

**CLINICALLY OBVIOUS FACIAL ASYMMETRY AND PALATAL FORM-
A CORRELATIVE STUDY**

Dissertation

Submitted to

BABU BANARASI DAS UNIVERSITY,

LUCKNOW, UTTAR PRADESH

In the partial fulfilment of the requirements for the degree

of

MASTER OF DENTAL SURGERY

In

ORTHODONTICS AND DENTOFACIAL ORTHOPAEDICS

By

Dr. Akansha Chauhan

Under the guidance of

DR. ROHIT KHANNA

PROFESSOR

HEAD OF DEPARTMENT

Department of Orthodontics and Dentofacial Orthopaedics

BABU BANARASI DAS COLLEGE OF DENTAL SCIENCES, LUCKNOW

(Faculty of Babu Banarasi Das University)

YEAR OF SUBMISSION: 2022

BATCH: 2019-2022

DECLARATION BY THE CANDIDATE

I hereby declare that this dissertation entitled “**CLINICALLY OBVIOUS FACIAL ASYMMETRY AND PALATAL FORM- A CORRELATIVE STUDY**” is a bonafide and genuine research work carried out by me under the guidance of *Dr. Rohit Khanna*, Professor, Head of Department, Department of Orthodontics and Dentofacial Orthopaedics, Babu Banarasi Das College of Dental Sciences, Babu Banarasi Das University, Lucknow, Uttar Pradesh.

Date: 30/03/2022

Place: Lucknow

Dr. Akansha Chauhan

CERTIFICATE BY THE GUIDE

This is to certify that the dissertation entitled “**CLINICALLY OBVIOUS FACIAL ASYMMETRY AND PALATAL FORM- A CORRELATIVE STUDY**” is a bonafide work done by **Dr. Akansha Chauhan**, under my direct supervision and guidance in partial fulfilment of the requirement for the degree of MDS in Orthodontics and Dentofacial Orthopaedics.

Date: 30/03/2022

Dr. Rohit Khanna

Professor

Head of Department

Department of Orthodontics &

Dentofacial Orthopaedics

BBDCODS, BBDU

Lucknow

ENDORSEMENT BY THE HOD / HEAD OF THE INSTITUTION

This is to certify that the dissertation entitled “**CLINICALLY OBVIOUS FACIAL ASYMMETRY AND PALATAL FORM- A CORRELATIVE STUDY**” is a bonafide work done by **Dr. Akansha Chauhan** under the supervision of **Dr. Rohit Khanna**, Professor & Head, Department of Orthodontics and Dentofacial Orthopaedics, Babu Banarasi Das College Of Dental Sciences, Babu Banarasi Das University, Lucknow, Uttar Pradesh.

Dr. ROHIT KHANNA

Professor & Head
Department of Orthodontics &
Dentofacial Orthopaedics
BBDCODS, BBDU
Lucknow

Dr. PUNEET AHUJA

Principal
BBDCODS, BBDU
Lucknow

COPYRIGHT

DECLARATION BY THE CANDIDATE

I hereby declare that the **Babu Banarasi Das University** shall have the rights to preserve, use and disseminate this dissertation in print or electronic format for academic / research purpose.

Date: 30/03/2022

Place: Lucknow

Dr. Akansha Chauhan

The satisfaction and euphoria that accompany the successful completion of a task could be incomplete without the mention of the people who made it possible. I owe my immense respect to almighty God for living in my heart, inspiring me for noble values in life and for his divine blessings.

*It is my privilege and honour to express my most sincere and heartfelt thanks to my head and guide , **Dr.Rohit Khanna**, MDS, Professor & Head, Department of Orthodontics and Dentofacial Orthopaedics, Babu Banarasi Das College of Dental Sciences, Lucknow, for her co-operation and continuous help rendered during preparation of this dissertation. Her unflinching courage and conviction will always inspire me, and I hope to continue to work with her noble thoughts. I can only say a proper thanks to her through my future work. It is to her, that I dedicate this work.*

*I take this opportunity to express my profound gratitude and heartfelt thanks to **Dr. Tripti tikku** , MDS, Professor, Department of Orthodontics and Dentofacial Orthopaedics, Babu Banarasi Das College of Dental Sciences, Lucknow, for his expert guidance, personal attention and encouragement in preparing the dissertation.*

*I am also thankful to **Dr. Rana Pratap Maurya**, MDS, Reader, **Dr. Sneh Lata Verma**, MDS, Reader, **Dr Kamna Srivastava**, MDS, Reader, **Dr. Shweta Pandey** MDS, Senior Lecturer, **Dr. Srishti Aditi** MDS, Senior Lecturer, **Dr. Prateek Asthana** and **Dr. Abhimanyu** MDS, Senior Lecturer of Department of Orthodontics and Dentofacial Orthopaedics, Babu Banarasi Das College of Dental Sciences, Lucknow, for their valuable suggestions, time to time guidance, encouragement and constant moral support during the period of my study. Without their support nothing would have been possible for me. It was their understanding, valuable suggestions, unstinted help and personal attention that have provided good and smooth basis for this work.*

*I am really thankful to my parents **Mr. Rajkumar Chauhan and Mrs. Veerbala Chauhan and Mrs. Anoopi Devi** for their love and constant support throughout my life. Thank you for giving me sincere encouragement and inspiration throughout my research work and for giving me strength to reach for the star and chase my dreams. I owe you everything guys. Without your blessings it would never have been possible.*

*A special thanks to **Ayaan Sethi, Aakshi Chauhan, Mohit Sethi , Dr. Mayank Chauhan and Dr. Shweta Chauhan** for all his time, moral support and standing like a pillar side by side to bring this an end.*

*I would also like to thank my seniors and all my colleagues **Deepak Chandra ,Noor Zaman, Tanjula shair, Rigzing O. Lepcha Namka and Deepa Soni** for their help and encouragement throughout my work. I would also like to express my gratitude to all my juniors who helped me directly or indirectly in bringing the dissertation to completion.*

*My special appreciation goes to my juniors **bhanu, Minerva ,senapati sir, swagat, Kamran, sweety ,Aliya ,monica, sheeren, sarbajit and Jaya maam** for their constant support and help in all my work and bringing the dissertation to completion.*

*Last but not the least I would like to extend my special thanks to my friends **Yashika Singh Patel** who have shared intellectual support, assistance, suggestions and recommendations that contributed to the making of this dissertation a success.*

*I also acknowledge the assistance rendered by the paradecimal staff in the department, **Mr Surender and Mr. Narendra.***

Finally, I would like to thank all other unnamed who helped me in various ways. I would like to thank each and everyone....

Dr. Akansha Chauhan

TABLE OF CONTENTS

S. No.	CONTENTS	PAGE NO.
1.	ACKNOWLEDGEMENT	I–II
2.	TABLE OF CONTENTS	III
3.	LIST OF FIGURES	IV
4.	LIST OF TABLES	V
5.	LIST OF GRAPHS	VI
6.	LIST OF ANNEXURES	VII
7.	LIST OF ABBREVIATIONS	VIII
8.	ABSTRACT	IX
9.	INTRODUCTION	1–4
10.	AIM AND OBJECTIVES	5
11.	REVIEW OF LITERATURE	6–14
12.	MATERIALS AND METHODS	15–30
13.	OBSERVATION AND RESULTS	31–34
14.	DISCUSSION	35–46
15.	CONCLUSION	47
16.	SUMMARY	48–49
17.	BIBLIOGRAPHY	50 – 56
18.	ANNEXURES	57

Figure no:	Title of the Figure	Page
1	For Clinical Examination	17
2	DSLR Camera	17
3	For Study Models	18
4	For Hand Tracing On PA Ceph	19
5	Frontal Photograph	20
6	Photo Transferred into IC Measure Software	21
7	1. Interpupillary Line, 2. Glabella and 3. Soft Tissue Menton	21
8	Position of Patient For Taking Posteroanterior Cephalogram	22
9	Posteroanterior Cephalogram Transferred To Nemotec Software	23
10	Hard tissue cephalometric landmarks use in this study: 1- Zygomatic arch (ZA), 2-Anterior nasal spine (ANS), 3- Menton (Me)	24
11	Tracing with Ricketts Analysis (Maxillomandibular Midline)	24
12	Manipulation of Alginate	25
13	Impression Taking	26
14	Recording Palatal Depth	27
15	Recording Transverse Position of Maxillary First Molar	28

Table No.	Title of the Table	Page
1	Descriptive statistics of comparison between maxillomandibular midline shift between Group I and Group II	31
2	Descriptive statistics of comparison between palatal depth of Group I and Group II.	32
3	Descriptive statistics of comparison between distance of mesiopalatal cusp tip of maxillary first molar to midline of right and left side on study model	32
4	Descriptive statistics of comparison between distance of mesiopalatal cusp tip of maxillary first molar to midline of right and left side on Posteroanterior cephalogram.	33
5	Descriptive statistics of comparison between facial asymmetry and palatal depth	34

Graph No:	Title of the Graph	Page
1	Comparison between maxillomandibular midline shift between Group I and Group II	38
2	Comparison between palatal depth of Group I and Group II.	38
3	Comparison between distance of mesiopalatal cusp tip of maxillary first molar to midline of right and left side on study model between Group I and Group II.	39
4	Comparison between distance of mesiopalatal cusp tip of maxillary first molar to midline of right and left side on Posteroanterior cephalogram	40

S. No.	TITLE OF ANNEXURE
1.	Institutional Research Committee Approval
2.	Ethical Committee Approval
3.	PID – English and Hindi
4.	Consent form – English and Hindi
5.	Plagiarism Certificate
6.	Master Chart - Group I and Group II

S.NO.	ABBREVIATIONS	FULL FORM
1.	PA	Posteroanterior
2.	DSLR	Digital Single Lense Reflex
3.	ANS	Anterior Nasal Spine

AIM : To evaluate and compare the correlation between clinically obvious facial asymmetry and palatal form in North Indian population.

MATERIALS AND METHODS: The Postero-anterior cephalogram (PA ceph) and study models of 50 subjects of North Indian population who had clinically obvious facial asymmetry as seen on frontal photographs were selected and divided into two Groups – Group I had 50 subjects (obvious facial asymmetry) and group II had 25 subjects (non obvious facial asymmetry). For evaluation of facial asymmetry, the postero-anterior cephalograms were analysed using Rickett's frontal analysis on Nemotec software program , on study model palatal depth and transverse position of molar was checked and hand tracing was also done on postero-anterior cephalogram to check transverse position of molar. The data obtained were analysed statistically.

RESULTS: When comparison of various parameters between Group I and Group II was done, it was found that Group I had menton offset greater than 2mm as compare to Group II, which is less than 1mm. The total facial structure was larger on the right side. The palatal depth of Group I and Group II show high statistical significance with palatal depth more in Group I. On study model, the transverse position of maxillary molar on right side in Group I and Group II is highly statistical significant, whereas on left side it is not statistically significant. Transverse position of maxillary molar on postero-anterior cephalogram on right and left side show statistical significant difference in both Group I and Group II.

CONCLUSION: Facial asymmetry increases as we go away from midline. Laterality of facial asymmetry was evident with deviation towards right side. The palatal depth was found to be more in Group I. For study model and posteroanterior cephalogram the findings was quiet similar.

INTRODUCTION

Symmetry is defined as an equality or correspondence in form of parts distributed around the center or an axis at the two extremes or poles or on the two opposite sides of the body¹, the word symmetry is derived from the Greek word *symmetria* which means 'of like measure'. Lack or absence of symmetry is described as an Asymmetry. When applying this to the human face, it illustrates an imbalance between the right and left sides. A degree of asymmetry is not abnormal and is acceptable in the average face. It may be caused by a range of elements that affects the underlying skeletal structure or soft tissue drape. However, due to biological factors inherent to processes development as well as environmental disturbances, perfect bilateral symmetry is rarely found².

Facial asymmetries are imbalances that occur between homologous parts of the face affecting the proportion of these parts to one another with regards to size, form and position on opposite sides of the plane, line, or point. Asymmetries exist in orthodontics as well as non-orthodontic individuals. Asymmetry is characterized by a shift of the midline, a difference in facial height between sides, a difference in facial width between sides, or a combination of two or more of these qualities.¹⁸

Cheong and Lo² stated that the causes of facial asymmetry can be grouped into three main categories: congenital, of prenatal origin; acquired, resulting from injury or disease; and developmental, arising during the development and of unknown etiology.

Chia SY¹⁹ reported causes of mandibular asymmetry can be divided into Developmental, Pathological, Traumatic and Functional.

As there is bilateral development of human face hence developmental processes and environmental disturbances can influence the symmetrical development of bilateral structures. Face become more asymmetrical when we move away from facial midline and when we move from cranial to caudal region³⁻⁵.

In the literature, a number of causal factors have been highlighted in the development of facial asymmetries. Melnik AK et al, investigated changes in mandibular symmetry according to the age and sex, the mean value of the asymmetry was 1.6 mm by the age of 16 years, 5% to 10% of the children at this age had asymmetries >5 mm.¹²

Liukkonen M et al, assessed mandibular asymmetry in healthy children and its possible fluctuation during growth. The results confirm that healthy young subjects generally have a statistically significant mandibular asymmetry.¹³

As population differences were seen in laterality of facial asymmetry, in the study conducted on south indian population by Taneja VK²⁰, found facial asymmetry with the left side being larger than the right side, whereas in the study done by Shah SM et al¹⁴ in Ahmedabad population, Chebib FS et al¹⁵ in Canadian population and Rajpara et al¹⁷ in Udaipur population found total facial structures were significantly larger on the right side than on the left side.

Facial asymmetry may be associated with normal malocclusion with a greater tendency towards dental arch asymmetries in individuals with Angle Class II and or Class III malocclusions. Scanavini PE, investigated that Class I malocclusion had less facial asymmetry as compare to Class II div 1 and div 2 malocclusion.¹⁶

Clinically obvious facial asymmetry as seen in the soft tissue will also be reflected in underlying hard tissue. Beside congenital and acquired causes, muscular imbalance and habitual chewing on one side has been quoted as the most important reason for development of facial asymmetry⁶.

Considering maxilla, right and left halve of the palate develops separately and mid palatine suture between them fuses at around 18-20 years of age. The causes of

variation of the palatal form had been attributed for unequal growth of two halves of the palate, low descent of antrum, faulty readjustment of pre-maxillae and malocclusion of teeth⁷.

Before complete ossification of the mid palatine suture, right and left halves of the palate are under influence of soft tissue particularly muscles of facial expression and muscles of mastication etc.

Skeletal open bite and long face have been associated with a high and narrow palatal vault, whereas skeletal deep bite and short face with a shallow and wide palate

It might be expected that muscular imbalance causing facial asymmetry may also influence the palatal form. Though association of palatal form had been evaluated in different types of malocclusion⁸, in mixed dentition phase⁹, different facial form¹⁰, and different populations¹¹ but correlation between clinically obvious facial asymmetry and palatal form had not been evaluated in literature.

Nahidh M et al¹ compared the palatal dimensions (width, length, height) in different occlusal relationships and he found Class I subjects had the largest palatal width and depth while Class II subjects had the largest palatal length. Class I males and Class III females had the largest palatal width than other classes. Class III females and Class II males had the largest palatal depth than other classes. Zaaba et al²¹ evaluated association between maxillary arch form, and length, width and depth of palate in Malaysian and Indian population and he found tapered arch form and low palate were common in both the population groups.

