Republic of Iraq

Ministry of Higher Education

University Of Baghdad

College Of Dentistry

Relationship Between Facial Landmarks

A Project Submitted to

The College of Dentistry, University of Baghdad, Department of Prosthodontics

In Partial Fulfillment for the Bachelor of Dental Surgery

By

Omnieh Khalis AbdulRazzaq AlQaseer

Supervised by:

Dr. Ban Saad

B.D.S M.Sc Prosthodontics

April, 2022

Certification of the Supervisor

I certify that this project entitled "***Relationship Between Facial Landmarks***" was prepared by the fifth-year student **Omnieh Khalis** under my supervision at the College of Dentistry/University of Baghdad in partial fulfilment of the graduation requirements for the Bachelor Degree in Dentistry.

Dr. Ban Saad

April 2022

Dedication

For my mom and dad who taught me about dreams and how to reach them, who always support me, encourage me on every adventure and believe in me even when I don’t.

For my sisters and my brother who always support me and remind me of my potentials.

For all my friends who walked with me all the way, all these years.

Acknowledgment

First and lastly, all gratefulness, faithfulness, and thankfulness to ALLAH for providing me with patience, perseverance and the ability to undertake and finally complete this study.

I want to express my great thanks with respect to **Dr. Raghad Abdul-Razaq AlHashimy**, Dean of the Collage of Dentistry, University of Baghdad for his support to the research student's program.

I would like to thank my **Dr. Abdalbasit Ahmad Fatihallah** , the head of Prosthetic Department, for its scientific support, encouragement and advice.

My sincere thanks and deep appreciation to my supervisor **Dr. Ban Saad**, for her continuous support, encouragement, scientific advice, and great effort in the supervision of this review.

Finally, I would like to thank all of our prosthodontics department seniors, whom never scrimp any of their knowledge to teach us.

Table of content

List of figures

List of Abbreviations

O.V.D	Occlusal vertical dimention
NLF	Nasolabial fold
ATL	Ala-Tragus line
ZMJ	Zygomaticus major muscle
FH	Frankfort horizontal plane
OP	Occlusal plane
Sn	Subnasale
G	Glabella
TMJ	Temporomandibular joint

Introduction

Symmetry, normalcy and youthfulness have been considered the classical elements of facial beauty. **(Rhodes, 2006)**

By definition, symmetry is the "correspondence in size, shape, and relative position of parts on opposite sides of a dividing line or median plane or about a center or axis." **(Merriam, 2008)** This dividing line, which is used to attain symmetry, is known as the midline. It is the fundamental reference for all esthetic deviations. Therefore, knowledge of the midline will invariably result in a better understanding of facial and dental esthetics.

Historically, a diverse number of facial anatomic landmarks located on the middle third of the face, such as the bisector of the pupils, nasion, tip of the nose, tip of the philtrum, and chin, have been used to determine the facial and dental midlines. **(Arnett, 1993)** Some advocate the use of intraoral landmarks, such as the incisive papilla, for determination of the maxillary dental midline. **(Latta, 1988)**

It has been argued in the literature whether the dental midline should be made coincident with the midline of the face or the midline of the oral commissures. **(Lombardi, 1973)** Some believe that making the dental midline coincident with the midline of the oral commissures is adequate, as patients tend to relate their dental midline to proximal structures rather than anatomic structures which are farther from the mouth. **(Tjan and Miller, 1984)** However based upon convention and dogma, most clinicians choose one specific anatomic landmark and an imaginary line passing through it. Others use dental floss and hold it in front of the face from glabella to menton. Thus, the clinician is left with no predictable guidelines, and must determine the midline based on unverified landmarks. **(Arnett and McLaughlin, 2004)**

Aims Of Review

The objectives of the review:

- To review the previous studies on the relationship between facial landmarks, its effect on the construction of complete dentures and on the esthetics and function of the dentures.
- To define the hierarchy of facial anatomic landmarks closest to the midline of the face and the oral commissures (mouth) and observe the relationship between the midline of the oral commissures and the midline of the face.

Chaper One

Review Of Literature

Chapter One: Review of literature

1.1. Facial Landmarks

Standard definitions for anatomic landmarks were used for all purposes of the study. ***Lateral canthus*** was defined as the lateral angle formed by the meeting of the upper and lower eyelids. **(Merriam, 2008)** ***Exocanthion*** was defined as the point at the outer commissure of the eye fissure. **(Farkas, 1994)** ***Nasion*** was defined as the point in the midline of both the nasal root and nasofrontal suture. ***Philtrum*** was defined as the vertical groove on the median line of the upper lip. **(Merriam, 2008)** Commissure was defined as a point or line of junction between 2 anatomic parts (the lips). ***Cheilion*** was defined as the point located at each labial commissure. **(Farkas, 1994)** ***Tip of the nose (pronasale)*** was defined as the most protruded point of the apex of the nose. These definitions were used for all clinical markings as well as to digitally construct an "***Esthetic Frame***."

1.1.1 Extraoral landmarks

The following extraoral anatomical features should be noted when the patient has his/her mouth closed (mandible in resting position) and his/her top and bottom lips lightly touching:

- Philtrum
- labial tubercule,
- vermillion borders
- nasolabial groovea
- labiomental groove **(Arthur *et al*., 2009)**

1.1.1.a. The Nasolabial fold:

It is commonly known as the "***smile lines***" or "***laugh lines***", they are facial features. They are two skin folds that run from each side of the nose to the corner of the mouth. They are defined by facial structures that support the buccal fat pad. They separate the cheeks from the upper lips. The term derives from Latin ***nasus*** for "nose" and ***labium*** for "lip".

Nasolabial fold is a misnomer, however. The proper anatomical term is ***melolabial fold***, meaning the fold between the cheek and lip. **(As shown in fig.1.1)**

With ageing the fold may grow in length and depth. Dermal filling may be used to replace lost fats and collagen in the facial area. Facial exercises give effective results in erasing the appearance of nasolabial folds. The Nasolabial fold is not a simple crease, but a complex three-dimensional curvature resulting from the crease which forms the medial boundary of the malar fat pad due to the cutaneous insertion of the upper lip elevators and zygomaticus major muscle (ZMJ) along the sulcus. Therefore, the nasolabial fold can be defined as one of natural components of the face rather than a wrinkle which appears as a result of aging.

The factors influencing the formation of NLF include the loss of skin thickness over the sulcus, the presence of redundant skin drooping over the sulcus, the excessive fat deposits laterally to the sulcus, ptosis and/or laxity of the malar fat pad, and muscular hyperactivity.

In elderly individuals, more than one factor is usually related with the prominent nasolabial fold, and the nasolabial fold can vary from individual to individual. **(Hur *et al*., 2020)**

Figure 1.1, *Nasolabial Fold* (Mayeaux, 2009)

1.1.1.b. Philtrum:

The Philtrum or "***the medial cleft***" is a central and vertically oriented portion of the upper lip situated between the two skin relieves of the philtrum columns. **(As shown in fig. 1.2)** There is a gentle concavity on its lower portion called the ***philtrum dimple***. The philtrum survives as a medial depression between the nose and the upper lip. It is also known as ***the infranasal depression*** but has no apparent function. The philtrum is formed where the nasomedial and the maxillary processes meet during embryonic development. When these processes fail to fuse fully a cleft lip may result. **(Meneghini and Biondi, 2005)**

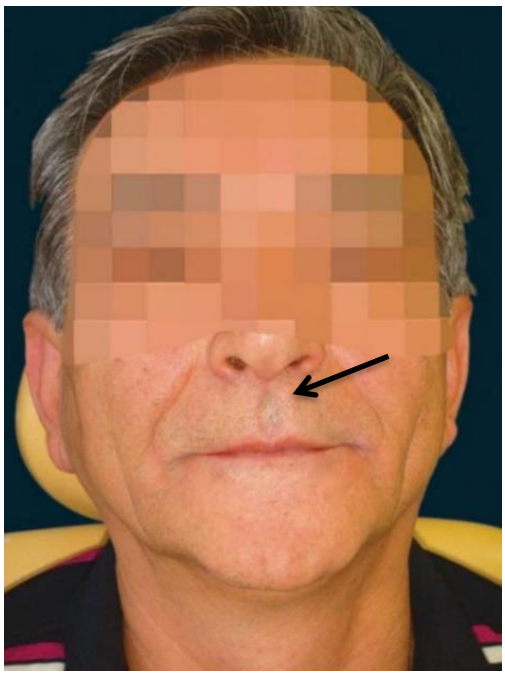

Figure 1.2, *Philtrum Groove* (Özkan, 2018)

The philtrum plays a key role in the appearance of the upper lip and nostril sill. Therefore, construction of the philtrum is crucial for attaining a natural appearance of the lip. The philtrum, which derive from the Greek word philtron meaning "***love potion***" is the most characteristic feature of the upper lip, helping to create a natural appearance of the lip. It is observed that during motion, the philtrum column and dimple are highlighted, helping a viewer from an impression of the speaker. It is also showed morphological philtrum disorders occur in patients

with cleft lip, secondary cleft lip, nose deformity and deformity after tumor resection or traumatic injury, a smooth philtrum is also a characteristic feature of fetal alcohol syndrome. **(Yadav *et al*., 2018)**

1.1.1.c. Mentolabial Sulcus:

Mentolabial sulcus (also known as ***labiomental fold***) is one of the most important esthetic parameters of the lower face. In frontal view, the visible indentation responsible for the separation of the lower lip from the chin is known as the mentolabial groove or crease. In the lateral view, it is evident forming the transition from the lower lip to the soft-tissue chin. **(as shown in fig. 1.3)**

Within the sulcus angle, an inclination of the lower lip in relation to the true horizontal line through ***sublabiale*** is known as the upper component, whereas the inclination of the soft-tissue chin to the true horizontal line through sublabiale is known as the lower component.

