Pathway and Location of Posterior Superior Alveolar Artery: A Cone-Beam Computed Tomography Study. Cureus. 2022 Feb 8;14(2): e22028.
34. Mehtiev RS, Melnichenko YM, Kabak SL, Savrasova NA. Topographic assessment of the vascular anastomosis in the maxillary sinus wall using cone-beam computed tomography 2022;101(1):60-65.
35. Danesh-Sani SA, Movahed A, ElChaar ES, Chong Chan K, Amintavakoli N. Radiographic Evaluation of Maxillary Sinus Lateral Wall and Posterior Superior Alveolar Artery Anatomy: A Cone-Beam Computed Tomographic Study. Clin Implant Dent Relat Res. 2017 Feb;19(1):151-160.
36. Ang KY, Ang KL, Ngeow WC. The prevalence and location of the posterior superior alveolar artery in the maxillary sinus wall: A preliminary computed-cone beam study. Saudi Dent J. 2022 Nov;34(7):629-635.
37. Godil, A.Z., Devadiga, T., Supnekar, S., Kazi, A.I., Wadwan, S., & Dugal, R. (2021). Position of posterior superior alveolar artery in relation to the

maxillary sinus using cone beam computed tomography in Indian sub-population. Journal of Oral Medicine and Oral Surgery.

38. Manjushri waingade, someshwari salunkhe, raghavendra s medikeri (2021) Assessment of position of posterior superior alveolar artery in relation to maxillary sinus using cone-beam computed tomography. J Orofacial Sci, 13: 105-113
39. Kang SJ, Shin SI, Herr Y, Kwon YH, Kim GT, Chung JH. Anatomical structures in the maxillary sinus related to lateral sinus elevation: a cone beam computed tomographic analysis. Clin Oral Implants Res. 2013; 24:75– 81
40. Renuka Devi KR, Mahima V. Guledgud, Karthikeya Patil, Sanjay CJ, Nagabhushana D, Harshitha N Radiographic assessment of maxillary sinus lateral wall and anatomy of posterior superior alveolar artery: A Cone-Beam Computed Tomographic Eur J Anat, 26 (4): 399-408 (2022)
41. Shams N, Dabbaghi A, Shams B, Naderi L, Rakhshan V. Anatomy of the Posterior Superior Alveolar Artery: a Cone-Beam Computed Tomographic Study. J Maxillofac Oral Surg. 2022 Mar;21(1):203-210.
42. Kang SJ, Shin SI, Herr Y, Kwon YH, Kim GT, Chung JH. Anatomical structures in the maxillary sinus related to lateral sinus elevation: a cone beam computed tomographic analysis. Clin Oral Implants Res. 2013; 24:75– 81
43. Valente NA. Anatomical Considerations on the Alveolar Antral Artery as Related to the Sinus Augmentation Surgical Procedure. Clin Implant Dent Relat Res. 2016 Oct;18(5):1042-1050.
44. Kolte RA, Kolte AP, Rahate PS, Bawankar PV. Association of location and diameter of alveolar antral artery to crest of alveolar bone in dentate and partially edentulous patients - A cone-beam computed tomography study. J Indian Soc Periodontol. 2021 JanFeb;25(1):55-60.

ANNEXURE – I – ETHICAL CLEARANCE LETTER

Research and Ethics Committee
KLE VK INSTITUTE OF DENTAL SCIENCES
A Constituent Unit of KLE Academy of Higher Education & Research
Accredited 'A' Grade by NAAC — Placed in Category 'A' by MHRD (GoI)
Nehru Nagar, Belagavi - 590 010, Karnataka State
☎: 0831-2470362 — Web: http://www.kledental-bgm.edu.in
FAX: 0831-2470640 — E-mail:principal@kledental-bgm.edu.in

Sl. No. : 1633

CERTIFICATE

This is to Certify that the synopsis titled EVALUATION OF POSTERIOR SUPERIOR ALVEOLAR ARTERY USING CONE BEAM COMPUTED TOMOGRAPHY - A RETROSPECTIVE STUDY *Submitted by Dr.* REG NO. IG0222001 *P. G. Student / Staff, Guided by* *from Department of* ORAL MEDICINE and RADIOLOGY *has been critically evaluated by committee members and granted ethical clearance to conduct the above mentioned study*

Date : 27/3/25

Member Secretary
Research and Ethical Committee
KLEVK Institute of Dental Sciences
Belagavi

Chairman
Research and Ethical Committee
KLEVK Institute of Dental Sciences
Belagavi

ANNEXURE – II – WAIVER OF CONSENT

Waiver of Consent

Department of Oral Medicine, Diagnosis and Radiology
KLE VK Institute of Dental Sciences
KLE Academy of Higher Education and Research (KAHER) - Belagavi.

Waiver of informed consent form

It is not feasible to obtain individual informed consent of participants in this study. However, I assure you that the confidentiality of the participants' information will be ensured and no identifying information related to the study participants will be disclosed in any report/publication arising from the study.

ANNEXURE – III – MASTER CHART

Group 1:18-31 years

S.No	Age/Gender	Right						Left					
		Location	M1	M2	M3	MSW	Diameter	Location	M1	M2	M3	MSW	Diameter
1	24/M	IS	11.6	14.7	17.5	13.9	1.2	IS	13.35	14.04	17.86	12.8	1
2	23/M	IO	13.3	14.5	11.2	12.6	1.3	IO	11.8	14.2	16.8	14.2	0.9
3	29/F	IS	12.1	14.2	14.4	11.6	0.8	IS	14.2	13.5	11.1	12.4	0.6
4	18/M	IO	18.9	16.9	17.4	14.5	1	IO	17.3	15.2	16.2	16.2	1.5
5	27/F	IO	15.6	14.4	17	16.4	1.3	IO	17.6	14	15.9	15.9	1
6	21/M	IS	19.6	18.6	20.2	17.5	0.6	IS	19.6	18.6	20.2	16.8	0.5
7	22/F	IS	11	11.2	13.2	14.3	0.6	IS	17.2	13.2	11	12.1	0.7
8	30/M	IO	9.8	10	12.7	11.8	0.7	IO	10.2	9.8	9	10.3	1
9	24/M	IO	16.5	20.4	20.9	16.8	1.3	IO	13.8	18.7	19	16.1	1
10	25/M	IS	16.4	14.4	14.8	16.2	0.8	IS	14.6	11.4	14.6	15.7	0.5
11	30/M	IO	14	13.6	16.2	15.4	1	IO	13.8	14.3	18.8	16.8	1.2
12	24/M	IO	14	14.9	10.9	14.8	1.2	IO	14.6	14.3	14.9	15.6	1
13	18/F	IS	15.3	10.4	14.3	13.3	0.5	IS	17.9	10.2	9.4	12.8	0.7
14	29/F	IO	25.1	19.1	16.4	17.3	1.3	IO	22.1	23	15.5	16.9	1.2
15	27/M	IS	18.2	19.7	22.1	17.7	1	IS	14.7	15.6	19.1	17.4	0.9
16	19/M	SUP	12.5	16.5	17.3	17.2	0.6	SUP	11.4	16.2	15.4	17.8	0.7
17	20/F	SUP	13	14	14.5	15.4	0.5	SUP	11.6	16.2	17	16.9	0.8
18	19/F	IS	15.1	17.4	25.2	16.4	1	IS	14.6	15.2	17.1	17.4	1.3
19	25/M	IS	10	11.1	12.5	13.2	1	IS	7.5	12.5	9.9	12.8	0.9
20	20/F	IO	9.8	10.2	14.6	14.3	0.9	IO	13.4	9.8	14.1	13.2	0.7