Alongwith the clinical assessment, the radiographic techniques most used for evaluation of facial asymmetries is frontal cephalograms, among other radiographs.

The frontal or posterior-anterior cephalograms has advantage of positioning the subject in a fixation device thereby allowing image reproduction of high accuracy.

Considering this aim of the present study is to correlate clinically obvious facial asymmetry with palatal form on postero anterior cephalogram.

AIM & OBJECTIVE

Aim

Clinically Obvious Facial Asymmetry And Palatal Form- A Correlative Study

Objectives

1. To evaluate facial asymmetry on Postero-anterior (PA) cephalogram for selected subjects.
2. To evaluate palatal form on study models of selected subjects.
3. To correlate facial asymmetry as evaluated on PA cephalogram to palatal form.

REVIEW OF
LITERATURE

Vig PS, Hewitt AB (1975)³⁷ evaluated 63 postero-anterior cephalogram of “normal” children of 9-18 years of age with an aim to assess facial asymmetry. In their study, the axis representing the midline third of the face was found to be deviating to the left of the axis representing the lower third of the face in the 67% of subjects. An overall asymmetry was found in most of the children with the left side being larger. The dento- alveolar region exhibited the greatest degree of symmetry. They concluded that compensatory changes seem to operate in the development of the dento-alveolar structures.

Shah SM, Joshi MR (1978)¹⁴ conducted a study on posteroanterior cephalometric radiographs of 43 subjects to evaluate the degree of facial asymmetry having clinically symmetrical and pleasing facial features with normal occlusion. The total facial structures were significantly larger on the right side than on the left side. The lateral maxillary region exhibited greater degree of asymmetry than other components of the face.

Chebib FS, Chamma AM (1981)¹⁵ conducted a study on 64 subjects (32 male and 32 female) of Canadian population using PA ceph. They measured indices to assess craniofacial asymmetry using mid sagittal axis and lateral axis on PA ceph. All the midline structure would fall on the Maxis (Mid sagittal axis), a larger left side of the face was seen compared to the right. The specific indices of the bilateral craniofacial structure showed no significant asymmetry in the orbital region.

Farkas LG, Cheung G (1981)²³ conducted a study on 308(154 boys and 154 girls) of North American population using Anthropometry to evaluate a degree of subtle asymmetry that can be expected in all of us. They found asymmetry was found to be

very common, but average difference right and left measurements were mild (3mm or 3%), with right side usually the largest and in the upper third of the face (69.2%) and the right side was much longer than the left. Sex and age did not influence the prevalence of asymmetries significantly.

Peck S, Peck L, Kataja M (1991)³⁶ consisted of 52 white adult subject (49 female and 3 male) on PA ceph and photographs to evaluate skeletal asymmetry in esthetically pleasing faces. Each subject was positioned in a Margolis cephalostat for standardized x-ray and photographic records. 3 frontal facial line were constructed using bilateral skeletal landmarks first latero superior object second lateral zygoma and gonion. A slight tendency towards right side than left side was not statistically significant.

Ferrario VF, Sforza C, Pizzini G, Vogel G (1993)⁴³ evaluated size and shape difference in males and females using Euclidian distance matrix analysis on photographs of 108 healthy young adults (57 men and 51 women) were taken. It was found that males face was larger than females and the face was longer in males than females. A global shape difference was demonstrated, the male face being more rectangular and the female face more square. Gender variations involved especially the lower third of the face and , in particular, the position of the pogonion relative to the other structures was seen.

Ferrario VF , Sforza C, Miani A and Serrao G (1994)³² studies facial asymmetry in 80 young healthy adults (40 men and 40 women) using 3 dimensional coordinates of 16 standardized facial landmarks as measured by infrared photogrammetry. He concluded that right side of the face was larger than left side. The mean faces of both groups were significantly asymmetric i.e. two side of the face showed significant difference in shape but no difference in size.

Severt and Proffit 1997)⁴⁴ conducted a retrospective study of a referred population in the university of North Carolina where 1460 patients with dentofacial deformity were assessed with respect to facial asymmetry. It was found that 34% of the sample had a clinically detectable asymmetry that had been identified and recorded in their patient notes prior to treatment. Asymmetries affecting the upper face occurred in only 5% of their sample, 36% had asymmetry of the mid-face and 74% had asymmetry of the mandible. Furthermore it was concluded that individuals with a class II skeletal bas were least likely to have facial asymmetry.

Meintyre GT and Mossey PA (2002)³⁵ evaluated size related right:left asymmetry in parents of children with orofacial clefts using PA ceph and Conventional cephalometric asymmetry nalysis and morphometric asymmetry analysis were done. Wider hemiface on left side and shorter vertical dimension on right side were seen both in parents and children suggestive of heritable directional craniofacial skeletal asymmetry.

Goel S, Ambekar A, Darda M, Sonar S (2003)³¹ investigated the transverse frontal facial asymmetry seen in different malocclusion using frontal asymmetry analysis suggested of Grummons using postero anterior cephalogram of 120 subjects. In their study they found asymmetries were seen in all types of malocclusion , mandibular region showed the asymmetries of highest magnitude and asymmetries decreased as they approach higher in craniofacial skeleton.

Zaidel DW, Cohen JA(2005)⁴⁵ evaluated facial asymmetry in beautiful faces on photographs of ‘ beautiful’ faces from the collection of professional modeling agencies. The relationship between bilateral facial symmetry and beauty remains to be clarified were selected. First, beauty ratings were obtained for these faces. Then, they

created symmetrical left-left and right-right composites of the beautiful faces and asked a new group of subjects to choose the most attractive pair member. Same responses were allotted. No difference between the left-left and right-right composite was revealed but significant differences were obtained between same and the left-left or right-right. These results show that subjects detected asymmetry in beauty and suggest that very beautiful faces can be functionally asymmetrical.

Ercan I, Ozdemir S T, Etoz A (2008)⁴⁶ tried to identify normal facial asymmetry between the right and left sides of the face using Euclidean distance matrix analysis. Facial landmark data were collected from two dimensional digital images of 321 young healthy subjects (150 males and 171 females). They found that the left side of the face was larger in both males and females. The number of significantly asymmetric linear distances between the two halves of the face were found and differences were greater in females than in males.

Cheong YW, Lo LJ(2011)² discussed subclinical asymmetry, its etiology, assessment of soft tissues, dental and skeletal components contribution, and management of facial asymmetry. They stressed that patients' perceptions of facial asymmetry and real exceptions from treatments must be assessed before finalizing the treatment plan.

Hwang HS, Yuon D, Jeon H, Uhm (2012)⁴⁷ conducted a study with an aim of identifying the right and left difference in the facial soft tissue landmarks seen on computed tomography scans of 48 subjects (24 men, 24 women) with normal occlusion. In this study 27 soft tissue landmarks were identified in 3D coordinate system and their right and left differences were determined. The right and left difference value showed a tendency to increase as we proceed towards the lower part of the face or move laterally from the midline. Overall differences were determined not only in transverse

plane but also in sagittal and vertical plane, indicating that 3D evaluation would be essential in the facial soft tissue analysis.

Smith VM(2014)⁴⁸ conducted a study of 90 subjects(45 males and 45 females) of Dartmouth undergraduates on photographs using CANVAS software. This program calculated areal, linear, perimetric and angular measures once appropriate makers are placed on an image. He calculated area of right and left hemiface below interpupillary line, he found that the left hemiface was larger than that for the right hemiface in males, the deifference being .13sq cm (3.8%) and the variation among males in this respect was from.3 to 14.2 % and for the females the right hemiface mean was larger by0.9sq.cm. (2.7%) and the variation among females in this respect was .6-12.8%

Moshkelgosha V , Fathineja S (2015)⁴⁹established angular and linear photogrammetric norms for aesthetic treatment goals in 24 subjects (110 females and 130 males) aged 16-18 years of Persian population. The photographic records were analysed using a aesthetic analyser software program. 43 facial indices records were calculated digitally by computer software. Mouth width and nasal base width were significantly higher in males. The labial, nasal and chin showed sexual dimorphism in most of the parameters used in this study. They found that all participants showed right side laterality, in frontal measurements.

Skinazi GLS, Lindauer S, Issacson RJ (1994)⁵⁰ evaluated normal chin, nose and lips ratios in young men and women. They used surface landmarks only to define an area and soft tissue profile are analysed in terms of the surface area of each component part present within this area. The profile of 66 young adults were measured, and the mean total profile area and all of the component parts except the

nose were statistically larger in men than in females. The mean female nose was larger, but this difference was not significant.

Borod JC, Koff E, Yecker S , Santschi C(1998)⁵¹ conducted a study to examine 49 extant experiments of facial asymmetry during emotional expression in normal adults males and females in regard to gender , valence and measurement technique. When the facial asymmetry was evaluated by trained judges or muscle quantification, facial expression were left-sided, a finding implicating the right cerebral hemisphere in emotional expression. However, when self report experiential methods were utilized , the valence hypothesis received some support. Although there was some indications in single gender studies of greater facial laterilzation for males then for females.

Ferrario VF, Sforza C, Ciusa AV, Dellavia C(2001)⁵² assessed the effect of sex and age on 3D soft tissue facial asymmetry using an electromagnetic instrument. The midline landmarks used in this study were pronasale and menton and paired landmark used were exocanthus, endocanthus ,orbitale superior and gonion. The maximum normal asymmetry was slightly greater in females then in males of corresponding age, within each sex.

Haraguchi S, Lguchi Y and Takada K (2008)²⁸ investigated the laterality of the normal asymmetry of the human face , and examined difference in laterality in relation to sex, growth stage and skeletal classification using photographs. They concluded that the laterality in the normal asymmetry of the face which is consistently found in human is likely to be a hereditary rather than an acquired trait.

Fong JHJ, Wu HT, Huang MC, Chou YU, Chi LY , Fong Y (2010)⁵³ investigated the facial skeletal features associated with chin deviation (>2mm) on 25 subjects (14 males and 11 females) over the age of 15 years. The direction of the chin deviation

was significantly associated with the difference in the effective length of bilateral mandibular halves. Hence, it was concluded that facial asymmetry exists in patients with chin deviation and this should be considered when planning treatment for both the nonsurgical and surgico-orthodontic cases with chin deviation, 68% show deviation t left side then on right side.

Zaidel DW, Cohen JA(2005)¹² evaluated facial asymmetry on the photograph of beautiful faces taken from the collection of professional modelling agencies. Then, they created symmetrical left-left and right-right composites of the beautiful faces and asked a new group of subjects to choose the most attractive pair member. No differences between the left-left and right-right composites were revealed but significant differences were obtained between 'same' and the left-left or right-right. The result were found out that the beautiful faces can be functionally asymmetrical too.

Cheong YW, Lo LJ(2011)² discussed subclinical asymmetry, its etiology, assessment of soft tissue, dental and skeletal components contribution, and management of facial asymmetry. They stressed that patients perception of facial asymmetry and expectations from treatments must be assessed before finalizing the treatment plan.

Kim YM, Rha KS, Weissman JD, Hwang PH, Most SP(2011)¹³ compared the external and internal parameters of the face and whether their developmental differences are associated with non-traumatic deviated nasal septum. Five parameters (angle of septal deviation i.e ASD, angle of nasal floor i.e ANF, angle of lateral nasal wall i.e ALW, angle of inferior turbinate i.e AIT and width of IT i.e WIT) were measured. They found out that the difference between the right and left midsagittal

plane MSP-Zygion, glabella to exocanthion (G-Ex) and cheilon -Zygion(Ch-Zy) distance were significantly associated with the direction of septal deviation.

Nahidh M, Al-Khawaja NF (2012)⁸ compared the palatal dimensions (width, length, height) in different occlusal relationships. They found out that that Class I and II males had the largest palatal dimensions than females while Class III females had the largest palatal dimensions than males. Class I subjects had the largest palatal width and depth while Class II subjects had the largest palatal length. Class I males and Class III females had the largest palatal width than other classes. Class III females and Class II males had the largest palatal depth than other classes.

Taneja VK, Kumar GA, Farishta S, Minocha RC, Baiju G, Gopal D(2012)³ assessed the skeletal craniofacial asymmetry in south indian population using postero anterior radiographs. They found that the total facial structures were larger on the left side which was statistically insignificant. Also the cranial base structure was exhibited greater degree of asymmetry.

Maria CM, Silva AM, Busanello-Stella AR, Bolzan GD, Berwig LC (2013)⁹ investigated the correlation between quantitative and quantitative method of hard palate depth evaluation of children in their mixed dentition phase. In quantitative method, Palatal Height Index was calculated and the palate was classified as low, medium & high. The visual inspection of the plaster models was done in qualitative analysis by a speech therapist and classified as low, normal or increased. They concluded that the correlation between quantitative and qualitative methods of hard palate assessment was moderate.

Rajpara Y, Shyagali TR, Trivedi K, Kambalyal P, Sha T, Jain V(2014)⁴ studied the extent of facial asymmetry in individuals who had no visible facial asymmetry. They found out that skeletal asymmetries were common finding even in individuals who had normal facial features. Right sided dominance of the mandible was seen more. Moreover the mandible showed the left side deviation.

Reddy MR, Bogavilli SR, Raghavendra V, Polina VS, Basha SZ, Preetham R(2016)⁵ evaluated the prevalence of skeletal facial asymmetry in Tirupati population using both photographs and posteroanterior ceph of 100 subjects (50 males and 50 females). They analysed the soft tissue facial asymmetry by composite photographic analysis. The result was that all the participants showed mild asymmetry with right side laterality both in photographs and postero-anterior cephalogram

Zaaba (2018)¹¹ evaluated association between maxillary arch form, and length, width and depth of palate in Malaysian and Indian population. Tapered arch form and low palate were common in both the population groups.

MATERIALS

&

METHODS

This study was conducted in department of Orthodontics, BBDCODS. Patient reporting to department for orthodontic treatment. With an aim to evaluate and compare palatal form in 50 subjects of North Indian population with facial asymmetry as confirmed on digital photograph and PA ceph, approval was taken from Ethical Committee of Babu Banarsi Das College Of Dental Sciences, Babu Banarsi Das University, Lucknow before conducting this study, an informed consent was taken from all the participants of the study.

Materials :

Sample :

Sample selection was done after initial screening by clinical examination, measurements in digital photography and PA ceph.

A. Screening by clinical examination

70 subjects in the age range of 18-30 years reporting to the OPD of department of orthodontics BBDCODS and students of the college. The patient with chief complaint of obvious facial asymmetry on initial clinical examination were selected for the study.

Inclusion criteria:

- Adult patients with age range of 18-30 years to ensure complete growth of soft tissues.
- Patient with clinical obvious facial asymmetry.
- Patient who had not undergone fixed orthodontic treatment.

Exclusion criteria:

- Patients with history of trauma or surgery of craniofacial region.
- Patients who had multiple extraction of posterior teeth.
- history of any systemic illness.