Naini et al. mentioned that a mentolabial angle of 107°–118° (male: 115°–145° and female: 120°–130°) is considered as the most attractive although angle up to 140° is deemed acceptable.

Individuals with Class III skeletal profile exhibit an obtuse mentolabial sulcus angle, whereas those with Class II skeletal profile have an acute one. Mentolabial sulcus varies according to ethnicity and races of the people. **(Rokaya *et al*., 2018)**

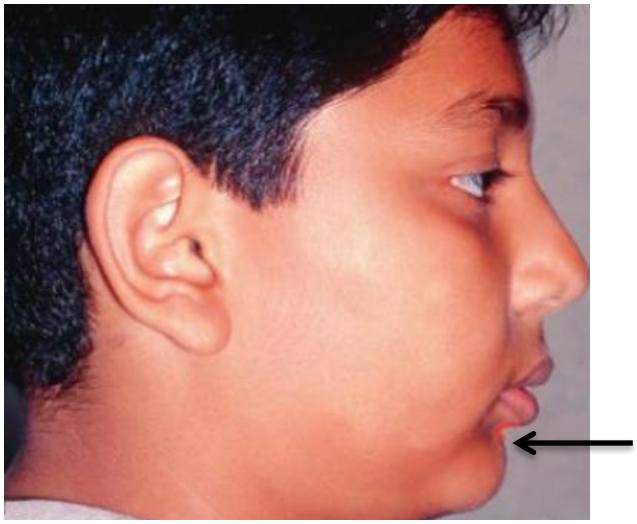

Figure 1.3, *Mentolabial Groove* (Ashok, 2014)

1.1.1.d. Vermilion Border:

The vermilion border (also known as ***margin*** or ***zone***) is the red border of the lips, representing a transitional zone where the lips merge into the mucous membrane or mucosa. **(As shown in fig. 1.4)** It has no sebaceous glands, sweat glands or facial hair. It is bounded externally on the face by ***Mucocutaneous Junction***, the junction between the skin of the face and the vermilion border of the lips. **(Julian *et al*., 2007)**

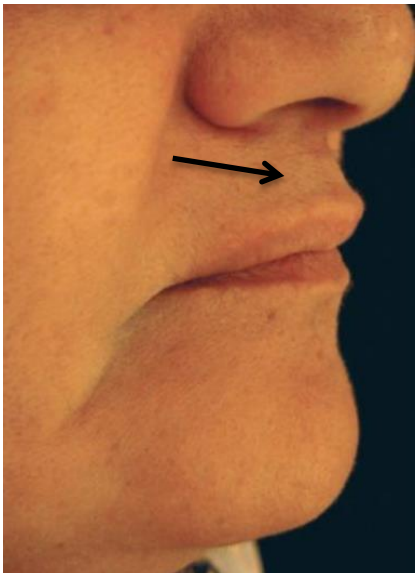

Figure 1.4, *Vermilion Border* (Özkan, *2018)*

The vermilion border is bounded internally in the mouth by the ***wet line*** where labial mucosa begins. The Wet line is the junction between the outer red portion (vermilion border) which is usually dry, and the inner smooth and moist mucosa. The wet line is located about 10mm back from the skin or ***mucocutaneous junction.*** The lips are redder in younger persons than in older persons. **(Julian *et al*., 2007)**

In some individuals, the lip color is reddish brown due to the presence of brown melanin pigment. The vermilion border and mucocutaneous junction are important in the head and neck examination because changes here may be caused by exposure to the sun and could lead to skin cancer. **. (Julian *et al*., 2007)**

There are two reasons why the vermilion border appears red in some people:

• The epithelium is thin and therefore the blood vessels are closer to the surface.

• This epithelium contains ***eleidin*** which is transparent, and the blood vessels are near the surface of the papillary layer, revealing the red blood cell color. At the angles of the mouth, there are sebaceous glands, without hair follicles, which are called ***Fordyce's spots***. **(William *et al*., 2019)**

Generally, the length of the upper occlusion rims is determined in relation to the length of upper lip. After insertion of the occlusion rims in patient's mouth, the length of the lip line is measured with compass and is superimposed over tubercle of the mouth and the lower of the mouth and the lower border of the chin with the jaw closed. If the two distances do not coincide, the height of the lower occlusion rims is reduced or extended accordingly. This method of determining the O.V.D. gives accurate results and can be used by any dentist. **(Boyanov, 1970)**

1.1.1.e. Angle of The Mouth:

The angle of the mouth or sometimes called the ***commissure of the mouth*** is the portion of the oral cavity that connects the upper lip and the lower lip together.As of known, the lips do not have any sebaceous glands, sweat glands or hair follicles. But sometimes they are found in the lateral corners of the mouth and in the cheeks opposite to the molar teeth which then they're called ***Fordyce's Granules.*** **(Christopoulos *et al*., 2011)**

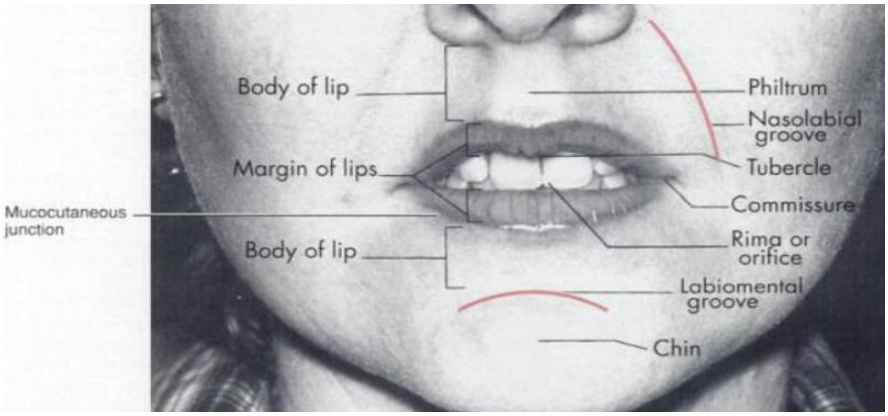

Figure 1.5, *Angle of The Mouth* (Rickne and Julian, 2007)

1.1.1.f. Modiolus:

In the anatomy of the face, the modiolus is a ***chiasma*** (is the spot where two structures meet forming an X-shape) of face muscles held together by fibrous tissue, located lateral and slightly superior to each angle of the mouth. **Fig. 1.6**

It is important in moving the mouth, facial expressions and in dentistry.

It is extremely important in the ***stability of the lower denture***, because of the strength and variability of movement of the area. It derives its motor nerve supply from the facial nerve, and its blood supply from the labial branch of the facial artery. **(Drake *et al*., 2010)**

1.1.f.A Importance of Modiolus:

• The modiolus becomes fixed when the buccinators contract while chewing.

• Contraction of modiolus presses the corner of the mouth against the premolars such that the occlusal table is closed in the front.

• Because of this action, food cannot escape out of the mouth when crushed by the premolars and the molars.

• It contributes to denture stability. **(Vijay and Ruchi, 2017)**

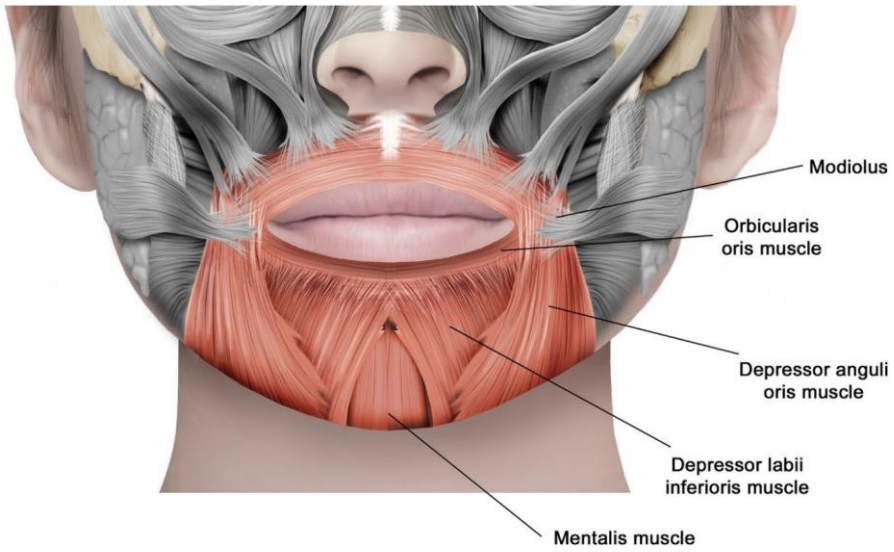

Figure 1.6, *Modiolus* (Mariam, 2020)

1.1.1.g. Ala of The Nose:

Is the lower lateral surface of the external nose, shaped by the alar cartilage and covered in dense connective tissue.