21	18/F	IS	12	15.5	15.7	16.1	0.7	IS	11.1	16.5	13.9	14.9	0.9
22	23/M	IS	10.6	10.8	9.8	13.2	1	IS	14	11.9	13.8	12.4	1.3
23	21/M	IS	13.4	11.4	16.8	11.6	0.8	IS	11.7	11.1	10.1	11.7	1
24	27/M	IO	11.2	12	17.2	15.8	1.3	IO	12.6	12.4	12.9	14.5	1
25	26/F	IS	19	18.8	16.6	17.2	0.5	IS	19.1	13.6	20.2	17.8	0.8
26	24/M	IO	19.7	21.4	15.9	17.9	1	IO	16.9	17.8	20.7	16.8	1.2
27	20/M	IO	14.1	17.1	13	15.2	1.2	IO	11	19.6	12.9	14.3	1
28	18/F	IS	19.7	12.7	19.9	17.9	1	IS	18.3	17.9	24.3	17.2	1.2
29	31/M	IO	12	14.9	13.5	15.5	0.9	IO	15.9	14.2	14	15.3	0.8
30	21/F	IO	7.8	10.5	11.2	13.4	1	IO	15.7	16.4	16.5	15.9	0.8
31	22/M	IS	13.1	11.8	14.6	14.5	0.9	IS	13.5	13.2	14	13.9	0.6
32	28/F	IS	16.9	14	13.5	14.6	1	IS	15.3	15.6	14	13.7	1.2
33	18/M	IS	22.7	20	24.3	18.2	1.2	IS	14.9	15.9	21.4	17.8	1
34	26/M	IS	11.7	13.2	16.4	15.2	1	IS	8.8	12.4	15.3	14.7	1
35	25/F	IS	15.5	17.7	15.4	13.8	1	IS	16.6	15.3	16.2	14.2	1.2
36	23/M	IS	15.6	17.7	17.5	16.5	1.1	IS	9.5	7.9	10	13.2	0.8
37	18/F	IS	11.8	14.9	17.8	12.4	0.9	IS	10	10.8	14.8	11.9	1
38	25/M	IS	15.4	15.1	16.8	13.7	1	IS	14.3	14.3	15.7	14.2	0.8
39	27/M	IO	16.1	21.6	21	17.4	0.9	IO	14.3	15.4	15.8	17	1
40	21/M	IO	21.9	13.4	18.3	16.2	1	IO	20.9	14.1	15.8	15.9	1.1
41	22/F	IO	12	17.8	17	15.6	0.8	IO	12.5	14.8	14.5	15	1
42	29/M	IS	12.3	13.9	14.8	12.7	0.7	IS	12.7	16.3	15.2	13.4	0.6
43	26/M	IS	12.5	12.6	19.7	17.5	1	IS	11.7	12.4	11.6	13.8	0.8
44	30/M	IS	15.6	16.2	18.1	15.5	0.9	IS	18.1	11.9	15.8	14.2	1
45	24/F	IS	13.9	14.6	16.8	14	1	IS	18.2	18.7	20	16.4	0.9
46	27/M	IS	11.1	10.8	11.3	10.4	0.8	IS	14.4	12.9	13.5	12.6	1
47	24/M	IO	13.9	13.3	11.5	12.8	1	IO	18.8	14.4	16.4	15.3	0.9

48	29/F	IS	12.3	12.5	11.9	10.5	0.7	IS	11.2	10.5	8.9	12.3	0.8
49	30/M	IS	19.1	20.9	19.7	17.3	1	IS	19.6	19.6	19.2	16.7	1
50	32/F	IO	14.2	15.7	19	15.3	0.9	IO	13.7	13.3	18.5	14.6	1
51	31/F	IS	15.5	16.8	12.6	12.4	1	IS	13.2	14.7	18.9	12.6	0.8
52	26/F	IS	13	15.1	11.7	11.3	0.7	IS	9.4	12	14.1	12.3	0.9
53	18/M	IS	10.7	11.4	11.9	10.5	1	IS	16.4	15.7	14.8	11.7	0.8
54	20/M	IS	16.1	20.2	16.4	15.2	0.7	IS	14	12.8	19	14.8	0.7
56	19/F	IS	14.5	14.3	12.4	11.8	1.2	IS	11.4	12	11.5	12	1
57	31/M	IS	13.9	15.2	12.7	12.5	1	IS	14.4	14.5	16.9	11.8	1
58	30/F	IO	16.2	16.1	17.6	15.4	0.9	IO	15.5	16.3	17.5	16.7	1.2
59	18/F	IS	11.3	13.6	20	17.4	1	IS	12.6	14.1	18.3	17.3	1
60	25/F	IS	10.7	10.5	12.5	13.1	0.8	IS	14.1	12.8	13.6	14.2	0.9
61	21/M	IS	11.8	10.1	11.5	10.5	0.7	IS	16.3	11.5	14.2	13.2	0.8
62	19/F	IS	11.5	10.7	10.4	9.8	0.9	IS	15.9	15.5	14.7	12.3	1
63	26/M	IS	17.1	16.3	18.4	16.3	1	IS	17.1	17.3	18.2	16	0.9
64	22/F	IS	14.2	12.2	10.3	14.3	0.8	IS	16.3	12.8	13	13.8	0.7
65	29/M	IS	15.1	16.1	16.8	15.7	1	IS	13.6	14.8	15.1	14.9	0.9
66	31/M	IS	13.2	13	13.5	15.5	1.2	IS	12.9	8.9	12.5	16.4	1
67	30/F	IO	22.7	15.2	14.3	16.9	1	IO	21.8	19.7	17.5	17.3	0.9
68	26/M	IO	11.6	17.8	18.7	18.4	1	IO	12.1	13.2	18.3	17.6	1.2
69	24/F	IS	16.9	16.7	15.9	14.8	0.5	IS	12.1	12.5	13.2	14.3	0.8
70	20/M	IS	12.8	14.7	16	14.3	1.3	IS	10.9	11.5	12.1	12.8	0.9
71	19/M	IS	10.7	13.3	13.9	13.5	0.9	IS	11.4	14.6	13.9	14.5	1
72	24/F	IS	17.7	17.4	19	16.4	1	IS	14.4	18	18.2	13.9	0.9
73	26/M	IS	15	15.4	15	12.4	0.9	IS	15.7	16.2	15.9	14.3	1
74	29/F	IO	12.4	14.2	16	13.2	1.2	IO	13.5	13.9	13.4	14.2	1.2
75	18/F	IS	13.6	13.5	14.6	16.4	0.8	IS	15.4	13.5	12.8	16.3	0.7

