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Facial Landmarks Used in Complete Denture Construction

A Project Submitted to

The College of Dentistry, University of Baghdad, Department of Prosthodontics
In Partial Fulfillment for the Bachelor of Dental Surgery

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Certification of the Supervisor

I certify that this project entitled "***Facial Landmarks Used in Complete Denture Construction*** " wasprepared by the fifth-year student **Ali Majid Jameel** under my supervision at the College of Dentistry/University of Baghdad in partial fulfilment of the graduationrequirements for the Bachelor Degree in Dentistry.

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B.D.S., M.Sc.

April 2023

Dedication

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

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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.

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ATL	ala-tragus line
C-T line	canthus tragus line
G	glabella
Sn	subnasale
Pg	pogonion
Me	menton
SL	superior lip
IL	inferior lip
OVD	occlusal vertical dimension
ZMJ	zygomaticys major muscle
NLF	Nasolabial fold

Introduction

In many countries of the world, much greater emphasis has to be placed in an individual's appearance and social professional interaction become even more numerous and more fleeting **(Bass, 1991).**

For Prosthodontic rehabilitation the construction of prosthesis is not purely mechanical, it involves combination of biological and mechanical principles. McCollum in 1926 states that the dentist should have thorough knowledge of Oral anatomy, physiology of supporting and surrounding structures for being the doctors and physicians of the mouth **(Heartwell, 1992).**

In case of construction of fixed or removable partial dentures, there are remaining natural teeth which act as a guide for recording jaw relation and registering the existing occlusion. But in cases of fabrication of complete dentures and bilateral distal extension removable partial denture there will be difficulty in recording jaw relation, orientation of occlusal plane and recording vertical dimension **(Rosenstiel, 2004).**

Loss of teeth and its associated structures, habitual jaw closure, altered neuromuscular coordination are some of the challenges in rehabilitation of completely edentulous patients **(Boucher, 1974).**

Loss of teeth affects facial appearance leads to psychological trauma. It is therefore essential that aesthetically pleasing and functionally comfortable dentures are provided **(Kassab, 2013).**

Certain anatomic structures related to the edentulous mandible and maxillae control the form of the borders of complete dentures. These structures and their effect upon the dentures have been described **(Boucher, 1944).**

When recording a jaw relationship for an edentulous patient, it is desirable to use are producible position **(McCarthy, 2003).**

Aims of Review

This review of literature aims to provide an overview of the facial landmarks that are relevant in the construction of complete dentures. It also discusses the importance of accurate identification and measurement of facial landmarks. It explores the different techniques used to identify and measure facial landmarks, their impact on the esthetic and functional outcomes of complete dentures and provides recommendations for future research in this area to improve the accuracy and predictability.

Chapter One

Review of Literature

Chapter One: Review of literature

1.1 Facial Landmarks

The dentist treating the patient with complete dentures has as much to do with the beauty and appearance of the face as has any other medical specialist. The appearance of the lower half of the face depends on the dentures. Mostly it is not very difficult in the casual and daily life settings to detect a person who is wearing poorly constructed dentures. There are several characteristics that describe the appearance of the poorly constructed dentures, Thin, drooping upper lip that appears lengthened and has a reduced vermillion border is a typical characteristic of mal-positioned anterior teeth and probably a reduced vertical dimension of occlusion **(Zarb and Bolender, 2004).** Tense, wrinkled lips often reveal the patient's efforts to hold the poorly constructed denture in place. Also, the drooping corners of the mouth indicates the misplaced dental arch form of the anterior teeth, the thin denture borders, and often the reduced occlusal vertical dimension. The appearance of premature aging may not be caused by age itself but by the lack of support for the lips and cheeks due to teeth loss or improper placement of teeth. The apparent extra fullness of the lower lip may be the result of a too broad mandibular arch or the elimination of the mento-labial sulcus. This may indicate the lower anterior teeth have been placed too far lingually or that the labial flange of the lower denture base is overextended or too thick. To reestablish the normal appearance and function, the dentist must replace the lost natural teeth with artificial teeth in their same position **(Zarb and Bolender, 2004).**

1.1.1 The Nasolabial fold:

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. Nasolabial fold is a misnomer, however. The proper anatomical term is melo-labial fold, meaning the fold between the cheek and lip **(Hur et al., 2020)**.

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 **(Hur et al., 2020).**

In complete denture fabrication, the nasolabial fold is used as a guide to determine the optimal position and extension of the denture's anterior teeth. The anterior teeth should be positioned to support the upper lip and fill the space created by the fold, which helps to restore the natural appearance of the patient's face and smile **(Rosenstiel, 2004).**

Figure1.1: Nasolabial Fold **(Mayeaux, 2009)**

1.1.2 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. 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 **(Meneghini and Biondi, 2005)**.