Assessment of facial asymmetry on:

B. Digital photography

Digital photograph of extraoral frontal view was taken with white background for all subjects with same camera mounted on tripod stand and kept at a fixed distance of 6 feet to have uniformity in taking photographs.

Photographs were uploaded on laptop and frontal photo was cropped to selected dimension and facial asymmetry was analysed using IC measure software by measuring menton offset (>2mm).

C. Assessment of facial asymmetry on PA

60 subjects who had obvious facial asymmetry with menton offset >2mm on photographs were selected for PA ceph. Taking Ricketts frontal analysis parameter (maxillomandibular midline) using Nemotech software for confirmation of the finding. The subjects who had menton offset <2mm or were not willing to participate in study further were excluded.

A total of 50 subjects were finally selected as these with obvious facial asymmetry (menton offset >2mm on PA ceph) and maxillary impression was taken for thesis.

Materials:

- **For clinical examination:**
 - Diagnostic instruments.
 - Drape



Fig. 1: For Clinical Examination

- **For facial photographs:**
 - Camera (DSLR)
 - White board as background
 - Tripod stand
 - Computer with software (IC measure)



Fig. 2: DSLR Camera

- **For PA ceph**
 - Cephalostat machine (Planmeca proline XC) in Department of Oral Medicine and Radiology
 - PA cephalogram
 - Computer with Nemotech software.
- **For Study models**
 - Impression trays
 - Bowl
 - Spatula
 - Alginate
 - Orthokal



Fig 3. For Study Models

- **For analysis on study**
 - Thermoplastic sheet
 - Paper scale

- Micromotor
- Dics bur

- **For hand tracing on PA ceph**
 - View box
 - Pencil
 - Scale
 - Rubber
 - Sheet
 - Tape



Fig 4: For Hand Tracing On PA Ceph

Methodology

A. For clinical examination :

- Patient was made to sit on dental chair with back in upright position.

- Proper history of the patient if he/she feels facial asymmetry as his/her concern was taken or facial asymmetry was noted by operator during clinical examination.
- Clinical examination was done under proper illumination.

B. For taking digital photography and photography analysis:

- Patient were made to stand in an upright position against the white background. Frontal facial photographs of the patients was taken in natural head position with maximum intercuspation and relaxed lip posture using DSLR camera. The natural head position was achieved by asking the subjects to stand still, look straight in a mirror placed in front of them. The frontal facial photographs of all the patients were taken using DSLR camera placed at a distance of 6 feet from the patients faces and the camera was secured in a tripod stand.



Fig. 5: Frontal Photograph

- The frontal photograph were transferred into PC. All photographs were cropped in size of 5X3.5 inches. Each image was saved as JPEG (Joint Picture Editing Group) file that was identical in size and resolution. The selected and cropped frontal photographs were transferred to IC measure software for evaluation of photographs. Photographic landmarks were identified and were marked on the photograph and facial asymmetry was checked.

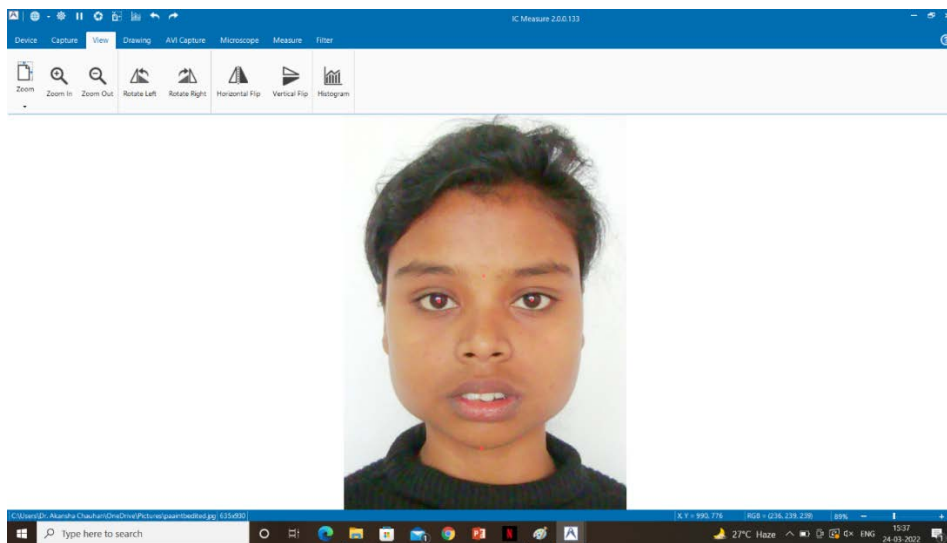


Fig 6: Photo Transferred into IC Measure Software

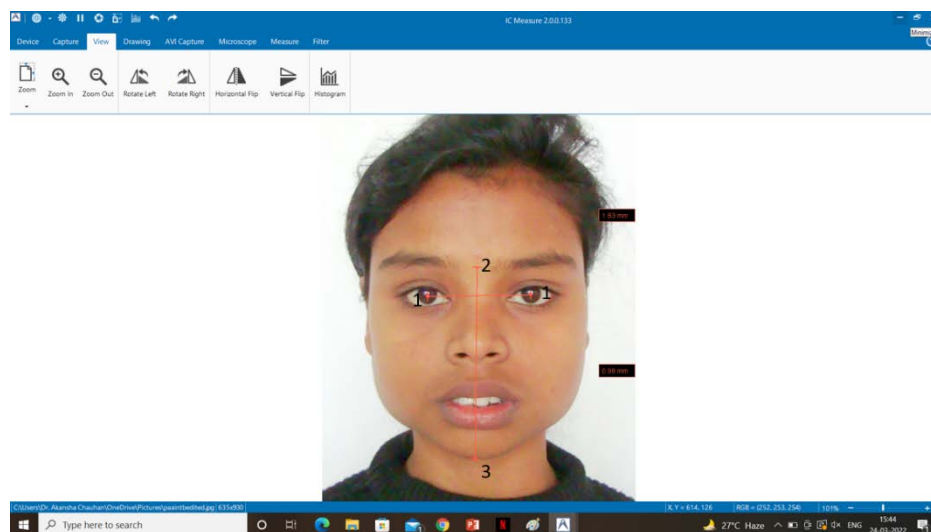


Fig 7: 1. Interpupillary Line, 2. Glabella and 3. Soft Tissue Menton

C. For PA ceph analysis using Nemotec software:

- Planmeca proine XC was used to take the PA of selected patients. The PA ceph was taken in natural head position with lips relaxed and teeth in centric occlusion. Natural head position is a standardized and reproducible orientation of head. The ear posts were used for correct alignment of the patients head for undistorted symmetrical image of the patient. The exposure values were set at 68Kv,5mA at 23 seconds exposure time.



Fig 8: Position of Patient For Taking Posteroanterior Cephalogram

- All the PA ceph were transferred to a computer loaded with Planmeca software from where the PA ceph were saved in bitmap files and taken in a CD ROM. The soft copies of all the PA ceph were transferred to Nemotec software program(Dental studio- NX, version 6.0).

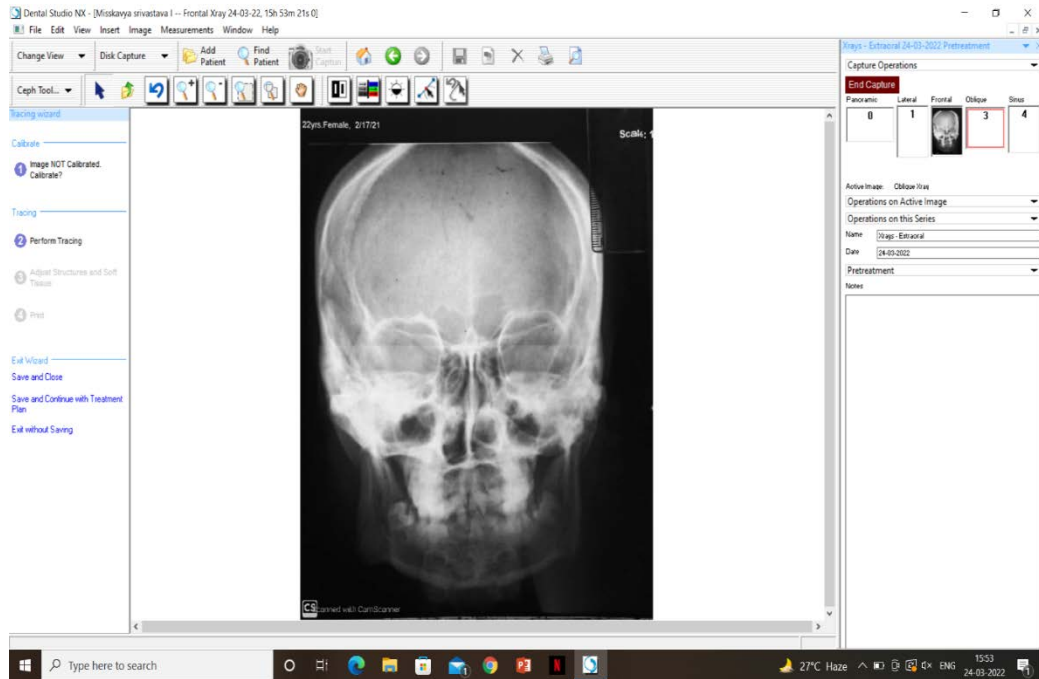


Fig 9: posteroanterior cephalogram transferred to Nemotec software

- The image were calibrated by identifying two crosshairs 10 mm apart on lateral cephalogram. The image enhancement feature of the software(basic an advanced cephalometric tools), like brightness, contrast adjustment and magnification were used to identify individual cephalometric landmarks as precisely as possible. The landmarks were marked with the help of cursor.

- **Following landmarks were used in the study(Fig 9)**

Hard tissue landmarks: (Fig- 9)

1. Zygomatic arch(ZA): center of the root of the zygomatic arch
2. Anterior nasal spine(ANS): tip of the anterior nasal spine above the hard palate and just below the nasal cavity.
3. Menton(me): the most inferior point on the mandibular symphysis.

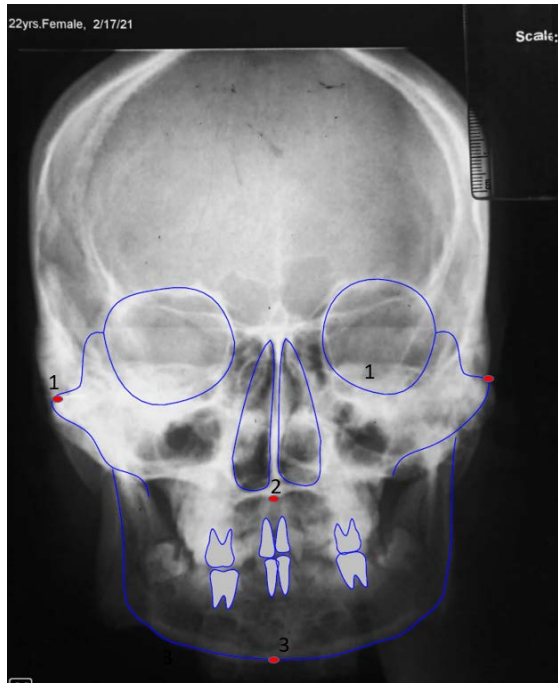


Figure 10:- Hard tissue cephalometric landmarks use in this study: 1-Zygomatic arch (ZA), 2-Anterior nasal spine (ANS), 3- Menton (Me)

Following hard tissue parameters from ricketts frontal analysis(maxillomandibular midline) were measured.

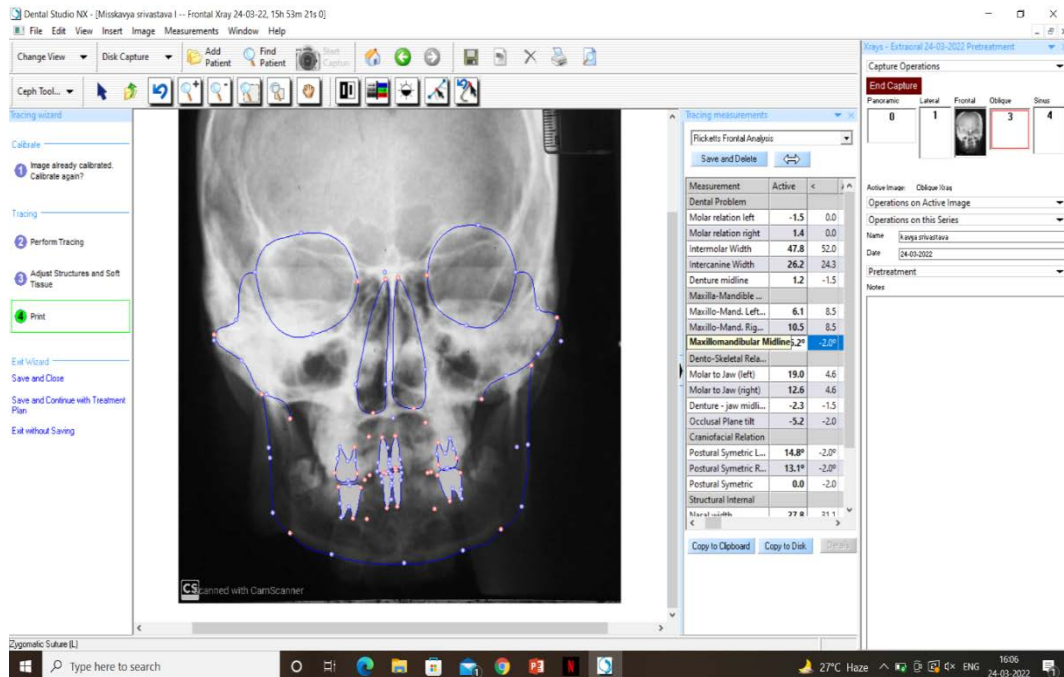


Fig 11: Tracing with Ricketts Analysis (Maxillomandibular Midline)

D. For study models:

1. Preparation of study model:

- Patient was sitted in an upright position so as to prevent gagging due to the backward flow of excess material into the throat. Impression tray was selected according to the jaw size. Alginate was manipulated according to recommended water powder ratio .The weighed powder is incorporated into the water by carefully mixing with the curved spatula.The alginate is manipulated by spatuating the mix against the side of the bowl while using the vigorous figure of 8 motion till a smooth creamy mix is obtained.