The alae flare out to form a rounded eminence around the nostril. **Fig. 1.7 & 1.8**

Sexual dimorphism is evident in the larger nose of the male. This is due to the increased testosterone that thickens the brow ridge and the bridge of the nose making it wider. **(Saladin, 2011)**

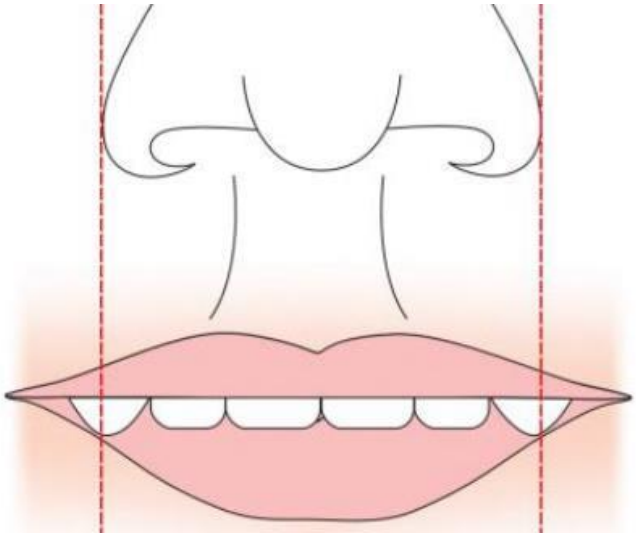

Figure 1.8, *Ala of Nose* (Rangarajan and Padmanabhan, 2017)

Figure 1.7, *Ala of Nose* (Deepak, 2017)

1.1.1.h. External Eye:

The eyelids protect the eye from trauma, dryness, and too much light. They also assist in lubrication of the anterior surface of the eye by blinking.

The upper eyelids are larger and more movable than the lower eyelids.

The eyelids meet at the medial and lateral angles (which is also known as ***canthi***). The opening between the eyelids is known as the ***palpebral fissure***. This opening normally ranges from 8 mm to 11 mm. When the eyelids are wide open, the average of the lateral fissure angle is 60 degrees; medially the fissure is rounded. In Asian people, the medial angle is overlapped by a vertical skin fold called the ***epicanthus***. The appearance of the external eye can vary from race to race, and all are simply variations of the normal. **(Sheil, 1999)**

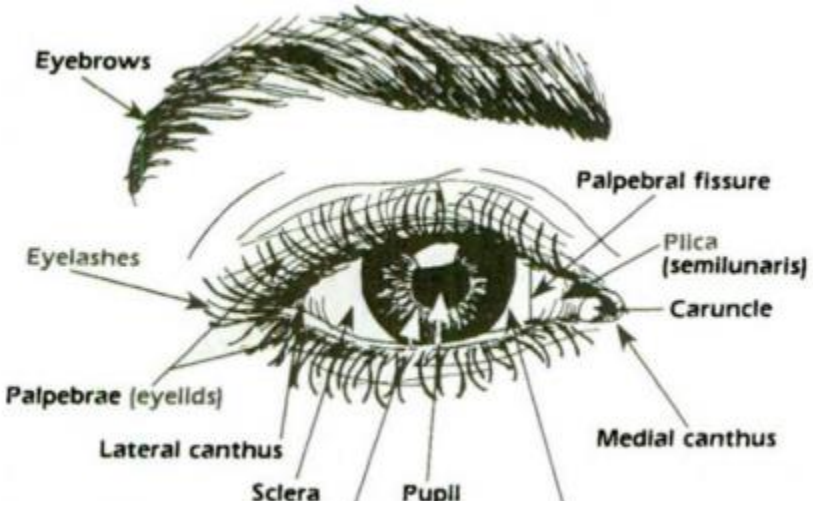

Figure 1.9, *External Eye Anatomy* (Sheila and Lens, 1999)

Young children sometimes have a prominent epicanthal fold, causing them to appear ***esotropic*** (the eye seem to turn inward, making the chil0d look "cross-eyed").

When the eye is closed, the entire cornea should be covered by the eyelid.

If the lids do not close completely, the condition is termed ***lagophthalmos***.

When looking straight ahead with the eye open, the upper eyelid rests just below the superior margin of the cornea.

If the eyelid is lower than this, it is referred to as ***ptosis***. **(Sheil, 1999)**

The lower eyelid should cover 1 mm to 2 mm of the inferior cornea. If the cornea is exposed to the point that the sclera is visible, we say that the patient has scleral show. The lower lid elevates just slightly when is eye is closed.

The lateral angle of the eyelid rests flush against the eye, while the medial angle is approximately 6 mm from the eye. The medial angle has a small pink elevation called the ***caruncle***.

The caruncle has small hairs the functions a trap for secretions in the corner of the eye, as well as sebaceous glands the contribute oil to the tear film. The soft, half-moon fold of tissue next to the caruncle is the ***semilunaris plica***.

The plica represents the junction of the bulbar conjunctiva and muscle tissue. **(Sheila, 1999)**

1.1.1.i. The Tragus of The Ear:

The tragus is a small cartilaginous structure located on the anterior border of the auditory canal. It presents a backward inclination protecting the entrance of the external auditory meatus.

It is covered by special skin on its anterior and posterior aspects and is important to the ear for its esthetic, anatomical, and functional aspects.

Figure 1.10, *Tragus of The Ear* (Juarez, 2013)

The esthetic and anatomical ones represent rebuilding a segment of the complex architecture of the auricle since the tragus is so evident on any description of the normal anatomy, as well as when one looks on the lateral side of the face. However, the functional aspect is even more important than reinstating the esthetic and anatomy of the external entrance of the auditory meatus since many patients complain about its absence.

There are 3 origins of the absence of the tragus:

• Congenital.

• Traumatic amputation.

• Iatrogenic. **(Juarez, 2013)**

1.1.2 Interpupillary line:

An imaginary horizontal line drawn between the centers of the pupils of the eyes. The length of the line is the ***interpupillary distance***. This line is of major importance in the construction of complete dentures. **(As shown in fig. 1.11)**

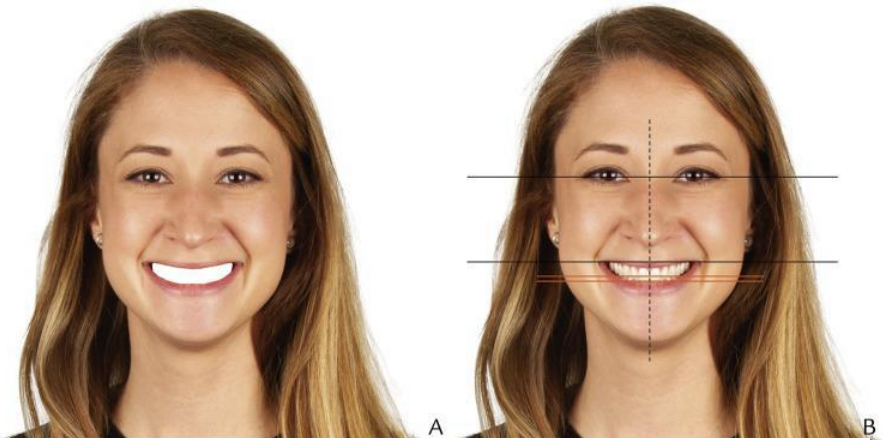

Figure 1.11, *Interpupillary line* (Revilla *et al.,* 2019)

The fox occlusal plane plate will be used to establish the anterior plane parallel to an interpupillary line, and the anterior-posterior plane parallel with Camper's plane (ala-tragus line). The occlusal plane of most natural posterior teeth is approximately parallel with these landmarks. **(As shown in fig.1.12)**

This plane ideally would be parallel to the interpupillary line, equally split the distance between the opposing ridges, be at the level of the middle to upper third of the retromolar pad, be parallel to remaining ridges, and be just below the corners of the mouth when the patient smile**. (Arthur *et al.*, 2009)**

Figure 1.12 *Interpupillary Line with Fox Bite Registration* (Arthur *et al*., 2009)

1.1.3 Ala-Tragus Line (Camper's Line):

An imaginary line extending from the lower border of the ala of the nose to the upper border of the tragus of the ear. It is used as a reference line in orthodontics, radiography, and the construction of complete dentures. **Fig. 1.13**

The occlusal plane is defined as the average plane established by the incisal and occlusal surfaces of the teeth. Several principles have been postulated for determining the Occlusal plane; however, no single method seems to be fully accepted. Although criticized, ***Camper's line*** or A***la-Tragus line (ATL)*** is a widely used guide for occlusal plane orientation. **(Carole *et al.*, 2014)**

Many studies have analyzed orientation of Occlusal plane in complete the denture construction, and the occlusal plane in relation to the craniofacial reference points. During denture fabrication, the Occlusal plane is generally established in the patient's mouth in reference to anatomic or physiologic landmarks.

One common method to establish Occlusal plane in clinical practice involves dividing it into 3 segments, one anterior and 2 posterior.

The anterior segment of Occlusal plane is usually determined according to esthetic and phonetic criteria.

It is then rendered parallel to a line connecting pupils of the eyes.