76	19/F	IS	10.2	12.4	15.4	15.6	0.9	IS	9.8	9.7	12.8	14	0.8
77	31/M	IS	16.9	15.4	11.3	16.6	1.2	IS	12	15.3	13.3	14.5	1
78	22/F	IS	8.9	9.2	12.6	11.4	1	IS	11.2	12.1	14.2	10.8	0.9
79	21/F	IO	13.1	13.3	15.6	12.5	0.8	IO	12.5	11.2	17.7	12.1	0.9
80	19/F	IO	10.8	11.3	16.6	17.1	1.2	IO	11.1	12.8	14.3	15.4	1.2
81	18/F	IS	11.7	13.1	11.6	14.9	1	IS	12.4	12.8	13.2	14.1	1
82	23/M	IS	10.4	10.7	9.6	16.4	1	IS	10.2	12.5	14.9	15.1	1.2
83	24/F	IS	15.5	16.4	16.2	11.3	0.8	IS	12.7	16.1	15.3	11.8	0.9
84	22/F	IS	13.1	13.8	16.9	18.5	1.2	IS	14.4	14.2	15.9	12.6	1
85	30/M	IS	9.6	10.1	11.6	10.1	1	IS	15.9	11.8	12	10.8	1.3
86	31/F	IS	15.6	16.3	16.4	11.8	0.7	IS	12	12.2	14.6	11.2	0.8
87	23/F	IS	17	20.8	18.7	16.4	1.1	IS	19.6	20.3	20.5	17	1
88	20/F	IS	14.8	14.1	16.5	16.8	1	IS	10.6	13.2	14.5	16.4	1.2
89	18/M	SUP	15.4	15	11.7	14.1	0.8	SUP	13.4	12.9	12.7	14.9	0.9
90	30/M	IO	15.2	14.1	16.4	16.7	1.2	IO	16.1	15.6	15.9	18.1	1
91	23/M	IS	15.2	14.4	16.2	15.1	1	IS	14.9	14.3	14.4	14.1	0.9
92	18/F	IS	12.3	13	13.8	13.7	0.8	IS	16.6	15.8	15.4	14.5	1
93	19/M	IS	14.1	13.9	12.6	10.9	1.1	IS	13.1	11.4	10.2	12.3	1.1
94	30/M	IS	13.3	12.5	15.1	13.1	1	IS	10.6	14	14.3	13.7	0.9
95	21/F	IS	12	13.6	13.2	11.3	0.7	IS	10.3	12	13.8	11.2	0.8
96	24/M	IS	11.3	12.1	12	14.2	0.8	IS	12.5	13.6	15.3	13.6	0.9
97	29/M	IS	10.8	12.5	11.5	13.7	1	IS	12.4	11.3	13.7	13.3	1.2
98	24/M	IO	17.5	17.1	17.4	16.8	0.8	IO	16.8	16.4	15.6	15.9	0.7
99	30/M	IS	13.9	14.3	14.5	14.8	1	IS	14.3	13.7	14.5	14.4	1.2
100	31/F	IS	12.9	12.6	11.8	12.6	0.9	IS	13.2	12.8	11.4	13.4	1
101	28/F	IS	14.1	15.2	15.3	11.8	1.2	IS	13.8	13.3	12.8	11.6	1.1
102	23/F	IS	13.6	13.2	14.2	12.6	1	IS	14.1	14.4	14.7	14.6	0.9