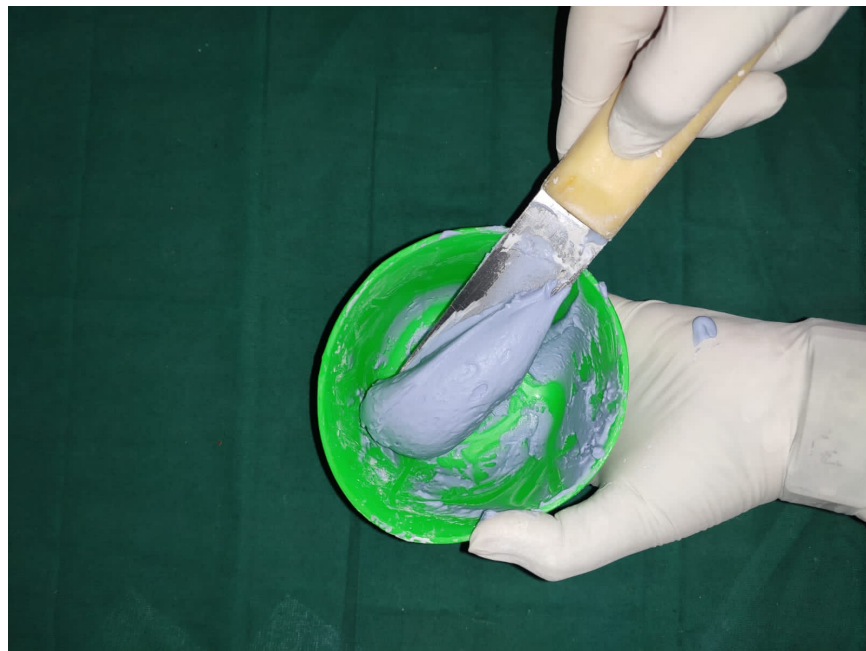


Fig 12: Manipulation of Alginate

- The alginate is loaded into the impression tray and is firmly placed inside patient mouth. After the alginate is set inside patient mouth it is taken out and is poured immediately with Orthokal. After the cast was dried and set, the cast was trimmed.

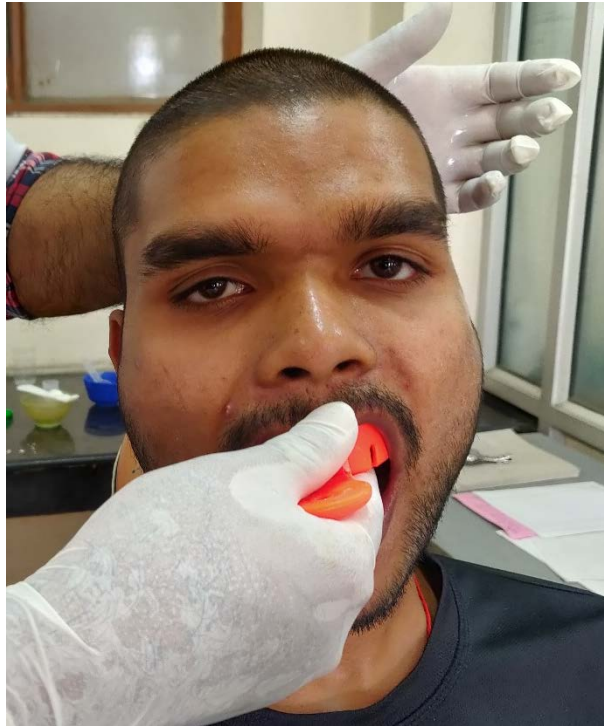


Fig 13: Impression Taking

2. Analysis on study model:

- Palatal depth and distance of maxillary molar to midline was measured on either side using new device devised for the study.

Palatal depth

- To measure palatal depth, new occlusal grid was devised for study. It was fabricated by following these steps:
 - (i) Thermoplastic sheet of 2mm thickening for vaccum press machine was taken.
 - (ii) It was cut to square of dimension 82x87cm using disc bur.
 - (iii) Sheet was split in midline till 45cm in length.
 - (iv) Paper scale (60cm) was cut and pasted horizontally approximately at $1/3^{\text{rd}}$ distance from one edge, perpendicular to midline cut.

- (v) Another plastic ruler was cut to length of 50 cm. The edge that will approximate palate was shaped curved.
- (vi) This scale was made to slide freely, vertically through midline cut from posterior edge of occlusal grid.
- (vii) Vertical depth was read while scale was sliding.
- (viii) The point where maxillary depth was seen was taken as palatal depth.

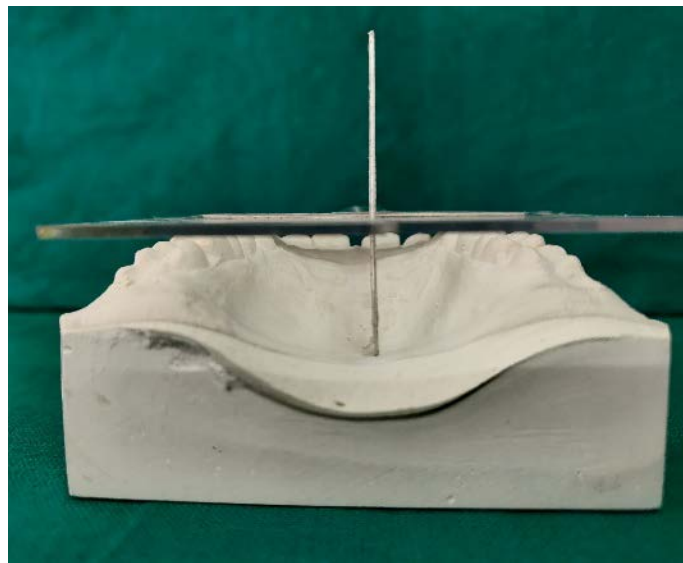


Fig 14: Recording Palatal Depth

Transverse Position of Maxillary Molars

- (i) Mesio palatal cusp tip was marked and horizontal scale was slid to that occlusal grid. Occlusal grid was placed in such a way that horizontal scale could be used to read a distance of tip of mesio palatal cusp tip of maxillary first molar to midline.
- (ii) This was done separately for both the side as maxillary molars might not be at same level horizontally.

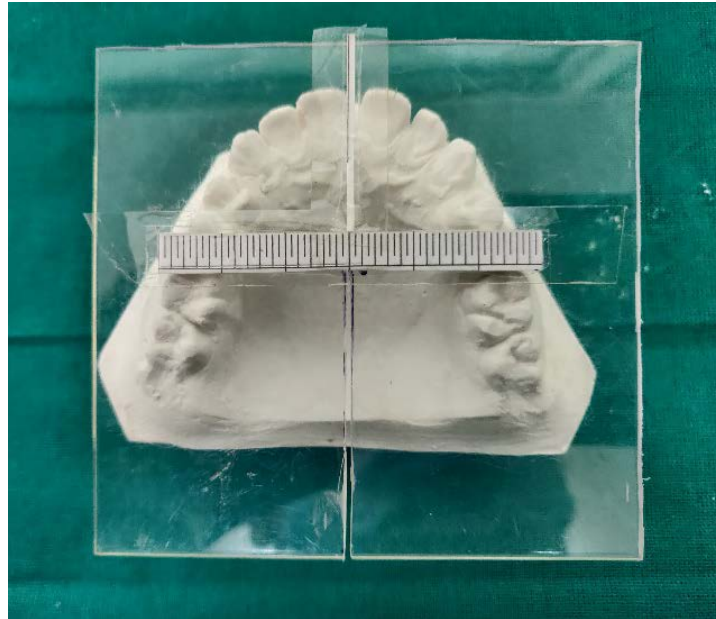


Fig 15: Recording Transverse Position of Maxillary First Molar

E. For PA ceph analysis using hand tracing : transverse position of maxillary molar is recorded from mesiopalatal cusp tip of maxillary first molar of right and left side to the midline(drawn from ANS to occlusal plane)

Measurement of reliability

To determine measurement reliability, 10 PA ceph of 10 patients were selected randomly and maxillomandibular midline was checked on Nemoceph. 10 study model were selected and palatal depth and transverse position of molar was checked in Group I and Group II. Transverse position of molar was also checked on hand tracing of 10 PA ceph.

Measurement of reliability

To determine measurement reliability, 10 PA ceph of 10 patients were selected randomly and maxillomandibular midline was checked on Nemoceph. 10 study model were selected and palatal depth and transverse position of molar was checked in Group I and Group II. Transverse position of molar was also checked on hand tracing of 10 PA ceph.

Variable	Maxillo- mandibular midline	Palatal depth	Right molar to midline	PA	Model	Left molar to midline
Reading 1 mean±SD (mm)	4.10±2.23m m	23.10±3. 10mm	17.90±2. 64mm	17.00±2.6 6mm	19.80±2.1 4mm	18.60±1.2 6mm
Reading 2 Mean±SD (mm)	4.06±2.22m m	22.80±2. 93mm	17.84±2. 40mm	16.95±2.6 5mm	19.76±2.0 3mm	18.76±1.4 2mm
p-Value	0.309	0.081	0.770	0.647	0.721	0.323

Comparison between the first reading and second reading was done using paired t-test on statistical analysis. It was observed that the mean difference between reading 1 and 2 was statistically non significant. Hence the measurement taken were considered reliable with no discrepancies on the operator side.

Data analysis

Statistical analysis was carried out by using SPSS software (v11.0). paired 't'- test was used to assess the paired observation and independent groups were tested using independent student 't'-test.

Formulas used for analysis

The Arithmetic Mean

This is the most commonly used measure of central tendency and is also known as mean or average.

$$\text{mean} = \frac{\sum_{i=1}^N X_i}{N}$$

The Standard Deviation

$$\text{SD} = \sqrt{\frac{\sum |x - \bar{x}|^2}{n}}$$

Maximum and minimum:

The lowest and largest value in a data set is referred to as minimum and maximum and the difference of the two groups is the range.

Range= maximum- minimum

Paired t- test:

The difference between paired samples were calculated using the paired sample t- test when the variable in sample 1 is somehow correlated to an observation in sample 2, so that the data may be considered to be happening in pairs. Paired t-test was done using SPSS software.

OBSERVATION
AND
RESULTS

The present study was conducted in the Department of Orthodontics & Dentofacial Orthopaedics, Babu Banarsi Das College of Dental Sciences, Lucknow to evaluate obvious facial asymmetry and its correlation with palatal form in 50 subjects of North Indian population divided in two groups –Group I (study Group) and II (control Group) , Group I had 50 subjects with mean age of 23.82 years and Group II had 25 subjects with mean age 24.2 yrs. The data obtained were recorded on Microsoft excel sheet and subjected to statistical analysis. The result of the study is tabulated as follows:

- Table 1: Descriptive statistics of comparison between maxillomandibular midline shift between Group I and Group II.
- Table 2: Descriptive statistics of comparison between palatal depth between Group I and Group II
- Table 3: Descriptive statistics of comparison between right and left molar to midline distance on model.
- Table 4: Descriptive statistics of comparison between right and left molar to midline distance on PA
- Table 5: Descriptive statistics of comparison between facial asymmetry and palatal depth

Table 1: Descriptive statistics of comparison between maxillomandibular midline shift between Group I and Group II

	Group	N	Mean	Std. Deviation	Std. Error Mean
Maxillomandibular midline shift	I	50	3.762	1.8972	.2683
	II	25	.936	.5438	.1088
P value	0.0001				

Table 1 showed the Descriptive statistics of comparison between maxillomandibular midline shift between Group I and Group II.

The mean value for maxillomandibular midline for Group I is 3.762 and for Group II is 0.936. The p value is less than 0.0001 which show highly statistical significant difference of maxillomandibular shift in Group I and Group II.

Table 2: Descriptive statistics of comparison between palatal depth of Group I and Group II.

	Group	N	Mean	Std. Deviation	Std. Error Mean	
Palatal depth	I	50	24.340	3.4083	.4820	
	II	25	21.240	2.2038	.4408	
P value						0.0001

Table 2 Showed the Descriptive statistics of comparison between palatal depth of Group I and Group II.

The mean value for group I is 24.340 and for Group II is 21.240. The p value is less than 0.0001 which show highly statistical significant difference of palatal depth between Group I and Group II.

Table 3: Descriptive statistics of comparison between distance of mesiopalatal cusp tip of maxillary first molar to midline of right and left side on study model

	Grp	N	Mean	Std. Deviation	Std. Error Mean	P value
Distance of Right molar to midline	I	50	18.400	2.3474	.3320	0.001
	II	25	20.160	1.6503	.3301	
Distance of Left molar to midline	I	50	18.400	2.8926	.4091	0.075
	II	25	19.560	1.9596	.3919	

Table 3 Showed the descriptive statistics of comparison between distance of mesiopalatal cusp tip of maxillary first molar to midline of right and left side on study model.

The mean value of mesiopalatal cusp tip of maxillary first molar to midline of right side in Group I is 18.4 and for Group II is 20.16 . The p vale is less than 0.001 which show very high statistical significant difference between distance of mesiopalatal cusp tip of maxillary first molar to midline of right side in Group I and Group II.

The mean value of mesiopalatal cusp tip of maxillary first molar to midline of left side in Group I is 18.4 and for Group II is 19.56 . The p value is greater than 0.05 which show statistical insignificant difference between distance of mesiopalatal cusp tip of maxillary first molar to midline of left side in Group I and Group II.

Table 4: Descriptive statistics of comparison between distance of mesiopalatal cusp tip of maxillary first molar to midline of right and left side on Posteroanterior cephalogram.

	Grp	N	Mean	Std. Deviation	Std. Error Mean	P value
Distance of Right molar to midline	I	50	16.900	2.3057	.3261	0.0001
	II	25	19.240	1.6902	.3380	
Distance of Left molar to midline	I	50	17.840	2.7207	.3848	0.043
	II	25	19.080	1.8009	.3602	

Table 4 Showed the descriptive statistics of comparison between distance of mesiopalatal cusp tip of maxillary first molar to midline of right and left side on posteroanterior cephalogram.

The mean value of mesiopalatal cusp tip of maxillary first molar to midline of right side in Group I is 16.9 and for Group II is 19.24 . The p vale is less than 0.001 which

show very high statistical significant difference between distance of mesiopalatal cusp tip of maxillary first molar to midline of right side in Group I and Group II.

The mean value of mesiopalatal cusp tip of maxillary first molar to midline of left side in Group I is 17.84 and for Group II is 19.08. The p value is less than 0.05 which show statistical significant difference between distance of mesiopalatal cusp tip of maxillary first molar to midline of left side in Group I and Group II.

Table 5: Descriptive statistics of comparison between facial asymmetry and palatal depth

		Group I Palatal depth	Group II Palatal depth
Maxillomandibular midline	Pearson Correlation	.164	.031
	P value	.255	.884
	N	50	25

Table 5 Showed the descriptive statistics of comparison between facial asymmetry and palatal depth.

The pearson correlation between facial asymmetry and palatal depth of Group I is 0.164 and Group II is 0.031 . The p value is greater than 0.05 which show statistical insignificant correlation between facial asymmetry and palatal depth of Group I and Group II.

DISCUSSION

The human facial skeleton is made up of various component, each of which is capable of having discrete variations between the right and left side of the face. Many human body parts undergo development with bilateral symmetry, this implies that the right and left sides can be divided into identical mirror images. However, due to biological factors inherent to processes of development as well as environmental disturbances, perfect bilateral symmetry is rarely found.²

Asymmetry is a naturally occurring phenomenon and was explained by Hasse in 1887 to be a feature of every human face. According to Thompson²² a perfectly symmetrical face would have an unpleasant , mask-like appearance. While a person may notice their own facial asymmetry, other people will probably not be aware of them. In fact, research shows that it may even be a desirable feature and part of what makes a person unique.

Slight facial asymmetry is a common biological variations in “normal” humans²³ and perfect symmetry is a theoretical concept that is rarely observed in real world. The minor facial asymmetry does not require any treatment. The point at which normal asymmetry becomes abnormal cannot be easily defined and is often determined by the clinician’s sense of balance and the patient’s sense of imbalance²⁴. Clinical facial asymmetry is the craniofacial complex ranges from the barely detectable to gross discrepancies between the right and left halves of the fac. The normal asymmetry which usually results from a small size difference between the two sides should be distinguished from a chin or nose that deviates to one side, which can produce severe disproportion and esthetic problems.