Posterior segments are made parallel to the Ala-tragus line which is defined as 'a line running from inferior border of ala of the nose to some defined point on ear tragus, usually considered to be the tip of tragus. **(Carole *et al.*, 2014)**

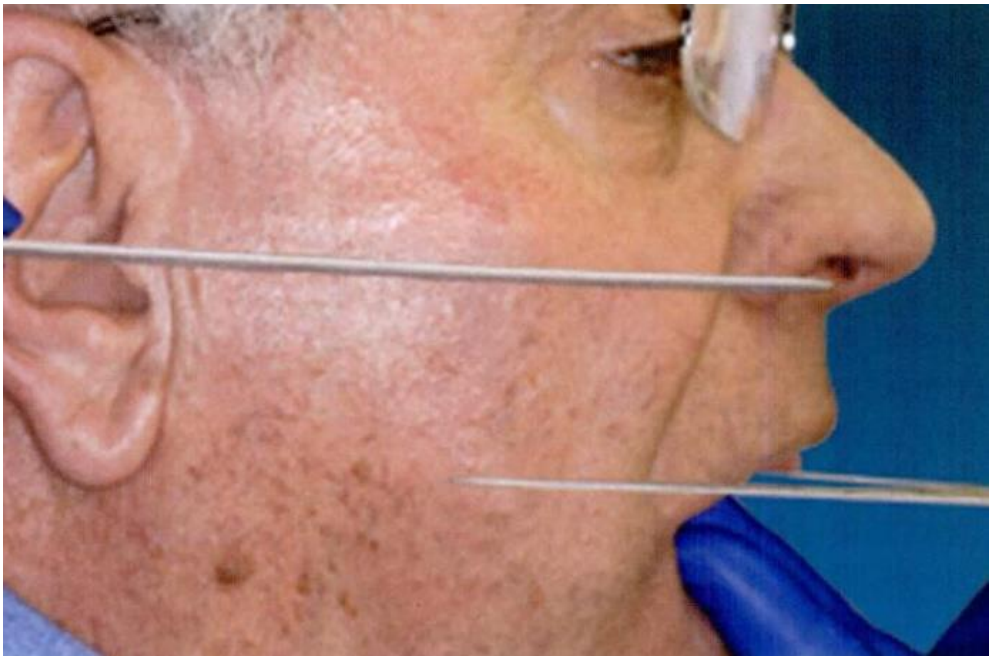

Figure 1.13, *Ala-tragus Line* (Arthur et al., 2009)

1.1.4 Canthus Tragus Line:

It is an imaginary line extending from the outer canthus of the eye to the superior border of the tragus of the ear. It is essential in the construction of complete dentures, particularly in locating the position of the condyles. **Fig. 1.14**

Mark a reference position over the patient's condyle, either by palpating for the condyle or measuring 13 mm anteriorly from the tragus of the ear on a line between the tragus and the outer canthus of the eye**. (Duncan, 2012)**

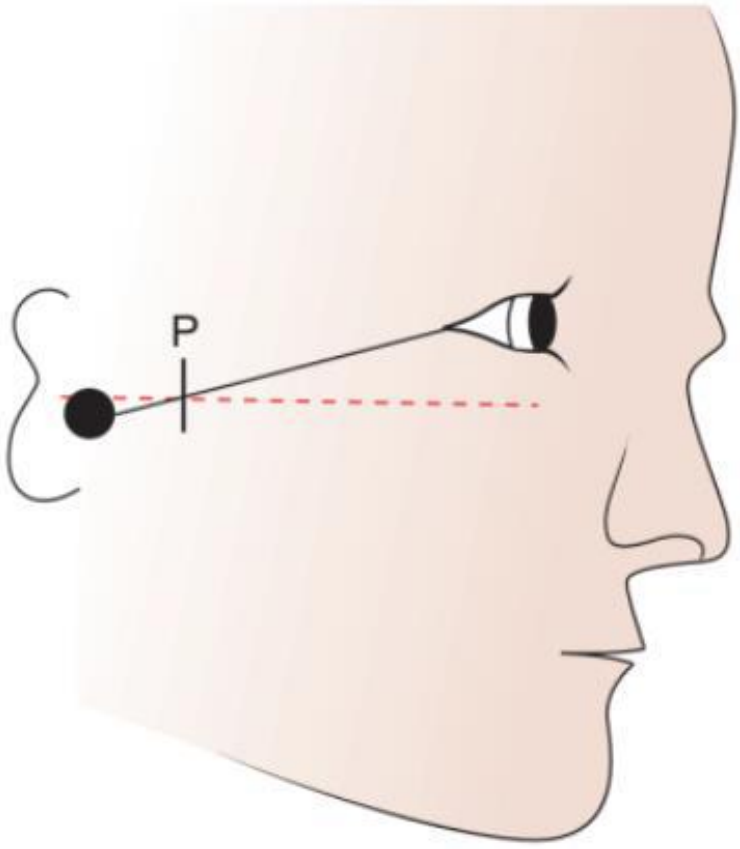

Figure 1.14, ***Canthus Tragus Line*** **(Vijay and Ruchi, 2017)**

1.1.5 Ear Lobes:

The ear lobes can be used during maxillomandibular relationship registration. This is commenced by comparing the Fox plane guide with the ear lobes on both sides simultaneously. **Fig. 1.15**

The distance between the inferior border of the ear lobe and the Fox plane guide should be equal on both sides and this is estimated with the practitioner's eyes.

Any discrepancies can be adjusted by adding or removing from the occlusal rim.

As the ear lobes are important stable landmarks unlike the moving pupils of the patient. **(Bayan, 2010)**

Figure 1.15, ***Using Ear Lobes During Maxillomanibular Relationship Registration*** **(Bayan, 2010)**

1.1.6 Anterior Reference Points:

By using face-bow, casts can be positioned at any point between the upper and lower arms of the articulator, because the face-bow can rotate upward and downward around the hinge axis of the articulator. So, a standard is needed which can be used to mount most casts. Some operators prefer the midway point in the articulator, whereas others prefer to orient it according to anatomical landmarks obtained from the patient. Thus, the anterior point of reference determines at what level in the articulator the occlusal plane is placed or in other words, it determines the level at which the casts are mounted**. (Jyotsna, 2015)** The selection of anterior

reference point determines which plane in the prosthesis becomes the plane of reference. The objective of the natural appearance in the form and position of the teeth is achieved by mounting the maxillary cast relative to the ***Frankfort horizontal plane*** (FH plane). The objective of the natural appearance in the occlusal plane is achieved by mounting the cast relative to the ***Camper's plane***. To establish a standard line for comparison between the patient's FH plane, anterior reference point is frequently used**. (Vijay and Ruchi, 2017)**

1.1.6.1 Commonly used Anterior reference points:

• (A) ***Nasion***: Used with Quick mount face-bow.

• (B) ***Orbitale***: It is the lowest point on the infraorbital rim and along with the two posterior points.

• (C) Orbitale minus 7 mm.

• (D) ***Ala of the nose***: This plane represents Camper's line. As shown in (fig 16)

• 43 mm superior from the lower border of the upper lip. **(Jyotsna, 2015)**

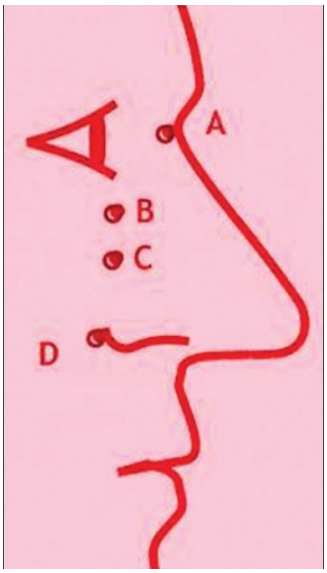

Figure 1.16, *Anterior Reference Points* (Prince *et al.*, 2013)

1.1.7 Posterior Reference Points:

The position of the terminal hinge axis on either side of the face is generally taken a posterior reference point. Prior to aligning the face-bow on the face, the posterior reference points must be located and marked. They are located by either of these methods. **As shown in fig. 1.17**

a) Arbitrary Method: Either by measurement or by palpation of the TMJ area to locate the hinge axis, as the patient opens and closes his mouth.

b) Kinematic Method: It is the most accurate method of locating the hinge axis using a kinematic face-bow. **(Jyotsna, 2015)**

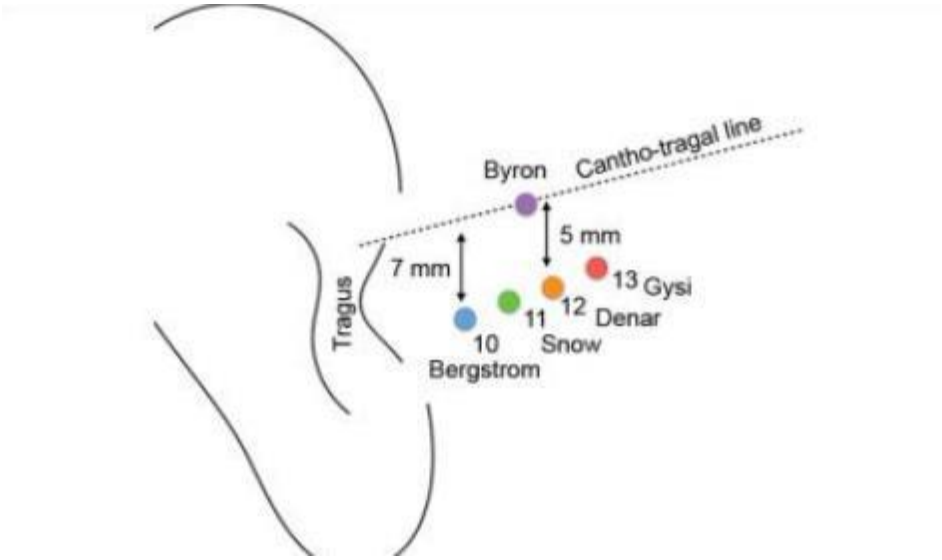

Figure 1.17, *Posterior Reference Points* (Deepak, 2017)

1.7.1 Importance of Posterior Reference Points:

1. In edentulous mouth, above three relations together help to determine the height of the dentures and the way they are related to each other.