103	20/F	IS	12.6	12.8	13.3	14.2	0.8	IS	11.3	12.4	13.2	14.2	1
104	26/M	IS	14.1	13	12.6	13.5	0.9	IS	13.6	12.9	12.5	13.7	1.1
105	22/M	IS	13.1	12.8	12.6	16.2	1	IS	13.7	13.1	12.9	15.7	0.9
106	28/M	IS	10.5	10.5	11.1	10.9	1.1	IS	9.8	10	10.9	11.3	1
107	25/M	IS	12.5	17.5	12.7	14.5	0.7	IS	16.1	17.1	15	16.4	0.9
108	21/M	IS	12.5	16.5	13.5	14.6	1	IS	16	16.7	15.2	15.6	0.8
109	27/M	IS	15.2	14.4	16.2	15.1	0.9	IS	14.9	14.3	15.1	14.1	1
110	29/M	IS	12.1	13.2	14	11.4	0.8	IS	13	12.7	12.3	16.1	0.9
111	31/F	IS	11.8	15.7	16.6	11.9	1	IS	16.6	15.7	15.3	15	0.8
112	30/F	IS	11.3	12.4	13.1	12.9	1	IS	12.3	13.4	13.2	11.6	0.9
113	18/F	SUP	12.5	12.7	13.7	15.2	0.9	SUP	11.9	13.2	13.5	12.4	1
114	22/F	IS	12.4	13.8	14.6	14.2	1	IS	12.3	13.4	13.7	14.6	0.9
115	18/F	IS	13.1	12.3	13.2	11.7	1.2	IS	12.6	12.3	13.2	12.8	1
116	31/M	IS	15.3	12.4	15.6	12.3	1	IS	14.2	13.4	12.9	13.6	0.9
117	28/F	IS	13.2	12.8	14.3	14.2	0.8	IS	12.1	13.2	11	12.5	1
118	19/F	IS	13.5	13.9	14.5	17.3	1	IS	11.1	12.4	13.6	17.4	0.9
119	20/F	IO	10.6	10.1	12	10.9	0.8	IO	11.2	11.7	12.5	13.2	1
120	22/M	IS	12.1	12.4	13.8	14.1	1	IS	10.4	11.2	11.9	14.3	0.9
121	25/F	IS	14.4	14.6	14.6	15.8	0.7	IS	11.7	12.1	14.5	12.7	1
122	30/M	IS	12.3	12.7	13.2	14.1	1	IS	12.3	13.5	14.1	11	1.1
123	31/F	IO	15.5	16.2	16.9	10.7	0.9	IO	11.6	10.7	11.2	13.8	1
124	23/F	IS	14.9	14.5	16.3	16.5	1	IS	12.1	13.4	15.2	16.3	0.8
125	25/F	SUP	12.9	15	15.4	16.5	0.9	SUP	15.1	15.6	16.1	15.6	0.7
126	30/M	IS	13.3	12.5	15.1	13.1	1	IS	10.6	14	14.8	13.7	1.3
127	29/M	IS	10.7	12.5	11.5	16.3	0.8	IS	12.4	11.3	13.7	13.3	1

Group 2:32-45 years

S.No	Age/Gender	Right						Left					
		Location	M1	M2	M3	MSW	Diameter	Location	M1	M2	M3	MSW	Diameter
1	36/F	IO	13.1	14.2	10.5	12.6	1.1	IO	11.8	10.8	10.9	12.1	1
2	43/M	IO	19	17.1	17.5	15.4	1.3	IO	15.6	16.2	16.9	14.9	1
3	39/F	IO	12.6	13.7	10.2	13.7	0.9	IO	10.4	12.5	12.1	12.9	0.8
4	32/F	IS	13.3	15.02	14.5	10.5	0.8	IS	15.1	13.7	14.4	11.2	0.6
5	40/F	IO	13.2	13	13.7	15.5	1.2	IO	12.9	8.9	12.5	16.4	1
6	40/M	IO	22.7	15.2	14.3	16.9	1	IO	21.8	19.7	17.5	17.3	0.9
7	39/M	IO	11.6	17.8	21.7	18.4	1	IO	12.1	13.2	18.3	17.6	1.2
8	34/F	IS	17.4	16.7	15.9	14.8	0.5	IS	12.1	12.5	13.2	14.3	0.8
9	36/M	IS	12.8	15.7	16	14.3	1	IS	10.9	11.5	11.9	12.8	0.9
10	33/M	IO	10.7	13.3	13.9	13.5	0.9	IO	11.4	14.6	13.9	14.5	1
11	32/M	IS	17.7	17.4	19	16.4	1	IS	14.4	18	18.2	13.9	0.9
12	41/F	IS	15	15.4	15	12.4	0.9	IS	15.7	16.2	15.9	14.3	1
13	38/F	IS	10.4	14.2	17	13.2	1	IS	14	14.9	13.4	13.4	1.2
14	34/F	IO	15.4	15.1	16.8	13.7	1	IO	14.3	14.3	15.7	14.5	0.8
15	36/M	IO	11.64	14.76	19.65	13.9	1.2	IO	13.35	14.04	17.86	12.8	1
16	38/M	IS	13.3	14.5	12.2	12.6	1.3	IS	11.8	14.2	16.8	14.2	0.9
17	42/F	IO	12.1	14.2	14.4	11.8	0.8	IO	14.2	13.5	11.1	12.4	0.6
18	43/M	IO	18.9	16.9	17.4	14.5	1	IO	17.3	15.2	16.8	16.2	1.5
19	40/M	IO	15.6	14.4	17	16.4	1.3	IO	17.6	14	15.9	15.9	1
20	41/F	IS	19.6	18.6	20.2	17.5	0.6	IS	19.6	18.6	20.2	16.8	0.5
21	39/M	IS	11	11.2	13.2	14.3	0.6	IS	17.2	13.2	11.4	12.1	0.7
22	40/F	SUP	9.8	10	12.7	11.8	0.7	SUP	10.2	9.8	9	10.3	1
23	34/F	IO	16.5	20.4	20.9	16.8	1.3	IO	13.8	18.7	19	16.1	1