In the literature, a number of causal factors have been highlighted in the development of facial asymmetries, Chia et al¹⁹ , suggested that asymmetries could have

pathological, traumatic, functional or developmental causal factors. Haraguchi et al²⁵ claimed that the etiology of facial asymmetry can be grouped into hereditary factors of prenatal origin and acquired factors of postnatal origin, conversely, Cheong and Lo⁵, reported that the causes of facial asymmetry can be grouped into three main categories: (I) congenital, of prenatal origin; (II) acquired, resulting from injury or disease; and (III) developmental, arising during development and of unknown etiology.

In many cases, the etiology of facial asymmetry remains unknown and, for this reason, it is termed asymmetry of development. Such idiopathic asymmetries are common in the overall population, but are not found at an early age, appearing gradually throughout craniofacial development.^{2,26}

Facial asymmetry must be assessed by thorough analysis conducted by means of a first interview, extra- and intraoral clinical examination, as well as supplementary diagnostic examination. In order to have asymmetry assessed, patients must be in upright position, looking forward, with teeth in normal occlusion and relaxed lips. In our study skeletal analysis with x-rays has been used to diagnose facial asymmetry and Rickett's frontal analysis is been used. Generally, orthodontists evaluate facial asymmetry by analyzing the facial skeleton quantitatively using frontal cephalometry. Two dimensional (2D) measurement Posterior-anterior cephalometric radiographic evaluation is important for diagnosis and treatment planning for facial asymmetry, and the asymmetries are calculated by comparing the measurements of corresponding structures from the right and left sides. Facial form is also part of the craniofacial complex, in which the morphology of palate can be the key indicator of the anatomical structure in deforming the skeletal pattern. Clinically obvious facial asymmetry as seen in the soft tissue will also be reflected in underlying hard tissue.

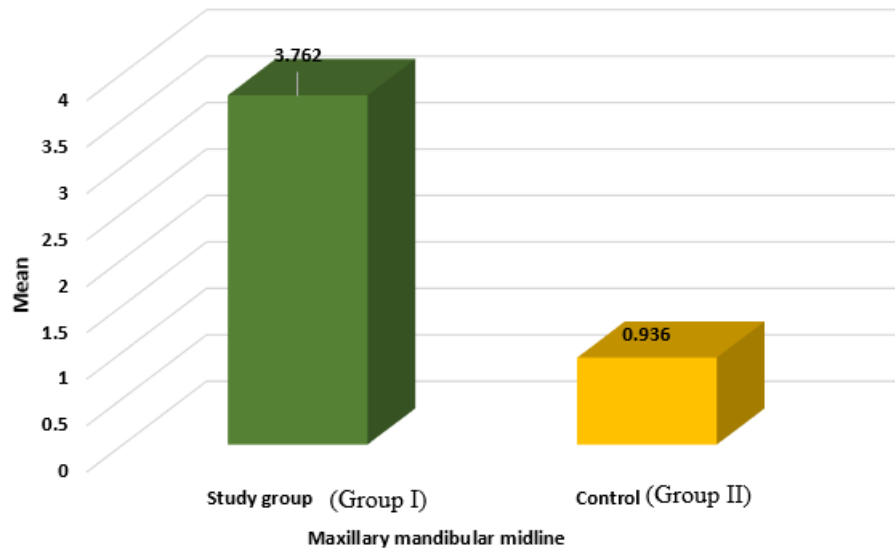
Therefore the goal of this study is to determine the dentofacial asymmetries from posteroanterior (PA) cephalograms and its correlation to palatal form.

The studies conducted on Turkish, Korean²⁷, Japanese²⁸, Brazilian²⁹ and Chinese³⁰ population have shown population difference in laterality of facial asymmetry with right side of the face being larger than left side in some studies and vice versa in others. As population differences were seen in laterality of facial asymmetry, various studies have been conducted on Indian population to evaluate facial asymmetry using posteroanterior cephalometric radiographs and photographs. The study conducted on South Indian population by Taneja et al²⁰, by Shah et al¹⁴ in the Ahmedabad population, by Rajpara et al¹⁷ in Udaipur population and Goel et al³¹ in Karnataka population had given variable results in terms of laterality of facial asymmetry.

Till date no study had been conducted to evaluate facial asymmetry and its correlation with palatal form so it was decided to evaluate and compare the facial asymmetry with palatal form in clinically obvious and non obvious facial asymmetrical patients in North Indian population.

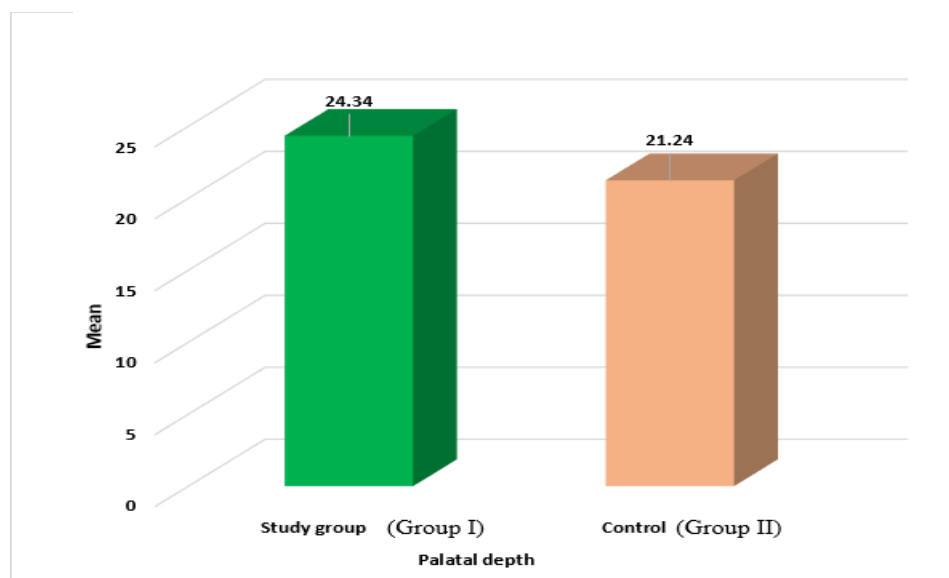
The present study was conducted in the Department of Orthodontics & Dentofacial Orthopaedics, Babu Banarsi Das College of Dental Sciences, Lucknow to evaluate obvious facial asymmetry in 50 subjects and non obvious facial asymmetry in 25 subjects of North Indian population and their correlation with palatal form. They were divided into two groups- Group I had 50 subjects with mean age of 23.82 and group II had 25 subjects with mean age of 24.2, the digital photographs of the subject was taken using DSLR camera. Assessment of facial asymmetry on PA was done using Ricketts frontal analysis parameter (maxillomandibular midline) using Nemotech software for confirmation of the finding, (menton offset >2mm on PA ceph) and

maxillary impression was taken. Palatal depth and transverse position of maxillary molars were recorded on maxillary cast.



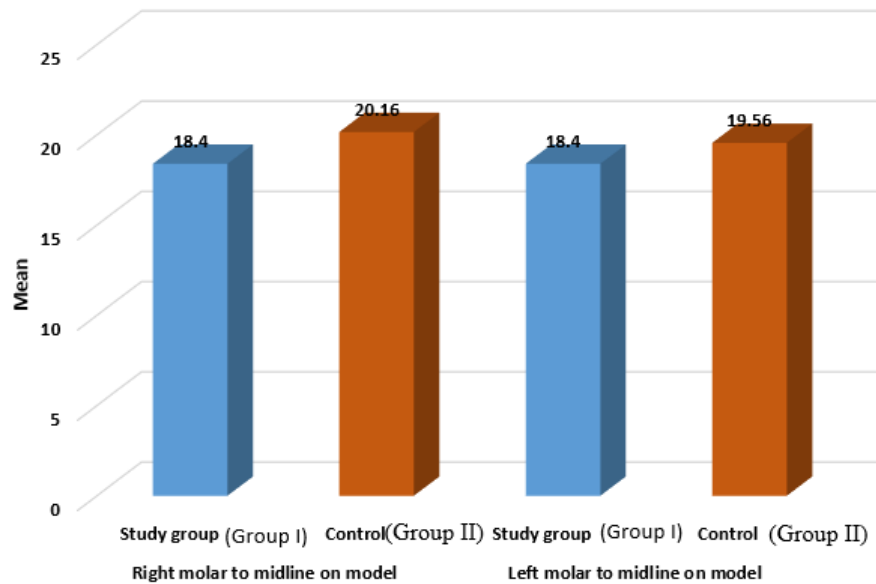
Graph 1: Comparison between maxillomandibular midline shift between Group I and Group II

The result of the present study suggested that for Group I facial asymmetry is highly statistical significant ($p < 0.0001$).



Graph 2: Comparison between palatal depth of Group I and Group II.

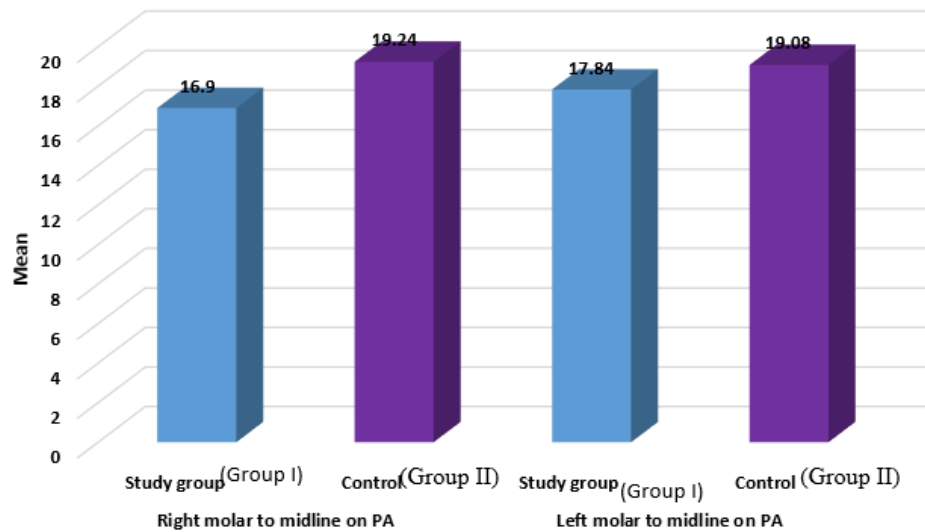
The result of the present study suggested that for Group I palatal depth is highly significant ($p < 0.0001$)



Graph 3: Comparison between distance of mesio-palatal cusp tip of maxillary first molar to midline of right and left side on study model between Group I and Group II.

The result of the present study suggested very high statistical significant difference between distance of mesio-palatal cusp tip of maxillary first molar to midline of right side in Group I and Group II ($p < 0.0001$).

And its statistical insignificant for mesio-palatal cusp tip of maxillary first molar to midline of left side in Group I and for Group ($p > 0.05$).



Graph 4: Comparison between distance of mesiopalatal cusp tip of maxillary first molar to midline of right and left side on Posteroanterior cephalogram

The result of the present study show very high statistical significant difference between distance of mesiopalatal cusp tip of maxillary first molar to midline of right side in Group I and Group II ($p < 0.0001$).

And it show statistical significant difference between distance of mesiopalatal cusp tip of maxillary first molar to midline of left side in Group I and Group II ($p < 0.05$).

The Pearson correlation between facial asymmetry and palatal depth of Group I is 0.164 and Group II is 0.031. The p value is greater than 0.05 which show statistical insignificant correlation between facial asymmetry and palatal depth of Group I and Group II.

In previous investigation, a significant facial asymmetry has been seen even in aesthetically pleasing faces. In the studies done by **Reddy et al**⁵ and **Ferrario et al**³² it has been shown right hemiface wider than left in males and studies by **Adamyu et al**³³ and **Ercan et al**³⁴ showed left hemiface wider than right in females.

Study conducted by **Mcintyre et al**³⁵ on PA ceph concluded that left side of the face was wider in subjects with cleft lip and palate. Another study conducted by **Taneja et al**²⁰ on Posteroanterior cephalograms of 60 subjects of South Indian population (30 males and 30 females) found that the cranial base region found to be insignificantly larger on the left side. Also the total facial structure was bigger on the left than on right both in males and females. **Goel et al**³¹ also conducted the study on Indian population of Karnataka region using posteroanterior cephalogram of 120 subjects(60 males and 60 females) with Class I occlusion, the bilateral widths were observed to be larger at right side than left side.

The study conducted by **Peck et al**³⁶ consisted of 52 white adult subjects (49 females and 3 males) on PA ceph and photographs. They found wider hemiface in right side than left side but the difference was not statistically significant. Another study conducted by **Shah et al**¹⁴ on 43 subjects of Indian population using posteroanterior cephalograms . the total facial structure was significantly larger on right than on the left side.

The study conducted by **Vig P.S and Hewitt A.B**³⁷ on cephalometric radiographs of 63 subjects of London population, they found that the middle third of the face was wider on the left side. The cranial base region and maxillary regions exhibited an overall asymmetry with the larger side being the left. The study conducted by **Chebib and Channa**¹⁴ on posteroanterior cephalogram in the University of Manitoba with 64 subjects (32 males and 32 females) on Canadian population showed a larger left side of the face compared to the right.

In the present study it was found that obvious facial asymmetry subjects had menton offset greater than 2mm, with mean of 3.762. Whereas in non obvious facial asymmetry patients the menton offset was less than or equal to 2mm, with mean of

0.936. Therefore, after statistical analysis, it was proven that facial asymmetry is clearly seen in obvious facial asymmetrical patients. The total facial structure was larger on the right side.

Clinically obvious facial asymmetry as seen in the soft tissue will also be reflected in underlying hard tissue. Beside congenital and acquired causes, muscular imbalance and habitual chewing on one side has been quoted as the most important reason for development of facial asymmetry. Considering maxilla, right and left halves of the palate develops separately and mid palatine suture between them fuses at around 18-20 years of age. The causes of variation of the palatal form had been attributed for unequal growth of two halves of the palate, low descent of antrum, faulty readjustment of pre-maxillae and malocclusion of teeth.

The study conducted by **Kareem FA**³⁸ in which he found the correlation between the arch form of palate and length, width, and depth of palate in Malaysian and Indian population with 30 subjects (15 Malaysian and 15 Indian). He found almost 50% of Indian population had low type of palate and approximately 67% of Malaysian population had this type of height of palate too. Only 20% of Malaysian population had medium type of palate and remaining 13% had high palate, whereas about 33% of Indian population had medium palate and 20% of them had high palate . The results of this study also shown that there was no statistically significant difference on transverse width of canines and molar of both Indian and Malaysian population.

In contrast to above study **Bhalla et al.**³⁹, found that the results may differ as they compare the depth of palate as well as the inter canine width in two types of malocclusion in Indian population, with the sample size of 152 subjects(76 males and 76 females). They found that the Class I occlusion shows widest intercanine width and shallowest depth of palate in Class II Division II malocclusion.