2. In patients with natural teeth, the teeth determine how the jaws are related to each other. However, in edentulous patients, the maxillomandibular relations must be established by the dentist. **(Jyotsna, 2015)**

1.7.2 Commonly used Posterior reference points:

- ***Simpson:*** 11 mm anterior to the superior border of the tragus on the camper's line **Fig. 1.18**

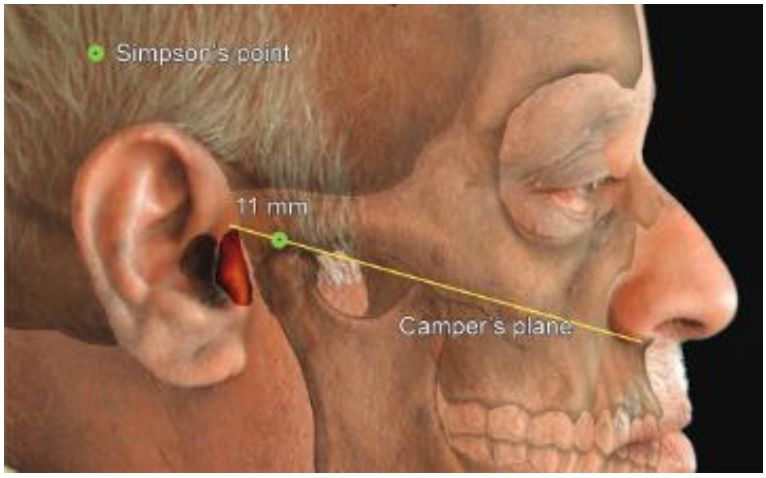

Figure 1.18, *Simpson's point* (Rahmath *et al*., 2019)

- ***Bergstorm Point:*** A point 10 mm anterior to the center of the external auditory meatus. **(Vijay and Ruchi, 2017) Fig. 1.19**

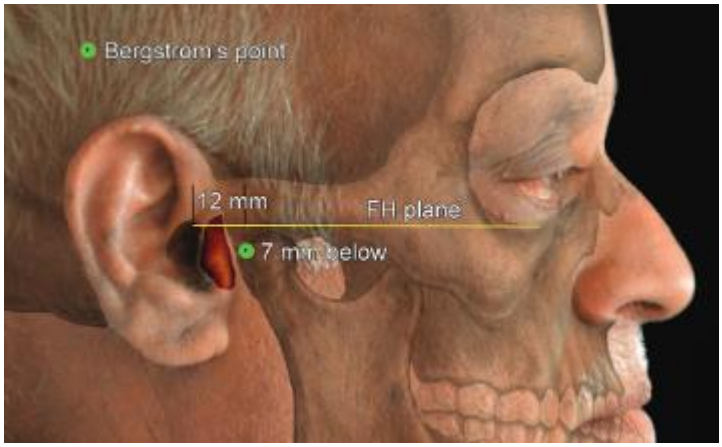

Figure 1.19, *Bergstorm's point* (Rahmath *et al*., 2019)

- ***Beyron's Point:*** A point 13 mm anterior to the posterior margin of the tragus of the ear on a line from the center of the tragus to the outer canthus of the ear. This point is the second most accurate. **Fig. 1.20**

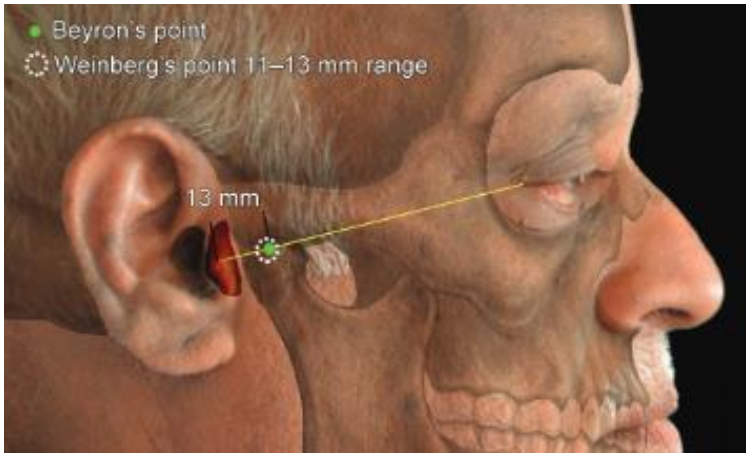

Figure 1.20*, Beyron's point and Weinberg's point* **(Rahmath *et al.*, 2019)**

- ***Denar reference Point:*** A point 12 mm anterior to posterior border of tragus and 5 mm inferior to the line extending from the superior border of tragus to outer canthus of eye. **(Vijay and Ruchi, 2017) Fig. 1.21**

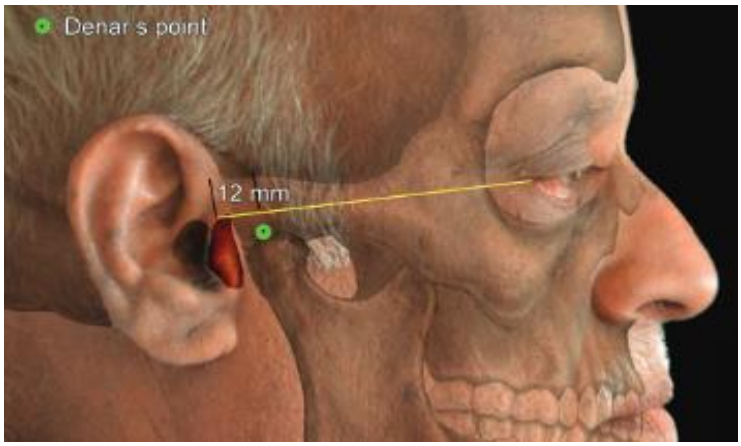

Figure 1.21, *Denar's point* **(Rahmath *et al.*, 2019)**

- ***Teteruck and Lundeen's Point:*** A point located 13 mm anterior to the tragus on a line from the base of the tragus to the outer canthus of the eye.

- ***Gysi:*** A point about 13 mm anterior to the anterior margin of external auditory meatus on a line from superior margin of external auditory meatus and the outer canthus of the eye. **(Vijay and Ruchi, 2017) Fig. 1.22**

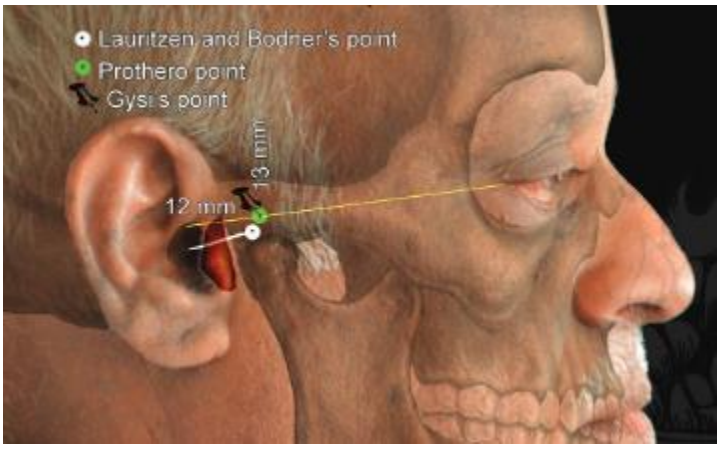

Figure 1.22, *Gysi's point* (Rahmath *et al.*, 2019)

1.1.8 Smile Line:

The smile line is one of the most important factors of aesthetics. In the smiling person, the lower lip creates a nice curve known as ***the smile line***. **Fig. 1.23** This curve can be used as a guide for upper anterior teeth arrangement. When the patient smiles, a nice expression occurs if the upper teeth's incisal edges follow the lower lip line. The incisal edges of upper incisor teeth should be parallel to the lower lip, also when smiling. . **(Ozkan, 2019)**

If this adaptation is not provided or a reverse contour occurs, the line created by the lower lip when smiling will not be harmonious with the incisal edges of the teeth, and this situation will create a disagreeable appearance. A reverse contour will usually give the appearance of an artificial denture. The vertical position of ***the upper canine*** is effective in the formation of the smile line. The smile line will be more parallel to the lower lip if the incisal edges of the canines are positioned slightly shorter than the incisors. Many patients desire larger and more visible upper anterior teeth during smiling. The vertical orientation of the lower anterior teeth is a better guide than the upper teeth. When the mouth is slightly opened, the incisal tip of the natural mandibular canine and buccal cusp of the first premolar are positioned at the commissures at the level of the lower lip. It should be

considered that the vertical positions of the teeth are not formed correctly if the artificial anterior teeth are positioned below or over this level. If the lower teeth are over the lip level at the commissures, either the anterior teeth have an excessive overlap the occlusion plane level is high, or the vertical dimension is high. If the lower teeth are below the lip line, then the reverse is in question. If the shape of the smile line reversed, the aesthetics will be disrupted, and there will be an artificial appearance. **(Ozkan, 2019)**

Figure 1.23, *Smile Line* (Ozkan, 2019)

1.1.9 Lip Line:

After evaluating the facial proportions, the clinician should classify the lip line according to its position in relation to the gingival line. The lip line, assessed when the patient is full smile, can be classified as high, medium, and low. A medium lip line relationship is generally considered ideal and most clinical guidelines assume a medium lip line. Although the classification is rather simple, the determination may be difficult because some patients may hide their natural lip line to cover an esthetic concern. Although the upper lip is evaluated during smiling, the lower lip is evaluated during speech. **(Rangarajan and Padmanabhan, 2017)**

1. 1.9.1. The lip line can be classified as follows:

• ***High***: Indicated excessive gingival display.