24	35/M	IS	16.4	14.4	14.8	16.2	0.8	IS	14.6	11.4	14.6	15.7	0.5
25	33/M	SUP	14	13.6	16.2	15.4	1	SUP	13.8	14.3	18.8	16.8	1.2
26	40/M	IO	8.8	12.8	13.4	11.5	1	IO	11.2	8.5	10.9	11	0.9
27	38/F	IO	12.3	14.7	15.2	12	0.9	IO	12.7	16.3	15.2	16	0.8
28	42/M	IS	10.7	11.2	13.1	13.7	0.6	IS	12.3	10.7	9.8	12.8	0.9
29	33/F	IO	11.2	10.8	16.9	14.3	1.3	IO	11.2	12	12.9	13.7	1
30	35/M	IO	12.8	17.6	24.3	17.2	1	IO	11.8	15.4	22.1	17.6	0.8
31	37/M	IO	12	14.7	15.9	16.2	1	IO	12.5	15.6	16.2	15.7	1.2
32	39/F	IS	13	16.1	16.1	15.4	0.8	IS	16.7	19	19.6	15.7	0.9
33	41/M	IO	15.9	16.8	17.1	14.3	1.2	IO	15.4	15.1	16.1	13.8	1
34	45/F	IS	12.2	14.1	12.1	11.9	0.8	IS	12.5	12.1	13.1	11.2	0.7
35	43/F	IO	13.3	12.6	15.6	16.8	0.9	IO	11.6	10.2	17.3	17.7	1.2
36	44/F	SUP	14.1	11.8	12.5	15.8	1	SUP	17.6	14.5	16.3	15.3	1
37	40/M	IO	13	14.9	13.5	15.5	0.9	IO	15.9	14.2	14	15.3	0.8
38	36/M	IO	11.1	10.8	11.3	10.4	0.8	IO	14.4	12.9	13.5	12.6	1
39	38/M	IO	13.9	13.3	11.5	12.8	1	IO	18.8	14.4	16.4	15.3	0.9
40	43/F	IS	12.3	12.5	11.9	10.5	0.7	IO	11.2	10.5	8.9	12.3	0.8
41	36/M	IO	16.9	17.7	13	11.8	1	IO	15.3	19.2	19.5	12.7	1
42	40/M	IS	13	15.1	11.7	11.3	0.7	IS	9.4	12	14.1	12.3	0.9
43	33/M	IS	8.8	12.4	15.3	14.7	1	IS	11.7	13.2	16.4	15.2	1
44	34/M	IS	16.6	15.3	16.2	14.2	1	IS	15.5	17.7	15.4	13.8	1
45	37/M	IO	9.5	7.9	10	13.2	1.1	IO	15.6	17.7	17.5	16.5	1.1
46	43/M	IS	10	10.8	14.8	11.9	0.9	IS	11.8	14.9	17.8	12.4	0.9
47	45/F	IS	14.3	14.3	15.7	14.2	1	IS	15.4	15.1	16.8	13.7	1
48	42/M	IS	14.3	15.4	15.8	17	0.9	IS	16.1	21.6	21	17.4	0.9
49	40/F	IS	20.9	14.1	15.8	15.9	1	IS	21.9	13.4	18.3	16.2	1
50	39/M	IS	12.5	14.8	14.5	15	0.8	IS	12	17.8	17	15.6	0.8

51	38/F	IO	12.7	16.3	15.2	13.4	0.7	IO	12.3	13.9	14.8	12.7	0.7
52	35/M	IS	11.7	12.4	11.6	13.8	1	IS	12.5	12.6	19.7	17.5	1
53	36/M	IS	18.1	11.9	15.8	14.2	0.9	IS	15.6	16.2	18.1	15.5	0.9
54	32/M	IS	13.9	15.2	12.7	12.5	1	IS	14.4	14.5	16.9	11.8	1
56	36/F	IO	16.2	16.1	17.6	15.4	0.9	IO	15.5	16.3	17.5	16.7	1
57	38/M	IS	12.3	13.9	14.8	12.7	1	IS	11.3	13.6	20	17.4	0.8
58	40/M	IS	12.5	12.6	19.7	17.5	1.2	IS	10.7	10.5	12.5	13.1	0.9
59	41/F	IS	15.6	16.2	18.1	15.5	1	IS	11.8	10.1	11.5	10.5	0.8
60	34/M	IO	13.5	12.3	13.7	14.5	0.9	IO	13.2	11	13.2	13.8	0.8
61	33/M	IS	20.1	19.4	18.6	16.3	1	IS	21.9	19.9	19.3	16.5	1
62	34/M	IS	13.3	15.3	14.9	13.5	0.9	IS	16.7	14.9	15.1	14.2	0.8
63	33/F	IS	11.5	10.7	10.4	9.8	0.9	IS	15.9	15.5	14.7	13.7	1
64	40/M	SUP	17.1	16.3	16.5	14.9	1	SUP	15.6	17.3	17.8	16.8	0.8
65	42/M	IS	13.5	12.7	10.3	13.8	0.8	IS	16.3	12.8	13	13.8	0.7
66	35/M	IS	15.1	16.1	15.5	16.1	1	IS	16.4	16.8	15.9	14.9	0.9
67	43/M	IS	14.2	15.6	15.8	14.5	1	IS	17.8	16.5	16.3	15.3	0.9
68	45/F	IS	14.1	13.4	10.6	14.8	1	IS	14.3	15.7	16.5	15.8	1
69	44/M	IO	18.1	11.9	15.8	14.2	0.9	IO	15.6	16.2	18.1	15.5	0.9
70	45/F	IS	10.7	12	13.1	13.7	0.6	IS	11.3	10.7	9.8	11.8	0.9
71	42/M	IS	11.2	10.8	16.9	14.3	1.3	IS	10.2	12	12.6	13.7	1
72	40/F	IO	12.8	17.6	24.3	17.6	1	IO	11.6	15.4	22.1	17.6	0.8
73	39/M	IO	12	14.7	14.5	15.2	1	IO	12.5	15.6	16.2	15.7	1.2
74	38/F	IS	14.3	16.1	17.1	15.7	0.8	IS	16.7	19	19.6	15.7	0.9
75	35/M	IO	15.9	16.8	17.1	14.3	1.2	IO	15.4	15.1	16.1	13.8	1
76	37/M	IS	12.2	13.7	12.1	11.6	0.8	IS	12.5	12.1	13.1	11.2	0.7
77	39/F	IO	13.3	12.6	14.9	15.5	1	IO	11.1	10.2	14.5	15.4	1.2
78	41/F	IS	15.1	13.2	13.5	15.8	1	IS	16.4	14.3	16.5	15.3	1