In the present study, we have compared palatal depth between Group I and Group II . The palatal depth, was found to be more in Group I i.e. cases with facial asymmetry , it was measured as the vertical distance from a deepest point in the midline on the palatal width to the occlusal plane , and on statistical analysis it is found that palatal depth is more in obvious facial asymmetrical patients with mean of 24.340. Whereas it is less in non asymmetrical patients with mean 21.24. the difference was found to be very highly statistically significant($P>0.0001$). it doesnot show similarity or contrary to any study previously done as no such correlation was conducted in past, other studies was confined to differenr malocclusion only.

In the study done by **Al-Sayagh et al**⁴⁰ in Iraqi population with sample size of 142 study models. He found Class II division 2 had shorter canine and molar depth than other occlusal groups in both genders.This shows a highly significant correlation of palatal height at 2nd premolar and 1st molar with inter premolars and 1st molar width.

In the study done by **Nahidh M et al**⁴¹ in Baghdad population with 60 subjects, he found out that that Class I and II males had the largest palatal dimensions than females while Class III females had the largest palatal dimensions than males. Class I subjects had the largest palatal width and depth while Class II subjects had the largest palatal length. Class I males and Class III females had the largest palatal width than other classes. Class III females and Class II males had the largest palatal depth than other classes.

In the present study, transverse position of maxillary first molar of right and left side from mesiopalatal cusp tip to midline on study model. The mean distance of Right molar to midline in Group I (study Group) is 18.4 and for Group II (Control Group)

is 20.16. The P value is less than 0.001 which show very high statistical significant difference between distance of mesiopalatal cusp tip of maxillary first molar to midline of right side amongst Group I and Group II. The mean value of mesiopalatal cusp tip of maxillary first molar to midline of left side in Group I is 18.4 and for Group II is 19.56 . The p value is greater than 0.05 which show statistical insignificant difference between distance of mesiopalatal cusp tip of maxillary first molar to midline of left side in Group I and Group II. The facial structure was deviated towards the right side. The reason to the above finding is explained in accordance to the facial shift which was predominately towards right side.

Transverse position of molar was also evaluated on posteroanterior cephalogram, the mean value of mesiopalatal cusp tip of maxillary first molar to midline of right side in Group I is 16.9 and for Group II is 19.24 . The p vale is less than 0.001 which show very high statistical significant. It was quiet similar to finding observed on study models. The mean value of mesiopalatal cusp tip of maxillary first molar to midline of left side in Group I(Study Group) is 17.84 and for Group II (Control Group) is 19.08 . The p value is less than 0.05 which show statistical significant difference between distance of mesiopalatal cusp tip of maxillary first molar to midline of left side in Group I and Group II.

In the literature, no comparison has been made between facial asymmetry and palatal depth. In the present study the Pearson correlation is done and it is found that there is no significant correlation between facial asymmetry and palatal depth of Group I(Study Group) and Group II (Control Group).

Skeletal asymmetry might involve a single basal bone only, however it usually affects the structures of the antagonist basal bone. Additionally, both the imbalanced and contralateral sides present with changes in structure. This is because whenever one

side of bone development is affected, the opposite side is somehow influenced, which leads to growth compensation. In this context, the mandible is the structure most often associated with craniofacial asymmetries, with maxillary asymmetries often being secondary to asymmetrical mandibular growth. Mandibular asymmetries might involve the condyle, the ramus, the mandibular body and symphysis, all of which might undergo changes in size, volume or position. Therefore, determining which structures are involved, whether in the maxilla, mandible and/or another craniofacial region, in addition to establishing how much those structures have been affected, is essential to achieve a correct diagnosis⁴². Therefore it might be expected that facial asymmetry may also influence the palatal form.

Epidemiological studies assessing facial asymmetries in orthodontic patients clinically found a prevalence ranging from 12% to 37% in the United States, 23% in Belgium and 21% in Hong Kong. Whenever prevalence was assessed by radiographic examination, it presented values higher than 50%.

Diagnosis of asymmetry can be easily achieved by the orthodontist working in cases involving significant deviation of dental midlines and absence of missing teeth, anomalies of shape or remarkable crowding on only one side of the arch. If the facial asymmetry being mild, it is not perceived by the individuals as a problem. In such cases no treatment is required but it has to be explained to the patients before starting orthodontic treatment. At times, on correction of dentition in patients undergoing Orthodontic treatment, they perceived mild form of facial asymmetry iatrogenic to treatment mechanics. In other cases where patients are conscious of their facial asymmetry, certain soft tissue surgeries like sliding genioplasty can be planned or Orthodontics mechanics can be employed to solve this disharmony by compensation. Depending on patient's age and the severity of the condition, a variety of orthodontics

and Orthopaedics options has been described in the literature with a view to correcting obvious facial asymmetries. Many therapeutic approaches that have been reported, usage of asymmetrical mechanics, asymmetrical extractions or surgical intervention are highlighted.

Owing to the scarcity of the articles we could not find any relevant study done which compared palatal form with obvious facial asymmetry.

The results of present study suggested that there is difference between palatal form and facial asymmetry between group I (obvious facial asymmetry) and group II (no obvious facial asymmetry) in our study. Larger sample size is required to further authenticate the observations of this study.

CONCLUSION

The following conclusion may be drawn from the present study conducted to evaluate facial asymmetry and its correlation to palatal form in North Indian population :

1. facial asymmetry evident with deviation towards the right side and subjects with obvious facial asymmetry had statistically significant difference in menton offset with non obvious asymmetric subjects.
2. The palatal depth was found to be significantly higher in asymmetric subjects in comparison to non asymmetric subjects.
3. There is no significant correlation between facial asymmetry and palatal depth of Group I and Group II.
4. Transversely on study model, position of maxillary molar was significantly closer to midline in asymmetric subjects on deviated side of subjects with obvious asymmetric subjects in comparison to same side of asymmetric subjects of Group I and whereas other side did not show statistically significant difference between Groups.
5. Transversely on PA ceph, position of maxillary molar was significantly closer to midline in asymmetric subjects on deviated side of subjects with obvious asymmetric subjects in comparison to same side of asymmetric subjects of Group I and Group II.
6. Overall, it can be concluded that obvious facial asymmetry has its correlation with palatal form. Further studies with large sample size can validate the results of present study.

SUMMARY

Symmetry is defined as equality or correspondence in form of parts distributed around the center or an axis at the two extremes or poles or on the two opposite sides of the body¹. The word symmetry is derived from the Greek word *symmetria* which means 'of like measure'. Asymmetry is described as a lack or absence of symmetry. When applying this to the human face, it illustrates an imbalance or disproportionality between the right and left sides.

While a person may notice their own facial asymmetry, other people will probably not be aware of them. In fact, research shows that it may even be a desirable feature and part of what makes a person unique. Patients with facial asymmetry can be evaluated through clinical assessment, photographs, posteroanterior cephalograms, and occasionally 3D-computed tomography. Clinical examination reveals asymmetry in the sagittal, coronal and vertical dimensions. Hard tissue measurements useful for characterizing facial morphology can be reliably measured from posteroanterior cephalograms hence it is decided to evaluate facial asymmetry using Nemotec software in the present study. The purpose of this study is to correlate obvious facial asymmetry and its correlation with palatal form in North Indian population.

The present study was conducted in the Department of Orthodontics & Dentofacial Orthopaedics, Babu Banarsi Das College of Dental Sciences, Lucknow to evaluate obvious facial asymmetry in 50 subjects and non obvious facial asymmetry in 25 subjects of North Indian population and their correlation with palatal form. They were divided into two groups- Group I had 50 subjects with mean age of 23.82 and Group II had 25 subjects with mean age of 24.2, the digital photographs of the subject was taken using DSLR camera. Assessment of facial asymmetry on posteroanterior cephalogram was done using Ricketts frontal analysis parameter (maxillomandibular midline) using Nemotec software for confirmation of the finding, (menton offset

>2mm on PA ceph) and maxillary impression was taken. Palatal depth and transverse position of maxillary molars were recorded on maxillary cast, and transverse position of maxillary molar was also recorded on hand tracing of PA ceph. The data was obtained were recorded on Microsoft excel sheet and subjected to statistical analysis.

The following conclusion may be drawn from the present study conducted to evaluate facial asymmetry and its correlation to palatal form in North Indian population :

1. Facial asymmetry:
 - a) On statistical analysis , facial asymmetry is clearly seen in obvious facial asymmetrical patients($P < 0.0001$)
 - b) It was evident with deviation towards the right side in Group I
 - c) Facial asymmetry had menton offset greater than 2mm with mean of 3.762
 - d) In non-asymmetrical patients, menton offset was less than 1mm with mean of 0.936
2. Highly statistical significant difference of palatal depth between Group I and Group II ($P < 0.0001$) and was more in Group I.
3. On study model, the mean of transverse position of maxillary molar on, highly statistically significant deviation was observed on right side amongst the Groups than on left side.
4. On posteroanterior cephalogram, the mean of transverse position of maxillary molar is similar to that of measurement on dental cast i.e. highly significant difference on Right side (Group I) as that of left side (Group II).
5. Pearson correlation confirms that there is no significant correlation between facial asymmetry and palatal depth in Group I and Group II separately.

BIBLIOGRAPHY

1. Stedman's Medical Dictionary, Baltimore, the Williams and Wilkins Company, 1966.
2. Cheong YW, Lo LJ. Facial asymmetry: etiology, evaluation, and management. *Chang Gung Med J.* 2011 Jul;34(4):341-51
3. Taneja VK, Kumar GA, Farishta S, Minocha RC, Baiju G, Gopal D. An assessment of skeletal craniofacial asymmetry in South Indian Population. *J Contemp Dent Pract.* 2012 Jan 1;13(1):80-4
4. Rajpara Y, Shyagali TR, Trivedi K, Kambalyal P, Sha T, Jain V. Evaluation of facial asymmetry in esthetically pleasing faces. *J Orthod Res.* 2014 May 1;2(6):79-84.
5. Reddy MR, Bogavilli SR, Raghavendra V, Polina VS, Basha SZ, Preetham R. Prevalence of facial asymmetry in Tirupati population: A posteroanterior cephalometric and photographic study. *Journal of International Society of Preventive & Community Dentistry.* 2016 Dec;6(Suppl 3):S205.
6. Shah SM, Joshi MR. An assessment of asymmetry in the normal craniofacial complex. *Angle Orthod* 1978;48(2) :141-148
7. Mosher HP. THE FORM OF THE HARD PALATE. In Transactions of the... Annual Meeting of the American Laryngological Association 1908 (Vol. 11, p. 340). American Laryngological Association.
8. Nahidh M, Al-Khawaja NF. Palatal dimensions in different occlusal relationships. *Journal of Baghdad college of dentistry.* 2012;24(1):116-20
9. Maria CM, Silva AM, Busanello-Stella AR, Bolzan GD, Berwig LC. Evaluation of hard palate depth: correlation between quantitative and qualitative method. *Revista CEFAC.* 2013 Oct;15(5):1292-9.

10. Dhanapal S, Jain RK, Dinesh SP, Kumar SN. Assessment of palatal depth and facial forms among adolescents in Chennai population-A prospective study. *Drug Invention Today*. 2019 Jan 1;11(1).
11. Zaaba NFA, Jain AR. Association between the maxillary arch form and length,width,and depth of palate in malaysian and indian population. *Drug Invention Today* 2018;10(5)790-795.
12. Melnik AK. A cephalometric study of mandibular asymmetry in a longitudinally followed sample of growing children. *American Journal of Orthodontics and Dentofacial Orthopedics*. 1992 Apr 1;101(4):355-66.
13. Liukkonen M, Sillanmäki L, Peltomäki T. Mandibular asymmetry in healthy children. *Acta Odontologica Scandinavica*. 2005 Jan 1;63(3):168-72.
14. Shah SM, Joshi MR. An assessment of asymmetry in the normal craniofacial complex. *The Angle Orthodontist*. 1978 Apr;48(2):141-8
15. Chebib FS, Chamma AM. Indices of craniofacial asymmetry. *The Angle Orthodontist*. 1981 Jul;51(3):214-26.
16. Scanavini PE, Paranhos LR, Torres FC, Vasconcelos MH, Jóias RP, Scanavini MA. Evaluation of the dental arch asymmetry in natural normal occlusion and Class II malocclusion individuals. *Dental Press Journal of Orthodontics*. 2012;17:125-37.
17. Rajpara Y, Shyagali TR, Trivedi K, Kambalyal P, Sha T, Jain V. Evaluation of facial asymmetry in esthetically pleasing faces. *Journal of Orthodontic Research*. 2014 May 1;2(2):79.
18. Fischer B. Asymmetries of the Dentofacial Complex: Their Influence on Diagnosis, Prognosis and Treatment. *The Angle Orthodontist*. 1954 Oct;24(4):179-92.

19. Chia MS, Naini FB, Gill DS. The aetiology, diagnosis and management of mandibular asymmetry. *Orthodontic Update*. 2008 May 2;1(2):44-52.
20. Taneja VK, Kumar GA, Farishta S, Minocha RC, Baiju G, Gopal D. An assessment of skeletal craniofacial asymmetry in South Indian Population. *J Contemp Dent Pract*. 2012 Jan 1;13(1):80-4.
21. Zaaba NFA, Jain AR. Association between the maxillary arch form and length,width,and depth of palate in malaysian and indian population. *Drug Invention Today* 2018;10(5)790-795.
22. Thompson JK. Neuroanatomy, hemisphericity and facial asymmetry. *Neuropsychologia*. 1982 Jan 1;20(6):699-702.
23. Farkas LG, Cheung G. Facial asymmetry in healthy North American Caucasians: an anthropometrical study. *The Angle Orthodontist*. 1981 Jan;51(1):70-7.
24. Bishara SE, Burkey PS, Kharouf JG. Dental and facial asymmetries: a review. *The Angle Orthodontist*. 1994 Jan 1;64(2):89-98.
25. Haraguchi S, Takada K, Yasuda Y. Facial asymmetry in subjects with skeletal Class III deformity. *Angle Orthod*. 2002 Feb;72(1):28-35.
26. Kawamoto HK, Kim SS, Jarrahy R, Bradley JP. Differential diagnosis of the idiopathic laterally deviated mandible. *Plast Reconstr Surg*. 2009 Nov;124(5):1599-609.
27. Hwang HS, Yuan D, Jeong KH, Uhm GS, Cho JH, Yoon SJ. Three-dimensional soft tissue analysis for the evaluation of facial asymmetry in normal occlusion individuals. *The korean journal of orthodontics*. 2012 Apr 1;42(2):56-63.