• ***Medium:*** Vermilion border of the upper lip is at or near the gingival line.

• ***Low:*** The upper lip covering a portion of the maxillary anterior teeth. **(Abhinav, 2018)**

As shown in fig. 1.24

Figure 1.24, ***(A) Low Lip Line. (B) High Lip Line.*** **(Rangarajan and Padmanabhan, 2017)**

1.1.10. Extraoral Midline References:

Symmetry has always been linked to beauty. Not surprisingly, it has also been ascribed as one of the characteristics of a beautiful smile.

This symmetry can be related to the size and shape of the teeth on both sides of each arch. Also, it is related to the relationship of the intraoral tissues to the lips on both the right and left sides. Therefore, the same amount of gingival display should be seen upon smiling, on both sides of the arch. Reasons for any asymmetry include a cant in the maxillary skeletal base, different amounts of tooth eruption on the right and left sides, or asymmetrical smiles. It is estimated that 8.7% of normal adults have asymmetrical smiles. **(Ravindra, 2012**) The dental midline is of high importance to the symmetry of the smile. The upper dental midline has been considered more important than the lower dental midline in esthetic smile design. It has been shown that a discrepancy of less than 2 mm between the upper dental midline and the facial midline is not readily perceived. However, any type of unparallel relationship between the interproximal contacts of the incisors related to the facial midline is more easily perceived. **(Ravindra, 2012**)

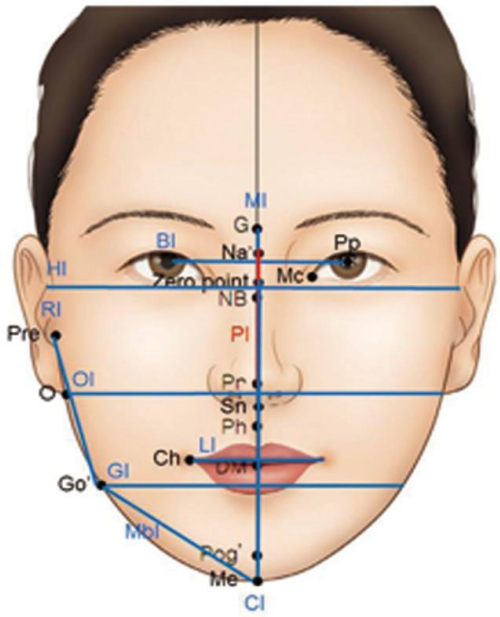

Figure 1.25, ***Extraoral Midline References*** **(Kang, 2015)**

Because the shape and movement of soft tissues, rather than the skeleton, are visible during interpersonal interaction, relative assessment of the facial can be considered as most important. No distinctive visible parameters or strategies have been established to distinguish between normal and abnormal asymmetries of the soft tissues. Instead, facial aesthetics are decided based on the subjective perception from patients or physicians. Therefore, subjective evaluations such as the perception of asymmetry of the facial profile will depend on soft tissues. The assessment should be systematically conducted as patients are standing or sitting comfortably, in the natural head position and centric occlusion state, with lips in resting state. The natural head position is the head position that patients feel most comfortable. To confirm the proper soft tissue change, patients should relax their lips. **(Kang, 2015)**

For example, patients who have vertical maxillary deficiency and severe malocclusion tend to strain the perioral musculature in compensation. Thus, patients must be assessed in a resting position in order to accurately assess the maxillary incisor-labial relationship. In such cases, patients might be asked to bite wax between their teeth to increase the vertical dimension until the lips are in contact.

Significant factors to assess include deficiency of dental show, foam, and lip thickness in relation to the front and back of the jaw, labiomental fold, upper lip length, nasolabial angle, and thickness of soft tissues. The midsagittal line that connects the glabella (G') and subnasale (Sn) is used to assess asymmetry. For highly accurate assessment, the soft tissue landmarks on patient's face should be marked and other features of the face should be masked before photogrammetric assessment. Most patients do not have perfect facial symmetry, but an unnoticeable asymmetry suggests a good profile. When the asymmetry is clinically obvious, using posterior-anterior cephalometric radiography can be beneficial is caused by the skeleton, soft tissues, or a combination of the two**. (Kang, 2015)**

1.1.10.1 The relationship of facial anatomic landmarks with midlines of the face and mouth

A study in 2009 showed that three commonly used anatomic landmarks, nasion, tip of the nose, and tip of the philtrum, were marked clinically on 249 subjects (age range: 21-45 years).
Frontal full-face digital images of the subjects in smile were then made under standardized conditions. A total of 107 subjects met the inclusion criteria. Upon applying exclusion criteria, images of 87 subjects were used for midline analysis using a novel concept called the Esthetic Frame.
Deviations from the midlines of the face and mouth were measured for the 3 clinical landmarks; the existing dental midline was considered as the fourth landmark. **(Bidra *et al*., 2009)**
The entire process of midline analysis was done by a single observer and repeated twice.
Within the limitations of the study, the hierarchy of anatomic landmarks closest to the midline of the face in smile was as follows: the midline of the oral commissures, natural dental midline, tip of philtrum, nasion, and tip of the nose. The hierarchy of anatomic landmarks closest to the midline of the oral commissures was: natural dental midline, tip of philtrum, tip of the nose, and nasion. **Fig. 1.26**
These relationships were the same for both genders and all ethnicities classified. **(Bidra *et al.*, 2009)**

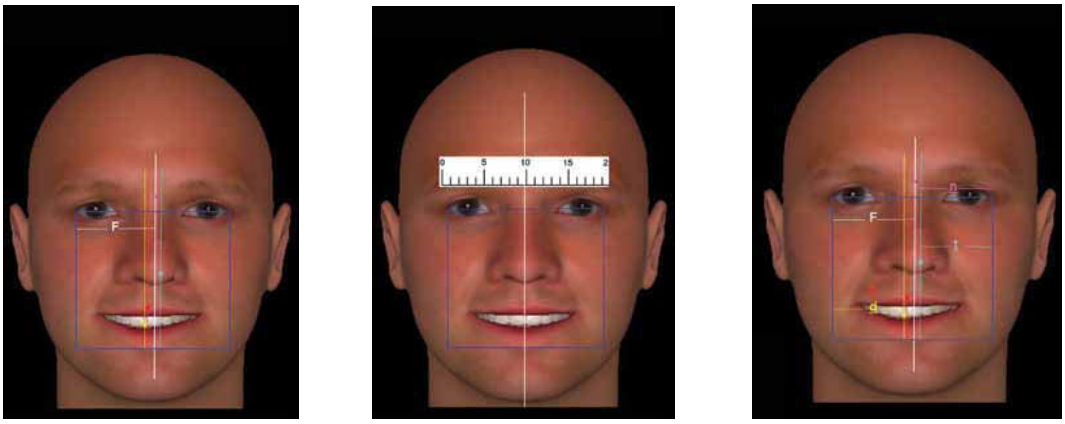

Figure 1.26, *Methods to determine facial landmarks relation wih midlines* (Bidra et al., 2009)

1.1.11. Facial Profiles:

Examination of the facial profile is very important because it helps in determining the jaw relation and occlusion. The profile is obtained by joining two reference lines. One line joins the forehead and deepest point in curvature of the upper lip and the second line joins the deepest curvature of the upper lip and the most prominent portion of the chin. **(Vijay, 2017)**

1.1.11.1 Facial Profiles Classification:

• ***Class I:*** Normal facial profile.

• ***Class II:*** Retrognathic profile or convex profile, Occlusion has Class II disharmony in the centric position.

• ***Class III:*** Prognathic profile or concave profile, Occlusion has Class III disharmony in the centric position. **(Vijay and Ruchi, 2017)**

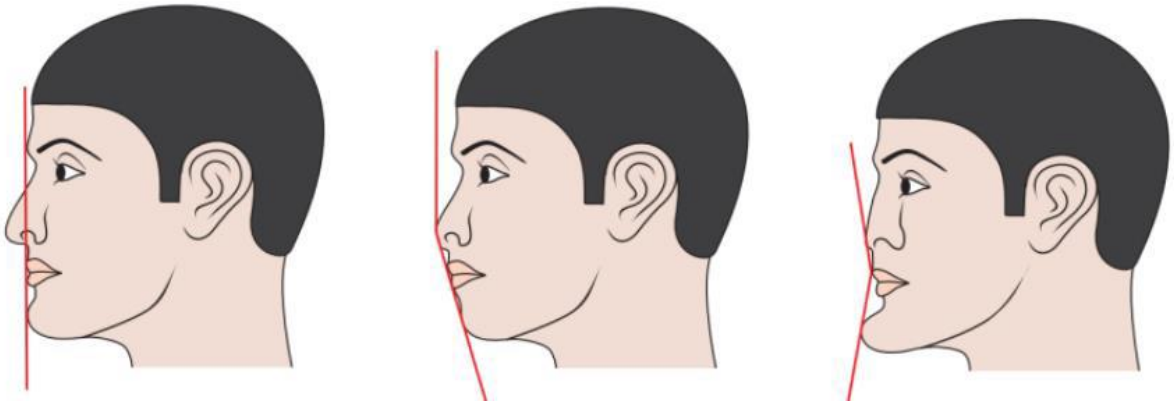

Figure 1.27, *Facial Profile Classification* (Vijay and Ruchi, 2017)

1.1.11.2 The following points were marked to analyze the facial profile in the lateral photographs:

• ***Glabella (G):*** most prominent point of the forehead.