79	45/M	IS	12.3	14.9	13.5	15.5	1	IS	15.9	14.2	14	15.3	0.8
80	44/F	IS	15.2	16.6	18.4	15.7	0.9	IS	17.8	16.5	18.7	16.4	0.8
81	39/M	IO	15.4	14.7	16.3	16.5	1	IO	15.1	12.9	16.1	15.7	1
82	32/F	IS	16.9	15.4	11.3	16.6	1.2	IS	12	15.3	13.3	14.5	1
83	35/F	IS	12.9	12.7	12.5	13.1	1	IS	12.1	12.4	13.2	11.5	0.9
84	44/M	IS	15.5	16.4	16.2	11.3	0.8	IS	12.7	16.1	15.3	11.8	0.9
85	45/F	IS	14.7	15.1	16.2	17.3	1.1	IS	10.7	14.4	15.2	16.4	1
86	35/M	IS	12.2	13.4	14.5	16.5	1	IS	9.2	11.1	14	15.4	0.9
87	39/M	IS	12.5	11.9	13.2	15.4	0.8	IS	16	12.9	11.9	11.6	16.2
88	42/F	IO	10.8	11.3	16.6	17.1	1.2	IO	11.1	12.8	14.3	15.4	1.2
89	35/M	IS	11.7	13.1	11.6	14.9	1	IS	12.4	12.8	13.2	14.1	1
90	35/M	IS	15.3	11	10.6	13.5	0.8	IS	14.1	12.1	11.7	16.4	0.7
91	45/F	IS	16.2	15.5	15.8	15.9	1	IS	14.8	15.1	15.2	15.6	1.2
92	36/M	IS	14.3	12.7	11.8	12.9	1.2	IS	13.2	11.8	11.3	13.4	1
93	32/M	IS	12.9	12.6	11.8	12.6	0.9	IS	13.2	12.8	11.4	13.4	1
94	39/F	IS	10.6	10.1	11.6	10.1	1	IS	15.9	11.8	12	10.8	1.3
95	41/F	IS	15.6	15.2	16.4	11.8	0.7	IS	12	13.3	14.6	11.2	0.8
96	45/M	IS	17	16.8	18.7	15.4	1.1	IS	19.6	18.7	18.2	17	1
97	44/F	IS	14.8	14.1	16.5	16.8	1	IS	11.6	13.2	14.5	16.4	1.2
98	39/M	SUP	15.4	15	14.6	14.1	0.8	SUP	13.4	12.9	12.7	14.9	0.9
99	35/F	IS	12.6	11.2	13.2	16.5	1	IS	10.2	11.3	11.8	15.4	0.8
100	37/M	IS	13.2	12.9	12.3	11.9	0.8	IS	13.5	12.6	11.5	11.3	0.9
101	41/F	IS	12.4	13.5	13.8	15.9	0.9	IS	14.1	13.9	14.5	14.7	1
102	36/F	IS	13	13.9	14.2	16.2	1	IS	13.9	12.7	12.5	16.9	1.2
103	32/M	IS	11.8	15.7	16.6	11.9	1	IS	16.6	15.7	15.3	15	0.8
104	44/M	IS	12.9	12.3	11.9	13.3	0.8	IS	13.4	12.9	12.2	13.5	1
105	42/F	IS	10.5	10.9	12.3	11.1	1	IS	13.8	12.6	10.7	10	1.2

106	35/M	IS	11.5	13.8	14.2	13.2	0.9	IS	12	12.3	12.2	12.9	1
107	34/M	IS	12	10.4	14.7	12.8	1	IS	12.4	12.6	12.3	10.6	0.8
108	38/M	IS	13.1	14.7	14.1	12.4	0.9	IS	12.3	10.4	13.4	13.3	1
109	37/M	IO	12.6	13.2	12.9	12.8	1	IO	14.2	13.2	10.5	12.8	0.9
110	42/M	IS	12.9	13.4	14.2	13.7	0.9	IS	12.3	12.6	14.1	13.1	1
111	42/F	IS	13.5	12.7	11.8	12.1	1	IS	12.4	11.9	11.6	12.1	0.8
112	45/M	IS	13.5	11.5	10.7	13.3	0.7	IS	12.2	11.3	13.2	12.5	1
113	40/M	IS	11.8	12.3	12.7	13.7	1	IS	12.3	12.7	13.2	11	1.1
114	43/M	IS	11.5	12.8	11	13.3	1	IS	13.6	11.8	11.3	14.2	0.9
115	41/F	IS	10.9	12.4	13.5	13.6	0.9	IS	12.1	12.4	13.6	14.1	1
116	39/F	IO	10.7	12.6	15.3	12.1	1.1	IO	11.9	14.1	14.7	12.2	1
117	42/F	IS	9.6	10.5	12.8	14.3	1	IO	9.9	10.4	13.2	14.2	0.8
118	45/M	IS	16.3	14.4	13.7	15.3	0.9	IS	14.3	13.5	16.1	15.9	1
119	37/M	IS	10.9	14.5	16.2	16	1.1	IS	13.5	13.9	14.3	16.2	1
120	38/F	IS	12.3	13.1	13.8	13.8	0.9	IS	15.4	15.8	16.1	14.5	1
121	35/M	IO	16.3	13.4	12.6	13.5	1.2	IO	14.1	12.7	10.8	16.1	1
122	41/F	IS	16.2	15.5	15.1	15.9	1	IS	14.9	15.1	15.2	15.6	0.9
123	33/M	IS	12.5	11.9	13.2	16.6	0.8	IS	14	12.9	11.6	16.3	1
124	35/M	IS	12.2	15.9	16.4	14.3	1	IS	10.2	11.1	13	16.2	0.7

Group 3:46-60 years

S.No	Age/Gender	Right						Left					
		Location	M1	M2	M3	MSW	Diameter	Location	M1	M2	M3	MSW	Diameter
1	56/F	IS	10.7	12	13.1	13.7	0.6	IS	11.3	10.7	9.8	12.8	0.9
2	48/M	IS	11.2	10.8	16.9	14.3	1.3	IS	10.2	12	12.9	13.7	1
3	49/M	IO	12.8	17.6	24.3	18.2	1	IO	11.8	15.4	22.1	17.6	0.8
4	57/F	IO	12	14.7	14.9	16.2	1	IO	12.5	15.6	16.2	15.7	1.2
5	56/F	IS	13	16.1	17.1	15.4	0.8	IS	16.7	19	19.6	15.7	0.9
6	55/M	IO	15.9	16.8	17.1	14.3	1.2	IO	15.4	15.1	16.1	13.8	1
7	56/F	IS	12.2	14.1	12.1	11.9	0.8	IS	12.5	12.1	13.1	11.2	0.7
8	55/F	IS	13.3	12.6	17.9	16.8	1	IS	11.1	10.2	18.4	17.7	1.2
9	51/M	IO	15.1	11.8	13.5	15.8	1	IO	19.6	14.3	16.7	15.3	1
10	59/M	IO	12	14.9	13.5	15.5	0.9	IO	15.9	14.2	14	15.3	0.8
11	60/F	IS	13.3	15.02	14.5	10.5	0.8	IS	15.1	13.7	14.4	11.2	0.6
12	46/M	IO	14.1	16.9	14.6	15.6	1.2	IO	11	19.6	12.9	16	1
13	48/F	IO	19.7	12.7	19.9	17.9	1	IO	18.3	17.2	24.3	17.2	1.2
14	52/F	IO	12	14.9	13.5	15.5	0.9	IO	15.9	14.2	14	15.3	0.8
15	49/M	IS	7.8	11.5	11.2	13.4	1	IS	15.2	16.4	16.5	15.9	0.8
16	55/F	IS	13.1	11.8	14.6	14.5	0.9	IS	13.5	13.2	14	13.9	0.6
17	48/F	IO	15.9	14	13.5	14.6	1.2	IO	15.3	15.6	14	13.7	1.2
18	47/M	IS	13.3	15.02	14.5	10.5	0.8	IS	15.1	13.7	14.4	11.2	0.6
19	49/F	IO	13.2	13	13.7	15.5	1.2	IO	12.9	8.9	12.5	16.4	1
20	54/M	IS	22.7	15.2	14.3	16.9	1	IS	21.8	19.7	17.5	17.3	0.9
21	56/F	IS	11.6	17.8	21.7	18.4	1	IS	12.1	13.2	18.3	17.6	1.2
22	53/F	IO	17.4	16.7	15.9	14.8	0.5	IO	12.1	12.5	13.2	14.3	0.8
23	60/F	IS	12.8	15.7	16	14.3	1	IS	10.9	11.5	11.9	12.8	0.9