28. Haraguchi S, Takada K, Yasuda Y. Facial asymmetry in subjects with skeletal Class III deformity. *The Angle Orthodontist*. 2002 Feb;72(1):28-35.
29. Carvalho B, Ballin AC, Becker RV, Berger CA, Hurtado JG, Mocellin M. Rhinoplasty and facial asymmetry: Analysis of subjective and anthropometric factors in the Caucasian nose. *International archives of otorhinolaryngology*. 2012 Oct;16(04):445-51.
30. Chew MT. Soft and hard tissue changes after bimaxillary surgery in Chinese Class III patients. *The Angle Orthodontist*. 2005 Nov;75(6):959-63.
31. Goel S, Ambekar A, Darda M, Sonar S. An assessment of facial asymmetry in Karnataka population. *Journal of Indian orthodontic society*. 2003 Jan;37(1):30-8.
32. Ferrario VF, Sforza C, Poggio CE, Tartaglia G. Distance from symmetry: a three-dimensional evaluation of facial asymmetry. *Journal of Oral and Maxillofacial Surgery*. 1994 Nov 1;52(11):1126-32.
33. Adamu LH, Ojo SA, Danborno B, Adebisi SS, Taura MG. Sex differences in facial asymmetry indices among Hausa ethnic group of Nigeria. *Annals of Bioanthropology*. 2016 Jul 1;4(2):105.
34. Ercan I, Ozdemir ST, Etoz A, Sigirli D, Tubbs RS, Loukas M, Guney I. Facial asymmetry in young healthy subjects evaluated by statistical shape analysis. *Journal of Anatomy*. 2008 Dec;213(6):663-9.
35. McIntyre GT, Mossey PA. Asymmetry of the parental craniofacial skeleton in orofacial clefting. *Journal of orthodontics*. 2002 Dec;29(4):299-305
36. Peck S, Peck L, Kataja M. Skeletal asymmetry in esthetically pleasing faces. *The Angle Orthodontist*. 1991 Mar;61(1):43-8.

37. Vig PS, Hewitt AB. Asymmetry of the human facial skeleton. *The Angle Orthodontist*. 1975 Apr;45(2):125-9.
38. Kareem FA, Rauf AM, Rasheed TA, Hussain FA. Correlation of Three Dimensions of Palate with Maxillary Arch Form and Perimeter as Predictive Measures for Orthodontic and Orthognathic Surgery. *Children*. 2021 Jun;8(6):514.
39. Bhalla A, Londhe SM, Kumar P, Datana S, Kadu A. Palatal dimension correction in malocclusions for mixed Indian population. *J Dent Res Rev* 2014;1:137-42.
40. Al-Sayagh NM. The relationship of palatal dimensions for Iraqi adolescents with different dental angle classifications. *Al-Rafidain Dental Journal*. 2011 Jun 1;11(2):251-9.
41. . Nahidh M, Al-Khawaja NF. Palatal dimensions in different occlusal relationships. *Journal of baghdad college of dentistry*. 2012;24(1):116-20
42. Burstone CJ. Diagnosis and treatment planning of patients with asymmetries. *Semin Orthod*. 1998 Sep;4(3):153-64
43. Ferrario VF, Sforza C, Pizzini G, Vogel G, Miani A. Sexual dimorphism in the human face assessed by euclidean distance matrix analysis. *Journal of Anatomy*. 1993 Dec;183(Pt 3):593.
44. Severt TR, Proffit WR. The prevalence of facial asymmetry in the dentofacial deformities population at the University of North Carolina. *The International journal of adult orthodontics and orthognathic surge*. 1997 Jan 1;12(3):171-6.
45. Zaidel DW, Cohen JA. The face, beauty, and symmetry: perceiving asymmetry in beautiful faces. *International Journal of Neuroscience*. 2005 Jan 1;115(8):1165-73.

46. Ercan I, Ozdemir ST, Etoz A, Sigirli D, Tubbs RS, Loukas M, Guney I. Facial asymmetry in young healthy subjects evaluated by statistical shape analysis. *Journal of Anatomy*. 2008 Dec;213(6):663-9.
47. Hwang HS, Yuan D, Jeong KH, Uhm GS, Cho JH, Yoon SJ. Three-dimensional soft tissue analysis for the evaluation of facial asymmetry in normal occlusion individuals. *The Korean Journal of Orthodontics*. 2012 Apr 1;42(2):56-63.
48. Smith BM, Brandt J, Lin Z, Zhang L. Nonparametric context modeling of local appearance for pose-and expression-robust facial landmark localization. *In Proceedings of the IEEE conference on computer vision and pattern recognition 2014* (pp. 1741-1748).
49. Moshkelgosha V, Fathinejad S, Pakizeh Z, Shamsa M, Golkari A. Photographic facial soft tissue analysis by means of linear and angular measurements in an adolescent Persian population. *The Open Dentistry Journal*. 2015;9:346.
50. Skinazi GL, Lindauer SJ, Isaacson RJ. Chin, nose, and lips. Normal ratios, in young men and women. *American Journal of Orthodontics and Dentofacial Orthopedics*. 1994 Nov 1;106(5):518-23.
51. Borod JC, Koff E, Yecker S, Santschi C, Schmidt JM. Facial asymmetry during emotional expression: Gender, valence, and measurement technique. *Neuropsychologia*. 1998 Nov 1;36(11):1209-15.
52. Ferrario VF, Sforza C, Ciusa V, Serrao G, Tartaglia GM. Morphometry of the normal human ear: a cross-sectional study from adolescence to mid-adulthood. *Journal of Craniofacial Genetics and Developmental Biology*. 1999 Oct 1;19(4):226-33.

53. Fong JH, Wu HT, Huang MC, Chou YW, Chi LY, Fong Y, Kao SY. Analysis of facial skeletal characteristics in patients with chin deviation. Journal of the Chinese Medical Association. 2010 Jan 1;73(1):29-34.

ANNEXURES

ANNEXURE - I

**BABU BANARASI DAS COLLEGE OF DENTAL SCIENCES
(FACULTY OF BBD UNIVERSITY), LUCKNOW**

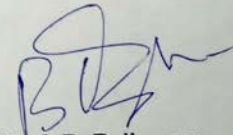
INSTITUTIONAL RESEARCH COMMITTEE APPROVAL

The project titled "Clinically Obvious Facial Asymmetry and Palatal Form- A Correlative Study" submitted by Dr Akansha Chauhan Post graduate student from the Department of Orthodontics and Dentofacial Orthopaedics as part of MDS Curriculum for the academic year 2019-2022 with the accompanying proforma was reviewed by the Institutional Research Committee present on 19th December 2019 at BBDCODS.

The Committee has granted approval on the scientific content of the project. The proposal may now be reviewed by the Institutional Ethics Committee for granting ethical approval.



Prof. Vandana A Pant
Co-Chairperson



Prof. B. Rajkumar
Chairperson

ANNEXURE - II

Babu Banarasi Das University
Babu Banarasi Das College of Dental Sciences,
BBD City, Faizabad Road, Lucknow – 226028 (INDIA)

Dr. Lakshmi Bala
 Professor and Head Biochemistry and
 Member-Secretary, Institutional Ethics Committee

Communication of the Decision of the VIIIth Institutional Ethics Sub-Committee

IEC Code: 08

BBDCODS/03/2020

Title of the Project: Clinically Obvious Facial Asymmetry and Palatal Form- A Correlative Study.

Principal Investigator: Dr. Akansha Chauhan **Department:** Orthodontics & Dentofacial Orthopedics

Name and Address of the Institution: BBD College of Dental Sciences Lucknow.

Type of Submission: New, MDS Project Protocol

Dear Dr. Akansha Chauhan,

The Institutional Ethics Sub-Committee meeting comprising following four members was held on 18th March 2020.

- | | |
|---|---|
| 1. Dr. Lakshmi Bala
Member Secretary | Prof. and Head, Department of Biochemistry, BBDCODS, Lucknow |
| 2. Dr. Amrit Tandan
Member | Prof. & Head, Department of Prosthodontics and Crown & Bridge, BBDCODS, Lucknow |
| 3. Dr. Sahana S.
Member | Reader, Department of Public Health Dentistry, BBDCODS, Lucknow |
| 4. Dr. Sumalatha M.N.
Member | Reader, Department of Oral Medicine & Radiology, BBDCODS, Lucknow |

The committee reviewed and discussed your submitted documents of the current MDS Project Protocol in the meeting.

The comments were communicated to PI thereafter it was revised.

Decisions: The committee approved the above protocol from ethics point of view.

Forwarded by:

Lakshmi Bala
18/03/20

(Dr. Lakshmi Bala)
 Member-Secretary
 IEC **Member-Secretary**
Institutional Ethic Committee
BBD College of Dental Sciences
BBD University
Faizabad Road, Lucknow-226028

B. Rajkumar

(Dr. B. Rajkumar)
 Principal
 BBDCODS
PRINCIPAL
Babu Banarasi Das College of Dental Sciences
(Babu Banarasi Das University)
BBD City, Faizabad Road, Lucknow-226028

ANNEXURE - III

**Babu Banarasi Das College of Dental Sciences
(A constituent institution of Babu Banarasi Das University)
BBD City, Faizabad Road, Lucknow – 227105 (INDIA)**

Participant Information Document (PID)

1. Study title

Clinically obvious facial asymmetry and palatal form- A correlative study

2. Invitation paragraph

You are being invited to take part in a research study. It is therefore important for you to understand why the study is being done and what it will involve. Please take time to read the following information carefully. Ask us for any clarifications or further information. Whether or not you wish to take part is your decision.

3. What is the purpose of the study?

The purpose of this study is to find the Correlation of clinically obvious facial asymmetry with palatal form.

4. Why have I been chosen?

You have been chosen for this study as you are fulfilling the required criteria for this study.

5. Do I have to take part?

Your participation in the research is entirely voluntary. If you do, you will be given this information sheet to keep and will be asked to sign a consent form. During the study you still are free to withdraw at any time and without giving a reason.

6. What will happen to me if I take part?

You will have to undergo radiographic examination for Postero anterior cephalogram and maxillary impression will be taken for study models with frontal photograph.

7. What do I have to do?

You do not have to change your regular lifestyles for the investigation of the study.

8. What is the procedure that is being tested?

the procedure that is being tested is correlation of clinically obvious facial asymmetry with palatal form.

9. What are the interventions for the study?

Frontal photograph and PA ceph will be taken. Impression of the maxilla will be taken and study model will be made.

10. What are the side effects of taking part?

There are no side effects on patients of this study.

11. What are the possible disadvantages and risks of taking part?

Patients coming to the OPD of department of Orthodontics and Dentofacial Orthopaedics with obvious facial asymmetry will have to undergo minimal radiation exposure as PA cephalogram is required as a part for diagnostic procedure.

12. What are the possible benefits of taking part?

The possible benefit is that we can relate the palatal form with facial asymmetry which will aid in the diagnosis and treatment planning.

13. What if new information becomes available?

If additional information becomes available during the course of the research you will be told about these and you are free to discuss it with your researcher, your researcher will tell you whether you want to continue in the study. If you decide to withdraw, your researcher will make arrangements for your withdrawal. If you decide to continue in the study, you may be asked to sign an updated consent form.

14. What happens when the research study stops?

If the study stops/finishes before the stipulated time, this will be explained to the patient/volunteer.

15. What if something goes wrong?

If any severe adverse event occurs, or something goes wrong during the study, the complaints will be handled by reporting to the institution (s), and Institutional ethical committee.

16. Will my taking part in this study be kept confidential?

Yes it will be kept confidential.

17. What will happen to the results of the research study?

Result is the sole property of the department of the Orthodontics BBDCODS Lucknow. Your identity will be kept confidential in case of any report/publications.

18. Who is organizing the research?

This research study is organized by Department of Orthodontics and Dentofacial Orthopaedics, BBDCODS Lucknow.

19. Will the results of the study be made available after study is over?

Yes.

20. Who has reviewed the study?

The study has been reviewed and approved by the Guide, Head of the Department of Orthodontics and Dentofacial Orthopaedics, and the (IEC) (IRC) of the institution.

Contact for further information

Dr. Akansha Chauhan
PG student
Department of Orthodontics and
Dentofacial Orthopedics
BabuBanarasi College of Dental
Sciences.
Lucknow-226028
Email id- akanshachauhan34@gmail.com

Mob - 9634685879

Dr. Lakshmi Bala,
Member Secretary IEC
Babu Banarasi College of
Dental Sciences.
Lucknow
bbdcods.iec@gmail.com

Signature of PI.....
Name.....
Date

BBDCODS

बाबू बनारसी दास कॉलेज ऑफ़ डेंटल साइंस
(बाबू बनारसी दास विश्व विद्यालय के एक घटक संस्था)
बीबीडी सिटी, फैजाबाद रोड, लखनऊ - 227105 (भारत)
प्रतिभागी जानकारी दस्तावेज़ (पीआईडी)

1. अध्यन शीर्षक

तालु के विभिन्न प्रकार के साथ चेहरे की विषमता जानना।

2. निमंत्रण पैरा

आपको इस शोध में भाग लेने के लिए आमंत्रित किया जा रहा है, इसलिए यह समझना आवश्यक है की यह अध्यन क्यों किया जा रहा है और इसमें क्या शामिल होगा। कृपया निम्न जानकारी को सावधानी पूर्वक पढ़ें। किसी भी स्पष्टीकरण के लिए हमें पूछें। आप भाग लेना चाहते हैं या नहीं आपका निर्णय है।

3. अध्यन का उद्देश्य क्या है ?

तालु के साथ चिकित्सकीय स्पष्ट चेहरे की विषमता के सहसंबंध को खोजने के लिए।

4. मैं क्यों चुना गया हूँ ?

आपको इस अध्यन के लिए चुना गया है क्योंकि, आप इस अध्यन के लिए आवश्यक मापदंडों को पूरा कर रहे हैं।

5. क्या इसमें मुझे भाग लेना चाहिए?

अनुसंधान के क्षेत्र में आपकी भागीदारी पूरी तरह स्वैच्छिक है। यदि आप करते हैं तो आपको इस जानकारी को रखने के लिए पत्र दिया जायेगा और एक सहमित पत्र पर हस्ताक्षर करने के लिए कहा जाएगा। अध्यन के दौरान आप कभी भी किसी भी समय और बिना कारण दिए वापस लेने के लिए स्वतंत्र हैं।

6. क्या होगा यदि मैं इस अध्यन में भाग लेता हूँ ?

आपको पी ए सेफ्लोग्राम के लिए रेडियोग्राफिक परीक्षा से गुजरना होगा और तस्वीर के साथ आपके ऊपरी जबड़ा का नाप दिया जाएगा

7. मुझे क्या करना होगा?

आपको अध्यन की जांच के लिए अपनी नियमित जीवन शैली बदलने की ज़रूरत नहीं है।

8. किस प्रक्रिया का परीक्षण किया जा है ?

तालु के विभिन्न प्रकार के साथ चेहरे की विषमता जानना का परीक्षण किया जा है।

9. इस शोध में कौन से हस्तक्षेप दिए जायेंगे ?

फ्रंटल फोटो, पीए सेफ ,ऊपरी जबड़ा और स्टडी मॉडल को लिया जाएगा

10. इस अख्यत में भाग लेने का क्या दुष्प्रभाव है ?

इस अख्यत के मरीजों पर कोई दुष्प्रभाव नहीं होता है।

11. इस अख्यत में भाग लेने के संभावित जोखिम और नुकसान क्या हैं?

चेहरे की विषमता वाले ऑर्थोडॉन्टिक्स और डेंटोफेसिबल ऑर्थोपेडिक्स विभाग के ओपीडी में आने वाले मरीजों को न्यूनतम विकिरण जोखिम से गुजरना होगा क्योंकि पीपू सेफेलोग्राम को नैदानिक प्रक्रिया के लिए एक भाग के रूप में आवश्यक है।

12. भाग लेने के संभावित लाभ क्या हैं ?