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 patient 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)**.

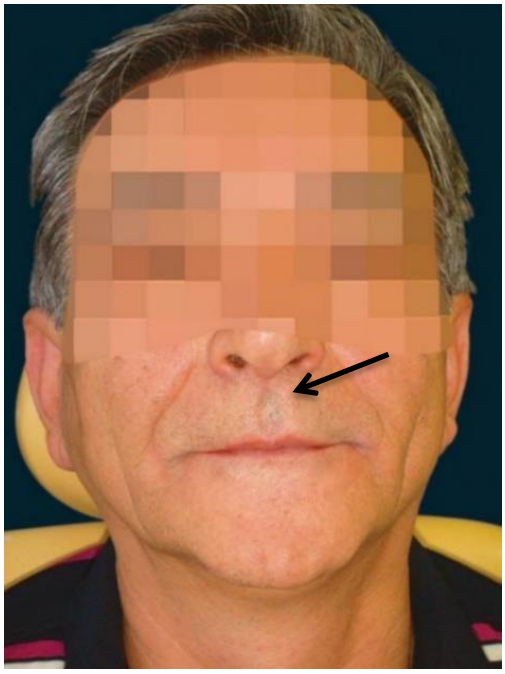

Figure 1.2: Philtrum Groove **(Özkan, 2019)**

1.1.3 Mento-labial Sulcus:

Mento-labial sulcus (also known as labio-mental 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 mento-labial groove or crease. In the lateral view, it is evident forming the transition from the lower lip to the soft-tissue chin.

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

Naini (2011) mentioned that a mento=labial 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. The facial profile is an important consideration in complete denture construction because it can have a significant impact on the patient's overall appearance and the functionality of the dentures by determining the appropriate size, shape, and position of the dentures to create a natural-looking smile that complements the patient's facial features, dictating the patient's lip support, facial height, and facial contours, the dentist can design dentures that look and feel like natural teeth which can also affect the patient's speech, supporting proper speech function and prevent lisping or other speech impediments and proper occlusal support, allowing the patient to chew and eat comfortably, and can design dentures that fit comfortably and securely in the mouth, reducing the likelihood of sore spots or discomfort **(Rokaya et al., 2018).**

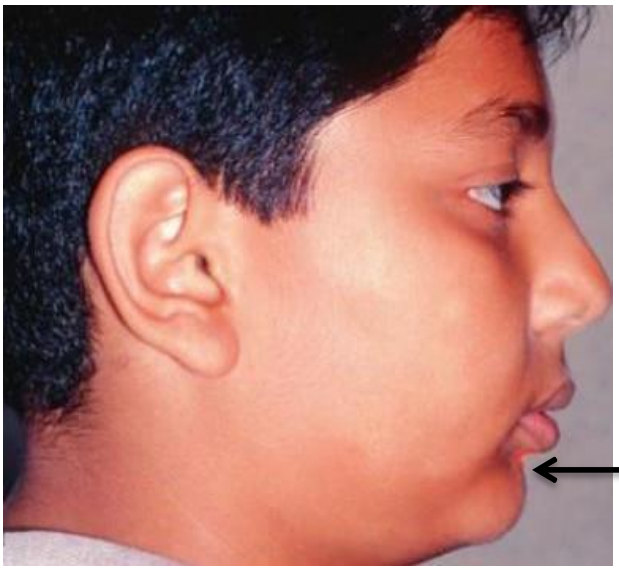

Figure 1.3: Mentolabial Groove **(Ashok, 2014)**

1.1.4 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. It is the area where females often place lipstick. 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. The vermilion border is bounded internally in the mouth by the wet line where labial mucosa begins. The lips are redder in younger persons than in older persons. In some individuals, the lip color is reddish brown due to the presence of brown melanin pigment **(Woelfel et al., 1990)**.

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).**

The anterior teeth of the complete denture should be positioned to support the lips and fill the space created by the vermilion border. The size, shape, and position of the teeth must be carefully selected to provide a natural-looking smile that is harmonious with the patient's facial features **(Boyanov, 1970).**