24	48/M	IS	10.7	13.3	13.9	13.5	0.9	IS	11.4	14.6	13.9	14.5	1
25	49/M	IO	14.4	16.6	17	15.3	1.1	IO	13.7	12.6	13.3	14.8	1
26	58/M	IS	19	18.8	16.6	17.2	0.5	IS	19.1	13.6	20.2	17.8	0.8
27	55/F	IO	19.7	21.4	15.9	17.9	1	IO	16.9	17.8	20.7	16.8	1.2
28	52/M	IO	14.1	17.1	13	15.2	1.2	IO	11	19.6	12.9	14.3	1
29	54/F	IS	16.9	12.7	16.2	16.3	1	IS	17.2	17.9	24.3	17.2	1.2
30	60/M	IO	12	14.9	13.5	15.5	0.9	IO	15.9	14.2	14	15.3	0.8
31	49/M	IO	7.8	10.5	11.2	13.4	1	IO	15.7	15.4	16.5	15.9	0.8
32	46/F	IS	13.1	10.8	13.6	14.5	0.9	IS	13.5	13.2	14	13.9	0.6
33	47/M	IO	16.9	14	14.5	13.6	1	IO	15.3	15.6	14	13.7	1.2
34	49/M	SUP	22.7	19.1	21.2	17.3	1.2	SUP	14.9	14.6	20.2	16.8	1
35	45/M	IS	11.7	13.2	16.4	15.2	1	IS	8.8	12.4	15.3	14.7	1
36	54/F	IS	15.5	16.7	15.4	13.8	1	IS	16.6	15.3	15.2	14.2	1.2
37	58/M	IS	15.6	16.2	18.1	14.5	0.9	IS	18.1	11.9	15.8	12.3	0.8
38	60/M	IO	19.1	20.9	19.7	17.3	1	IO	19.6	19.6	19.2	16.7	1
39	53/M	IO	14.2	15.7	19	15.3	0.9	IO	13.7	13.3	18.5	14.6	1
40	55/F	IS	15.5	16.8	12.6	12.4	1	IS	13.2	14.7	18.9	12.6	0.8
41	49/M	SUP	13	15.1	11.7	11.3	0.7	SUP	9.4	12	14.1	12.3	0.9
42	47/M	IS	11.8	10.8	10.9	12.1	1	IS	13.1	14.2	10.5	12.6	1.1
43	50/F	IS	15.6	16.2	16.9	14.9	1	IS	19	17.1	17.5	15.4	1.3
44	48/F	IS	10.4	12.5	12.1	12.9	0.8	IS	12.6	13.7	10.2	13.7	0.9
45	57/M	IS	15.1	13.7	14.4	11.2	0.6	IS	13.3	15.02	14.5	10.5	0.8
46	58/M	IO	12.9	8.9	12.5	16.4	1	IO	13.2	13	13.7	15.5	1.2
47	53/M	IS	21.8	19.7	17.5	17.3	0.9	IS	22.7	15.2	14.3	16.9	1
48	55/F	IS	12.1	13.2	18.3	17.6	1.2	IS	11.6	17.8	21.7	18.4	1
49	52/F	IS	12.1	12.5	13.2	14.3	0.8	IS	17.4	16.7	15.9	14.8	0.5
50	60/F	IS	10.9	11.5	11.9	12.8	0.9	IS	12.8	15.7	16	14.3	1

51	57/F	IO	11.4	14.6	13.9	14.5	1	IO	10.7	13.3	13.9	13.5	0.9
52	54/M	IS	14.4	18	18.2	13.9	0.9	IS	17.7	17.4	19	16.4	1
53	52/F	IS	15.7	16.2	15.9	14.3	1	IS	15	15.4	15	12.4	0.9
54	49/M	IS	14	14.9	13.4	13.4	1.2	IS	10.4	14.2	17	13.2	1
56	50/F	IO	16.2	16.1	17.6	15.4	0.9	IO	15.5	16.3	17.5	16.7	1
57	52/F	IS	12.6	14.1	18.3	17.3	1	IS	13	15.1	11.7	11.3	0.8
58	47/M	IS	14.1	12.8	13.6	14.2	0.8	IS	10.7	11.4	11.9	10.5	0.9
59	48/M	IS	16.3	11.5	14.2	13.2	1.2	IS	16.1	20.2	16.4	15.2	1
60	50/M	IO	13.2	11	13.2	13.8	0.8	IO	13.5	12.3	13.7	14.5	0.9
61	59/M	IS	21.9	19.9	19.3	16.5	1	IS	20.1	19.4	18.6	16.3	0.8
62	49/F	IS	16.7	14.9	15.1	14.2	0.8	IS	13.3	15.3	14.9	13.5	1
63	53/F	IS	11.5	10.7	10.4	9.8	0.9	IS	15.9	15.5	14.7	13.7	1
64	56/M	IS	17.1	16.3	17.6	14.9	1	IS	16.1	17.3	17.8	16.8	0.9
65	59/F	IS	14.2	12.2	10.3	13.8	0.8	IS	16.3	12.8	13	13.8	0.7
66	48/M	IS	15.1	16.1	15.5	15.7	1	IS	14.6	16.8	16.1	14.9	0.9
67	60/M	IO	19.6	12.5	18.5	14.2	0.8	IO	14.2	12.3	14.1	13.7	1
68	51/M	IS	15.2	16.6	16.8	14.5	1	IS	17.8	16.5	16.3	15.3	0.9
69	60/F	IS	14.1	13.4	10.6	14.6	1	IS	14.3	16.2	16.5	15.3	1
70	49/M	IS	12.1	12.5	13.2	14.3	0.8	IS	12.8	15.7	16	14.3	1
71	50/F	IS	15.1	17.4	25.2	16.4	1	IS	14.6	15.2	17.1	17.4	1.3
72	46/M	IS	10	11.1	12.5	13.2	1	IS	7.5	12.5	9.9	12.8	0.9
73	48/M	IO	9.8	10.2	14.6	14.3	0.9	IO	13.4	9.8	14.1	13.2	0.7
74	49/F	IS	12	15.5	15.7	16.1	0.7	IS	11.1	16.5	13.9	14.9	0.9
75	53/M	IS	10.6	10.8	9.8	13.2	1	IS	14	11.9	13.8	12.4	1.3
76	52/F	IS	13.4	11.4	16.8	11.6	0.8	IS	11.7	11.1	10.1	11.7	1
77	51/M	IS	15.2	16.6	18.4	15.7	0.9	IS	17.8	16.5	18.7	16.4	0.8
78	60/M	IS	14.1	13.4	12.6	14.8	1	IS	14.3	17.1	17.9	11.6	0.9