• ***Subnasale (Sn):*** limit point between the nasal septum and the cutaneous part of the superior lip.

• ***Pogonion (Pg):*** Most anterior point of the soft tissue of the chin.

• ***Menton (Me):*** Most inferior point of the soft tissue of the chin.

• ***Superior Lip (SL):*** Most prominent point of the superior lip.

• ***Inferior Lip (IL):*** Most prominent point of the inferior lip. **(Lorena *et al.*, 2017)**

1.1.12 Facial Measurements

Facial measurements can be used to aid in determining an acceptable O.V.D. Many prosthodontists have long sought to find constant anthropometric measurements, within the face. **(McGee, 1947)** proposed that facial measurement; he correlated the known O.V.D. with three facial measurement in which he claimed that they remain constant through life. The three measurements are :

- The distance from the center of the pupil of the eye to a line projected laterally from the median line of the lips.
- The distance from the glabella to the subnasion.
- The distance between angles of the mouth with the lips in repose

He stated that two of these three measurements will be invariably equal, and occasionally all three will be equal to one another. He also claimed that two or three of measurement correspond to the O.V.D. the facial measurements proposed by McGee have the support **(Pound, 1957)** and **(Paquette, 1966)**

Some observers have suggested that face can be divided into equal thirds, 1st the forehead, 2nd nose and 3rd is the lips and chin.

Unfortunately, the method of ***"equal-thirds"*** concept is off little practical value for a variety of reasons, generally, the points of measurements are too vague **(Sharry, 1962)**

However, it was shown that measurements made between marks on the skin of the upper lip and the chin when the mandible moves from the occlusal position to simulated postural positions were always less than the mandibular excursion involved. They concluded that what were being measured were not altered skeletal relationships but less perceptible, concomitant changes in the relative positions of the mark-bearing soft tissues. **(McMillan *et al.*, 1970)**.

On the other hand it was stated that the distance between the interpupillary line and parting line of the lips and between the base of the nose and the lower border of chin are not always equal. Therefore, another anthropometric method for determining the O.V.D. was described for edentulous patients. It was suggested that the length of lip line equals the distance between the tubercle of the mouth and the lower border of the chin with the jaw closed. **(Boyanov, 1970)**

1.1.13 Facial From:

House and Loop, JP Frush and RD Fisher, and Leon Williams classified the facial form based on the outline of the face. The teeth selected should be in harmony with the facial form. Ovoid teeth are preferred for patients with an oval face, etc.

1.1.13.1 The facial form was classified as follows:

- Ovoid.
- Tapering.
- Square.
- Combination of the above**. (Vijay and Ruchi, 2017)**

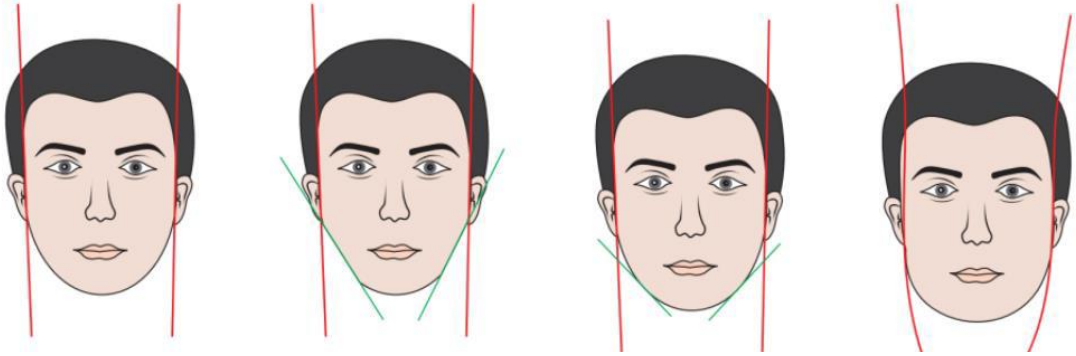

Figure 1.28, *Facial Form Classification* (Vijay and Ruchi, 2017)

1.1.14 Intraoral Landmarks:

1.1.14.1 Maxillary Landmarks:

- Incisive Papilla.
- Maxillary Tuberosity.
- Hamular Notch.
- Rugae Area.
- Torus Palatinus.
- Midline Raphe.
- Vibrating Line.
- Alveolar Bone.

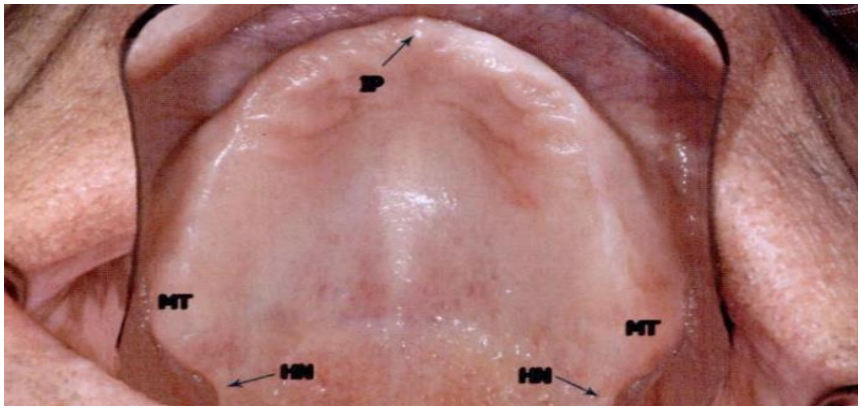

Figure 1.29, *Maxillary Landmarks* (Arthur et al., 2009)

1.14.2 Mandibular Landmarks:

• Retromolar Pad.

• Pterygomandibular Raphe Fold.

• Buccal Shelf Area.

• Lingual Frenum.

• Sublingual Fold.

• Torus Mandibularis.

• Genial Tubercle.

• Sublingual Caruncle. **(Arthur *et al*., 2009)**

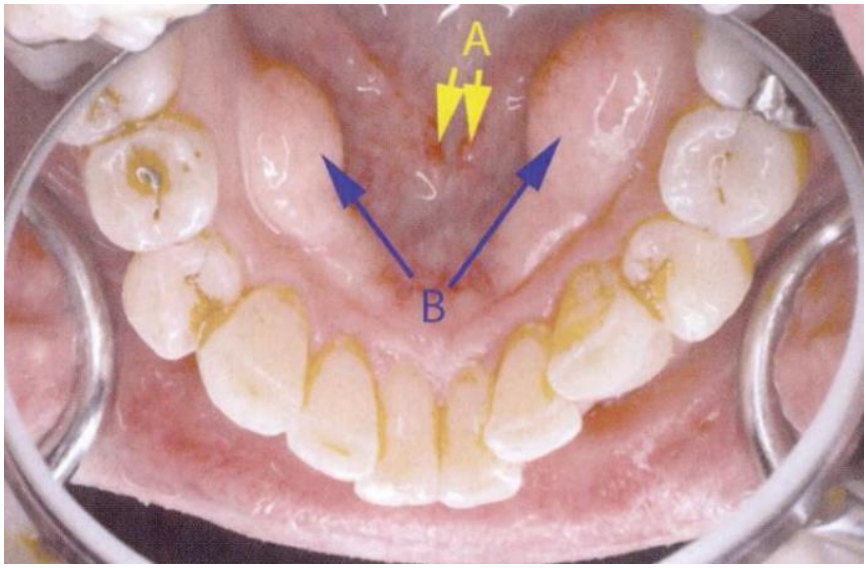

Figure 1.30, ***(A) Sublingual Caruncle. (B) Torus Mandibularis*** **(Arthur *et al*., 2009)**

In dental esthetics, it is more important that the maxillary dental midline and the facial midline coincide, than the mandibular and facial midlines. This is due to the dominant visibility of the maxillary anterior teeth in smile and function. . **(Beyer and Lindauer, 1998)**

The coincidence of facial, maxillary, and mandibular midlines is desirable, but not mandated. The maxillary dental and facial midlines have an important role in esthetics and occlusion in many disciplines, including removable and fixed prosthodontics, implant prosthodontics, orthodontics, and facial plastic surgery. **(Cardash *et al.*, 2003)**

Not being able to match the dental midline coincident to the midline of the face or mouth is a common cause of frustration for dentists. This generally results in elaborative procedures for correction, causing loss of clinical time.