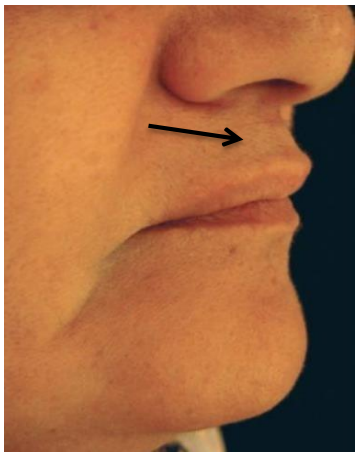

Figure 1.4: Vermilion Border ***(Özkan, 2019)***

1.1.5 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).**

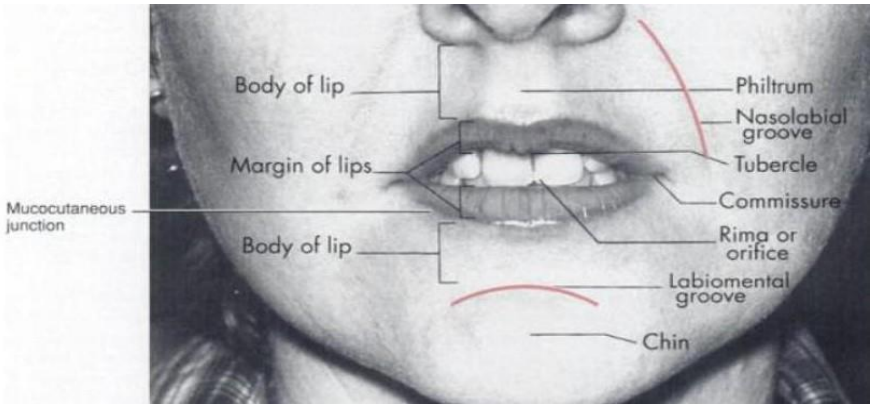

Figure 1.5: Angle of The Mouth **(Woelfel *et al.*, 1990)**

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 **(Drake *et al.*, 2010).**

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).**

1.1.6 Modiolus:

The modiolus is a conical fibrous structure at the medial end of the facial nerve that serves as a center of convergence of the muscles of facial expression. It is located in the center of the base of the skull, where the facial nerve makes a sharp turn and enters the facial canal **(Standring, 2016).**

- 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 **(Prakash et al, 2017).**

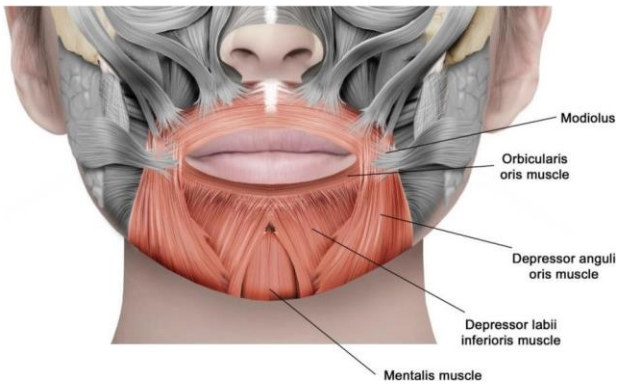

Figure 1.6: Modiolus **(Auada Souto et al, 2021)**

1.1.7 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 **(Saladin, 2011).**

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).**

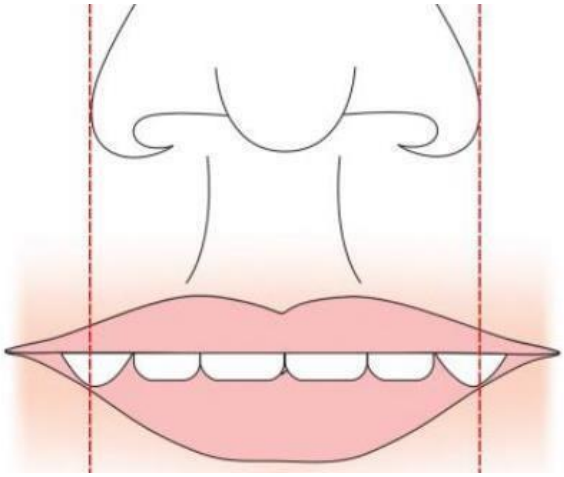

Figure 1.7: Ala of Nose **(Rangarajan, 2017)**

Figure 1.8: Ala of Nose **(Nallaswamy, 2017)**

1.1.8 External Eye:

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 **(Sheila and Lens, 1997).**

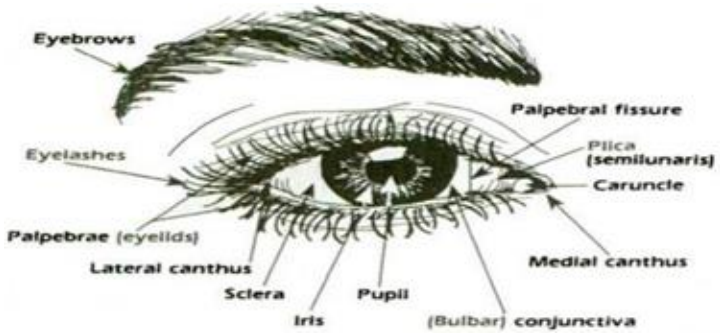

Figure 1.9: External Eye Anatomy **(Sheila and Lens, 1997)**

The external eye is an essential factor in complete denture construction as it plays a significant role in determining the esthetic outcome of the prosthesis. The shape, size, and position of the eyes must be considered during the selection of artificial teeth and arrangement in the denture base. The proper placement of the artificial teeth in relation to the external eye improves the overall esthetics of the complete denture, as well as the patient's self-esteem and satisfaction with the prosthesis.