79	49/M	IS	16.2	12.7	16.5	14	0.9	IS	16.5	11.9	13.6	11.6	1
80	54/F	IS	13.1	12.9	15.3	16.2	1.2	IS	13.5	14.2	15.9	12.6	1
81	47/M	IS	10.7	12	13.1	13.7	0.6	IS	11.3	10.7	9.8	11.8	0.9
82	49/F	IS	11.2	10.8	16.9	14.3	1.3	IS	10.2	12	12.6	13.7	1
83	54/M	IO	12.8	17.6	24.3	16.6	1	IO	11.6	15.4	22.1	17.6	0.8
84	56/F	IO	12	14.7	14.5	15.2	1	IO	12.5	15.6	16.2	15.7	1.2
85	51/F	IS	15.1	16.1	16.4	15.7	0.8	IS	16.7	17.5	18.6	15.7	0.9
86	46/F	IO	15.9	16.8	15.2	14.3	1.2	IO	15.4	15.1	16.1	13.8	1
87	47/M	IS	12.2	13.7	12.1	11.6	0.8	IS	12.5	12.1	13.1	11.2	0.7
88	49/M	IO	13.5	12.6	13.9	15.5	1	IO	11.1	11.2	14.5	15.4	1.2
89	45/M	IS	15.1	13.2	13.5	15.4	1.2	IS	15.6	14.3	16.5	16.2	1
90	54/F	IS	13.3	14.9	12.5	15.5	1	IS	15.9	14.2	14	15.3	0.8
91	49/F	IS	16.2	15.5	15.8	15.9	0.9	IS	14.8	15.1	15.2	15.6	1.2
92	56/F	IO	14.8	14.6	15.3	13.9	0.7	IO	15.1	13.1	14.2	10.5	0.9
93	46/M	SUP	11.6	12.4	13.1	13.5	1.1	SUP	13.5	13.9	12.9	12.3	1
94	60/F	IS	12.3	13.6	13.2	14.3	1	IS	10.7	12.1	11.7	13.5	1.2
95	53/F	IS	14.1	13.5	12.6	10.9	1.1	IS	13.1	11.4	10.2	12.3	1.1
96	48/M	IO	13.3	12.5	14.9	13.1	1	IO	11.4	12.2	14.3	13.7	0.9
97	46/M	IS	13.1	13.6	13.2	11.1	0.7	IS	10.3	12.7	13.8	11.2	0.8
98	49/F	IS	11.3	12.1	12	14.2	0.9	IS	12.5	13.6	15.3	13.2	0.9
99	52/F	SUP	10.8	12.5	11.5	13.7	1	SUP	11.8	11.3	13.7	13.3	1.2
100	58/M	IS	14.1	14.3	13.8	12.4	0.7	IS	13.1	14.2	14.5	12.5	0.7
101	47/M	IS	11.6	12.4	12.7	11	0.8	IS	11.5	12.4	13.4	14.6	1.1
102	54/F	IS	13.6	14.2	13.7	14.8	0.9	IS	11.1	11.5	12.1	15.2	1
103	59/M	IS	11.3	12.4	13.1	12.9	1	IS	12.3	13.4	13.2	11.6	0.9
104	46/F	IS	14.6	14.3	13.1	13.3	0.9	IS	14.7	13.6	13.1	14.4	1
105	54/F	IO	11.6	12.4	12.6	11.1	1	IO	13.9	12.4	10.7	12.1	1

106	48/F	IS	14.4	13.1	12.3	13.4	1.2	IS	14.1	12.7	11.2	11	1
107	60/F	IS	12.3	11.1	11.4	14.9	1	IS	11.4	13.2	12.2	14.1	0.9
109	52/M	IS	10.2	10.7	11.4	13.4	0.9	IS	11.3	10.9	10.5	10.4	1
110	48/M	IS	11.5	10.4	14.7	12.8	1	IS	12.4	12.6	12.3	10.6	0.8
111	59/M	IO	10.3	11.6	14.1	14.8	0.8	IO	11.3	12.4	12.7	14.2	1
112	60/F	IS	12.1	11	12.3	11.1	1	IS	13.4	12.2	11.9	10.7	0.9
113	46/M	SUP	10.9	11.5	12.4	15.3	0.9	SUP	11.6	12.2	12.4	14.6	1
114	55/F	IS	11.5	12.2	12.9	10.7	1	IS	11.4	12.4	12.5	13.2	1
115	60/F	IS	10.3	9.5	10	9.5	0.9	IS	10.2	10.7	11	10.1	0.7
116	56/M	IS	12.4	13.2	12.8	15.1	1.2	IS	11.4	12.3	13.7	14.8	1
117	52/M	IS	14.2	13.5	12.3	16.2	1	IS	14.3	14.1	15.7	15.6	1.2
118	58/F	IS	11	12.6	12.2	10.4	0.8	IS	10.5	11.1	11.6	10.5	1
119	60/F	IS	11.8	12.1	12.5	13.2	0.9	IS	12.4	11.8	11.3	12.9	0.8