Clinical studies have been limited to the amount of tolerance of deviated dental midlines from the facial midline, a span of approximately 2 to 3 mm. **(Beyer and Lindauer, 1998)**

1.14.3 Use Of Lingual Frenum

It is used for determining the original position of mandibular anterior teeth. A study was conducted to record the O.V.D. by depending on casts made from irreversible hydrocolloid impression material. Then the patient is instructed to elevate his tongue while impressions were made. The vertical distance between the anterior attachment of the lingual frenum and incisal edges of of mandibular central incisors was measured on the casts, the result is that; the distance between anterior attachments of the lingual frenum and incisal edges of mandibular incisors was relatively stable when frenum was recorded during function. **(Bissasu, 1999)**

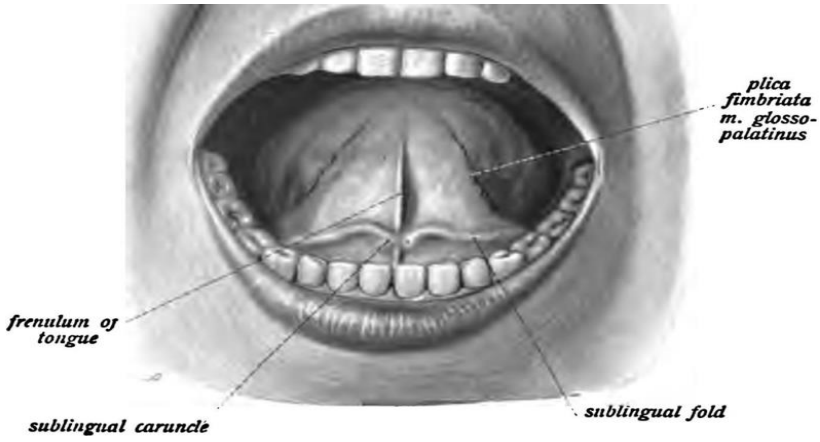

Figure 1.31, *Lingual frenum* (Parimala, 2006)

Chapter Two

Conclusion

Chapter Two: Conclusion

Out of the findings of this review, it can be concluded that the facial landmarks are of major importance in prosthetic dentistry and especially in the construction of complete dentures. We should always try and create a prosthesis that is esthetically appealing and functionally sound in respect to normal harmony of the facial landmarks. It is the duty of the dentists to carefully diagnose, analyze and deliver the best to their patients, taking into account all of the above discussed factors

References

(A)

- Arnett GW, McLaughlin RP. *Facial and dental planning for orthodontists and oral surgeons*. St. Louis: Elsevier; 2004. p. 52-70
- Apostolos Christopoulos, 2011. *Mouth Anatomy*. Medscape References
- Abhinav Gupta, 2018. *Perio-Esthetics and Implant Prosthodontics in Anterior Rehabilitation. Educreation Publishing.*
- Ashok Karad, 2014. *Clinical Orthodontics: Current Concepts, Goals and Mechanics.* Elsevier Health Sciences

(B)

- Bissasu M. *Use of lingual frenum in determining the original position of mandibular anterior teeth* J.Pros.Dent.1999;82(2):177-81
- Boyanov B. *Determining vertical dimension of occlusion and centric relation*.J.Prosrhet.Dent.1970;24:18-24
- Bayan S. Khalaf, 2010. *Ear lobes as facial landmarks for determining the occlusal plane. Journal of Baghdad College of Dentistry.*
- Bidra A., Uribe, F., Taylor T., Agar, J., Rungruanganunt, P. and Neace, W., 2009. The relationship of facial anatomic landmarks with midlines of the face and mouth. *The Journal of Prosthetic Dentistry*, 102(2), pp.94-103.

(C)

- Clark JR, Hutchinson I, Sandy JR. *Functional Occlusion: II. The role of articulators in orthodontics*. J Orthod 2001;28(2):173–177.

(D)

- Drake, Vogl, Mitchell., 2010. *Gray's Anatomy For Students* 2nd edition. Elsevier.
- Deepak Nallaswamy, 2017. *Textbook of Prosthodontics.* 2nd ed. JP Medical Ltd.

(G)

- Gates GN, Nicholls JI. *Evaluation of mandibular arch width changes*. J Prosthet Dent 1981;46(4):385–392.

(H)

- Hur, M., O., J., Yang, H., Kwon, H., Lee, S., & Lim, H. et al. (2020). *Heights and spatial relationships of the facial muscles acting on the nasolabial fold by dissection and three-dimensional microcomputed tomography*. PLOS ONE, 15(8).

(J)

- Johnson, T. and Wood, D., 2015. *Techniques in complete denture technology*. Chichester: Wiley-Blackwell

(K)

- Kumar, P., Kumar, A., Goel, R. and Khattar, A., 2013. *Anterior point of reference: Current knowledge and perspectives in prosthodontics*. Journal of Orofacial Sciences.

(L)

- Latta GH Jr. *The midline and its relation to the anatomic landmarks in the edentulous patient*. J Prosthet Dent 1988;59:681-3.
- Lombardi RE. *The principles of visual perception and their clinical application to denture esthetics*. J Prosthet Dent 1973;29:358-82.
- Lauritzen AG, Bodner GH. *Variations in location of arbitrary and true hinge axis points*. J Prosthet Dent 1961;11(2):224–229.
- Lens, A., 2008. *Ocular anatomy and physiology*. Thorofare, NJ: Slack Incorporated.

(M)

- McGee G.F *Use of facial measurements in determining vertical dimension*.J.AM.Dent.Ass.1947;35:342-50
- Meneghini, F., & Biondi, P. (2005). *Clinical Facial Analysis: Elements, Principles,* and Techniques. Springer
- McMillan, Barbenel and Quinn *Measurement of occlusal face height by dividers*.J.Pros.Dent.1970;20:177-79
- Makzoumé, J., Abi-Ghosn, C. and Younes, R., 2014. *The Ala-Tragus Line as a Guide for Orientation of the Occlusal Plane in Complete Dentures*. The Journal of Contemporary Dental Practice.
- Meneghini, F., & Biondi, P. (2005*). Clinical Facial Analysis: Elements, Principles, and Techniques*. Springer.

(N)

- Naini, F., 2011. *Facial Aesthetics: Concepts and Clinical Diagnosis.* Chichester: Wiley-Blackwell.

(O)

- Özkan, Y., 2019. *Complete Denture Prosthodontics: Treatment and Problem Solving.* Springer.
- Ozkul, T., Ozkul, M., Akhtar, R., Al-Kaabi, F. and Jumaia, T., 2009. A Software Tool for Measurement of Facial Parameters. *The Open Chemical and Biomedical Methods Journal*, 2(1), pp.69-71.

(P)

- Pound E. *Recapturing esthetic tooth position in edentulous patient*.J.AM.Dent.Ass.1957;55:181-91
- Parimala, B. and Prithviraj, D., 2006. n.d. *A Comparative Study of Mandibular Incisor Relation to the Lingual Frenum in Natural Dentition and in Complete Denture Wearers*.
- Prakash, V. and Gupta, R., 2017. *Concise Prosthodontics Paperback. 2nd ed.*

(R)

- Rhodes G. *The evolutionary psychology of facial beauty*. Annu Rev Psychol 2006;57:199-226
- Rokaya, D., Bhattarai, B., Suttagul, K., Kafle, D., & Humagain, M. (2018). *Mentolabial sulcus: An esthetic-based classification. Journal Of Datta Meghe Institute Of Medical Sciences University*, 13(1), 16.
- Rao, J., 2015. *QRS for BDS 4th Year - Prosthodontics. Elsevier India.*
- Ravindra Nanda, 2012. *Esthetics and Biomechanics in Orthodontic. 2nd ed. Elsevier Health Sciences.*
- Rahn, A., Ivanhoe, J., & Plummer, K. (2009). *Textbook of Complete Dentures. Blacklick:* McGraw-Hill Companies.
- Rangarajan, V. and Padmanabhan, T., 2017. *Textbook of ProsthodonticsE Book.* 2nd ed. Elsevi.
- Revilla-León, M., Meyer, M., Barrington, J., Sones, A., Umorin, M., Taleghani, M. and Zandinejad, A., 2019. *Perception of occlusal plane that is nonparallel to interpupillary and commissural lines but with the maxillary dental midline ideally positioned.* The Journal of Prosthetic Dentistry.

(S)

- Sharry J.J *Complete edentulous prosthodontics. McGraw Hill Book. Inc.USA* 1962:pp. 351-54, 187-90.
- Saladin, K., *2011. Human anatomy (3rd ed.).* McGraw-Hill.
- Simpson JW, Hesby RA, Pfeifer DL, Pelleu GB. *Arbitrary mandibular hinge axis locations.* J Prosthet Dent 1984;51(6):819–822.
- Sena, L., Damasceno e Araújo, L., Farias, A. and Pereira, H., 2017. *The influence of sagittal position of the mandible in facial attractiveness and social perception*. Dental Press Journal of Orthodontics.

(T)

- Tjan AH, Miller GD, The JG. *Some esthetic factors in a smile*. J Prosthet Dent 1984:51;24-8

(W)

- William D. James, Dirk Elston, *Timothy Berger and Isaac Neuhaus, 2015. Andrews' Diseases of the Skin : Clinical Dermatology*. 12th ed. Elsevier Health Sciences.

(Y)

- Yadav, S., Malla, B., Srivastava, A., Timsina, R., Srivastava, N., & Kumar, A. (2018). *Anthropometric study of philtrum (face) and other nasal parameters in Nepal. International Journal Of Modern Anthropology*, 2(11), 163

(Z)

- Zarb, G., & Bolender, C. (2004*). Prosthodontic treatment for edentulous patients.* St. Louis: Mosby