चेहरे की विषमता के साथ तालु रूप को संबंधित करने के लिए जो उपचार योजना और निदान में सहायता करेगा।

13. यदि कोई नयी जानकारी उपलब्ध हो जाती है ?

यदि अनुसंधान के दौरान अतिरिक्त जानकारी उपलब्ध हो जाती है तो आपको इनके बारे में बताया जाएगा और आप अपने शोधकर्ता के साथ चर्चा करने के लिए स्वागत हैं। आपका शोधकर्ता आपको बताएगा कि क्या आप अख्यत को जारी रखना चाहते हैं। यदि आप तुरंत करने हैं तो वापस लेने, आपका शोधकर्ता आपके वापसी के लिए व्यवस्था करेगा अगर तुम अख्यत में जारी रखने का निर्णय लेते हैं, तो आपको एक अद्यतन सहमति फॉर्म पर हस्ताक्षर करने के लिए कहा जा सकता है।

14. जब शोध अख्यत बंद हो जाता है तो क्या होता है?

अख्यत बंद हो जाता है / निर्धारित समय से पहले खत्म हो जाता है मरीज / स्वयंसेवक के लिए समझाया जाएगा।

15. क्या कुछ गलत हो सकता है?

यदि कोई गंभीर प्रातिकूल घटना होती है, या अध्ययन के दौरान कुछ घलत हो जाता है, तो शोधकर्ता को संस्था (संस्थाओं), और संस्थागत नैतिक समिति को रिपोर्ट करके संभाला जाएगा।

16. इस अख्यत में मेरे हिस्से को गोपनीय रखा जाएगा?

हाँ, यह गोपनीय रखा जाएगा।

17. शोध अख्यत के परिणामों का क्या होगा?

परिणाम ऑर्थोडॉन्टिक्स और डेंटोफेसिबल ऑर्थोपेडिक्स दंत चिकित्सा विज्ञान के बाबु बनारसी दंत कॉलेज लखनऊ के विभाग की आत्मा गुण है लखनऊ। किसी भी रिपोर्ट / प्रकाशन के मामले में आपकी पहचान को गोपनीय रखा जाएगा।

18. जो अनुसंधान का अयोजन किया जाता है?

यह शोध अध्ययन ऑर्थोडॉन्टिक्स और डेंटोफेसियल विभाग दन्त चिकित्सा विज्ञान के बाबू बनारसी दास कॉलेज लखनऊ द्वारा आयोजित किया जाता है।

19. क्या अध्ययन खत्म हो जाने बाद अध्ययन के परिणामों को उपलब्ध कराया जाएगा ?

हाँ।

20. कौन अध्ययन की समीक्षा किया है?

अध्ययन की समीक्षा की गई है और ऑर्थोडॉन्टिक्स और डेंटोफेसियल ऑर्थोपेडिक्स विभाग के प्रमुख ने और गाइड ने मंजूरी दे दी है, संस्था की आईईसी और आईआरसी।

21. अधिक जानकारी के लिए संपर्क

डॉ. आकांशा चौहान
पीजी छात्र
ऑर्थोडॉन्टिक्स और डेंटोफेसियल ऑर्थोपेडिक्स विभाग
बाबू बनारसी दास कॉलेज ऑफ़ डेंटल साइंस
लखनऊ-226028
ईमेल आईडी- akanshachauhan34@gmail.com
Mob- 9634685879

डॉ लक्ष्मी बाला,
सदस्य सचिव आईईसी
बाबू बनारसी दास कॉलेज ऑफ़ डेंटल साइंसेज
लखनऊ- 226028
bbdcods.iec@gmail.com

पीआई के हस्ताक्षर
नाम
तारीख

ANNEXURE - IV
Babu Banarasi Das College of Dental Sciences

(Babu Banarasi Das University)

BBD City, Faizabad Road, Lucknow – 227105 (INDIA)

Consent Form (English)

Title of the Study: **Clinically obvious facial asymmetry and palatal form- A correlative study**

Study Number.....

Subject's Full Name.....

Date of Birth/Age

Address of the Subject.....

Phone no. and e-mail address.....

Qualification

Occupation: Student / Self Employed / Service / Housewife/ Other (Please tick as appropriate)

Annual income of the Subject.....

Name and of the nominees(s) and his relation to the subject..... (For the purpose of compensation in case of trial related death).

1. I confirm that I have read and understood the Participant Information Document datedfor the above study and have had the opportunity to ask questions.

OR

I have been explained the nature of the study by the Investigator and had the opportunity to ask questions.

2. I understand that my participation in the study is voluntary and given with free will without any duress and that I am free to withdraw at any time, without giving any reason and without my medical care or legal rights being affected.

3. I understand that the sponsor of the project, others working on the Sponsor's behalf, the Ethics Committee and the regulatory authorities will not need my permission to look at my health records both in respect of the current study and any further research that may be conducted in relation to it, even if I withdraw from the trial. However, I understand that my Identity will not be revealed in any information released to third parties or published.
4. I agree not to restrict the use of any data or results that arise from this study provided such a use is only for scientific purpose(s).
- Yes [] No [] Not Applicable []**
6. I agree to participate in the above study. I have been explained about the complications and side effects, if any, and have fully understood them. I have also read and understood the participant/volunteer's Information document given to me.

Signature (or Thumb impression) of the Subject/Legally Acceptable

Representative:.....

Signatory's Name..... Date

Signature of the Investigator..... Date.....

Study Investigator's Name..... Date.....

Signature of the witness..... Date.....

Name of the witness.....

Received a signed copy of the PID and duly filled consent form

Signature/thumb impression of the subject or legally Date.....

Acceptable representative

Babu Banarasi Das College of Dental Sciences

(Babu Banarasi Das University)

BBD City, Faizabad Road, Lucknow – 227105 (INDIA)

सहमति पत्र

अध्ययन का शीर्षक :- तालु के विभिन्न प्रकार के साथ चेहरे की विषमता जानना।

अध्ययन संख्या

विषय का पूरा नाम

जन्म की तारीख / आयु

विषय का पता

फोन नंबर। और ई-मेल पता

योग्यता

व्यवसाय: छात्र / स्वयं कार्यरत / सेवा / गृहिणी / अन्य (कृपया उचित के रूप में चिह्नित करें)

विषय की वार्षिक आय

नाम और नामांकित व्यक्ति (नाम) और उनके विषय के संबंध में

..... (प्रयोजन के लिए मुकदमा संबंधित मौत के मामले में मुआवजे)

1. मैं पुष्टि करता हूँ कि मैंने प्रतिभागी सूचना दस्तावेज को पढ़ लिया है और समझ लिया है इसके बाद के अध्ययन के लिए और सवाल पूछने का अवसर मिला है। या मुझे अन्वेषक द्वारा अध्ययन की प्रकृति समझाई गई है और सवाल पूछने का अवसर मिला है।
2. मैं समझता हूँ कि अध्ययन में मेरी भागीदारी स्वैच्छिक है और बिना किसी दबाव के स्वतंत्र इच्छा के साथ दी गई है और किसी भी कारण के बिना किसी भी समय बिना किसी मेडिकल देखभाल या कानूनी अधिकारों को प्रभावित किए बिना किसी भी समय में वापस लेने के लिए स्वतंत्र हूँ।
3. मैं समझता हूँ कि इस परियोजना के प्रायोजक, प्रायोजक की ओर से काम करने वाले अन्य लोग, एथिक्स कमेटी और नियामक प्राधिकरणों को मेरे मौजूदा अध्ययन के संबंध में अपने स्वास्थ्य के रिकार्ड को देखने की मेरी अनुमति की आवश्यकता नहीं है और आगे की शोध इसके संबंध में आयोजित किया जा सकता है, भले ही मैं परीक्षण से वापस ले जाऊँ। हालांकि, मैं समझता हूँ कि मेरी पहचान तीसरी पार्टी के लिए जारी किसी भी जानकारी या प्रकाशित में प्रकट नहीं होगी।

4. मैं इस अध्ययन से उत्पन्न किसी भी डेटा या परिणामों के उपयोग को प्रतिबंधित करने के लिए सहमत नहीं हूँ एक प्रयोग केवल वैज्ञानिक उद्देश्य (प्रयोजनों) के लिए है
5. भविष्य के अनुसंधान के लिए मैं संग्रहीत नमूने (दांत / ऊतक / रक्त) का उपयोग करने की अनुमति देता हूँ
 हा [] नहीं [] अनपयुक्त []
6. मैं उपरोक्त अध्ययन में भाग लेने के लिए सहमत हूँ। मुझे जटिलताओं और साइड इफेक्ट्स, यदि कोई हो, के बारे में समझाया गया है और उन्हें पूरी तरह से समझा है। मैंने प्रतिभागी /स्वयंसेवक के सूचना दस्तावेज को भी पढ़ा और समझ लिया है
 प्रतिनिधि:
 हस्ताक्षरकर्ता का नाम तारीख।
 अन्वेषक के हस्ताक्षर दिनांक
 अध्ययन अन्वेषक का नाम दिनांक
 ..
 गवाह के हस्ताक्षर दिनांक
 ..
 गवाह का नाम
 पीआईडी की एक हस्ताक्षरित प्रति और विधिवत भरी सहमति फॉर्म प्राप्त किया
 विषय के हस्ताक्षर / अंगूठे का प्रभाव या कानूनी तौर पर दिनांक
 ..

स्वीकार्य प्रतिनिधि

----- दिनांक -----










ANNEXURE - V



Document Information

Analyzed document	thesis akansha checked.pdf (D131754667)
Submitted	2022-03-28T08:42:00.0000000
Submitted by	Kamna srivastava
Submitter email	dramitn99@bbdu.ac.in
Similarity	7%
Analysis address	dramitn99.bbduni@analysis.urkund.com

Sources included in the report

W	URL: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4686752/ Fetched: 2020-03-12T19:48:56.0270000	 7
W	URL: https://wikiortodonia.com/wp-content/uploads/23-31.pdf Fetched: 2020-04-06T08:58:45.2670000	 2
W	URL: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5556787/ Fetched: 2020-04-06T08:58:30.3800000	 1
W	URL: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5563424/ Fetched: 2020-09-01T15:44:46.2270000	 1
J	URL: f59feb3-1833-42c2-ae4b-1c1fa9b7cee6 Fetched: 2019-10-30T11:26:25.2800000	 1
SA	Main thesis of Dr.Subhash Kumar, Revised edition.docx Document Main thesis of Dr.Subhash Kumar, Revised edition.docx (D107460755)	 1
W	URL: https://www.nepjol.info/index.php/OJN/article/view/23068/19601 Fetched: 2021-11-19T10:44:00.8870000	 1
W	URL: https://www.scielo.br/j/dpjo/a/T5y5gcRSXMynWpdBbNb3SkN/?lang=en Fetched: 2021-11-15T07:12:18.6400000	 1
W	URL: https://www.researchgate.net/publication/23675173_Facial_asymmetry_in_young_healthy_subjects_evaluated_by_statistical_shape_analysis Fetched: 2022-03-28T08:42:58.0130000	 1

ANNEXURE - VI
MASTER CHART
GROUP - I

patient name	maxillomandibular midline	palatal depth	right molar to midline		left molar to midline		age
			model	Pa	model	Pa	
kavya	6.2	20	13	14	20	19	21
aisha	2.2	23	17	15	20	17	22
anita	2.2	28	21	21	23	19	22
aparna	3.2	20	18	16	21	18	23
pankaj	2.1	24	20	17	21	19	24
preeti	3.7	20	16	15	18	17	25
jyoti	5.8	28	18	16	17	20	28
naraynai	8.9	25	22	21	16	17	27
priyanka	4.1	21	18	20	21	20	25
ritika	2.6	22	16	15	21	20	24
harman	2.4	26	17	16	18	18	25
aman	3.4	25	14	15	19	18	24
ruby	10.4	27	14	15	20	21	21
divyanshi	3	22	16	14	18	15	19
madhu	6	23	20	20	22	21	22
mahima	2.6	20	19	18	18	20	25
sweety	3.4	29	17	16	16	15	24
vidushi	2.7	29	19	19	20	19	24
heena	6.9	28	21	14	18	16	21
seema	3.7	22	20	14	12	14	27
arti	2.5	22	18	19	20	21	25
amit	2	21	21	14	18	16	23
surendar	2.4	28	21	16	19	19	28
anurag	2.2	21	16	16	20	21	21
chaaya	2.9	20	21	14	22	20	22
aparna	3.5	26	23	22	27	26	24
arpit	2.7	25	20	19	19	20	25
ankur	2.1	29	18	19	24	23	21
aparna	2.3	19	21	16	17	16	22
ashraf	4.8	27	18	18	20	19	22
bhanu	2.5	28	22	21	19	18	24

huma	2.9	20	22	20	15	16	28
minerva	2.2	20	19	13	17	16	24
neetu	3	26	16	15	18	17	21
nidhi	4.5	23	20	19	16	15	28
pooja	3.4	21	15	14	14	14	29
pushpa	6.2	27	16	17	18	18	24
rais	2.7	20	18	17	20	21	19
shivani	3.8	28	16	16	20	20	26
sumaira	3.1	22	18	17	14	15	21
sunil	4.8	19	19	17	14	12	28
swati	2.6	27	19	17	15	17	23
yashwardhan	3.2	30	20	19	19	20	24
rohit	9.4	26	18	17	14	15	27
arpit	3.8	25	14	14	17	16	22
nishu	2.9	29	19	20	18	16	22
priti	3.5	27	18	16	14	13	21
vishakha	3.4	23	20	16	16	14	26
akash	4.1	30	20	19	21	19	24
aanya	3.2	26	18	17	16	16	24

MASTER CHART
GROUP - II

patient name	maxilomandibular	palatal depth	right molar to midline		Left molar to midline		age
	midline		Model	PA	model	PA	
aarfa	1	21	20	19	20	19	25
abhishel	1.8	20	20	19	18	19	21
aliya	1.6	21	19	16	19	17	23
jaya	0.6	16	18	18	16	15	20
krishna	0.3	20	20	18	19	20	22
manish	0.2	20	22	20	21	20	23
mitakshra	0.8	21	19	19	18	19	24
neeraj	0.1	21	21	20	22	20	24
nisha	1.6	22	21	22	20	19	26
reena	0.9	22	23	21	24	23	23
sarbjit	1.6	20	21	19	21	18	26
sherren	1.5	23	20	18	20	19	30
shreyash	0.3	28	17	16	18	19	28
sparsh	0.7	18	19	17	19	17	26
srishti	1.3	20	23	22	24	23	26
sweety	0.2	21	22	20	16	19	27
tanjula	0.9	25	16	18	18	18	24
tanya	0.4	22	20	18	19	16	24
tarunaam	1.8	22	20	19	20	21	26
akansha	1.5	23	20	19	18	19	22
dheeraj	0.5	21	22	21	20	19	27
danish	0.9	21	20	22	19	20	21
sonali	1.3	21	20	21	20	20	23
aiman	0.6	20	20	19	19	18	22
kashish	1	22	21	20	21	20	22