A study by **Mirmohammadi et al. (2016)** evaluated the effect of the position of artificial teeth in the maxillary central incisor region on the perception of esthetics by dental students and laypeople. The results of the study showed that the position of the artificial teeth had a significant effect on the perception of the esthetics of complete dentures.

Another study by **Kobayashi et al. (2008)** investigated the relationship between the position of artificial teeth and the perception of facial esthetics in complete denture wearers. The results indicated that the optimal position of the artificial teeth in relation to the external eye was an essential factor in achieving better facial esthetics and overall patient satisfaction with the prosthesis.

1.1.9 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 **(Sarandha et al., 2017; Nazirkar et al., 2019).**

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

The tragus of the ear can be used as a reference point for determining the anterior-posterior position of the occlusal plane in complete denture construction. According to some studies, the tragus can be used as a guide for establishing the occlusal plane in relation to the interpupillary line and the ala-tragus line **(Sarandha et al., 2017; Nazirkar et al., 2019).**

Additionally, the tragus can also be used to determine the midline position of the denture base in relation to the patient's face **(Murali et al., 2018)**. By using the tragus as a reference point, the clinician can ensure that the denture is properly aligned with the patient's facial features.

- **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.

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 **(Abi-Ghosn et al, 2014).**

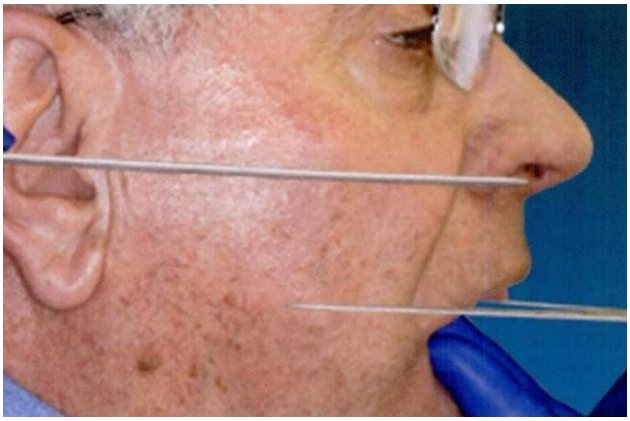

Figure 1.11: Ala-tragus Line **(Arthur et al, 2009)**

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 **(Abi-Ghosn et al., 2014).**

- **Canthus Tragus Line:**

The canthus tragus line, also known as the C-T line, is an imaginary line that connects the inner corner of the eye (canthus) to the tragus of the ear. The tragus is the small, cartilaginous protrusion on the outer ear that covers the ear canal.

The C-T line is an important anatomical reference point in plastic and reconstructive surgery, particularly in procedures that involve the midface and lower eyelid. It helps to establish the correct position and alignment of the eyelid, as well as the location of the lower lid margin and the position of the cheekbone.

The C-T line is also used in orthodontics and maxillofacial surgery to assess the relationship between the teeth and the jawbone, as well as to plan the correction of bite discrepancies and facial asymmetries **(Savin et al, 2018).**

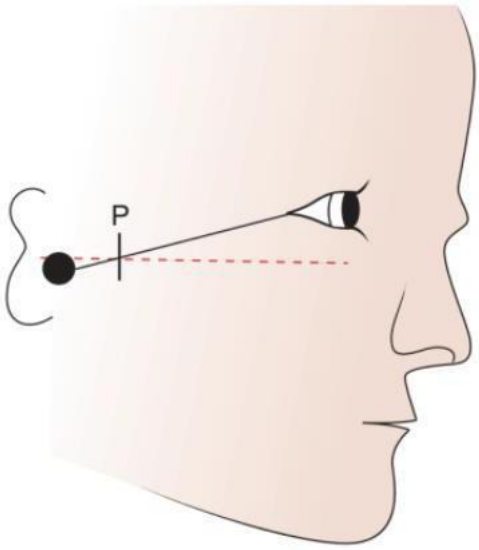

Figure 1.12: Canthus Tragus Line **(Prakash et al, 2017)**

It is essential in the construction of complete dentures, particularly in locating the position of the condyles.

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).**

1.1.10 Ear Lobes:

The earlobe, also known as the lobule, is the fleshy, lower part of the ear that hangs from the bottom of the earlobe. It is composed mainly of adipose tissue and is covered by skin. The earlobe lacks cartilage and is therefore soft and flexible.

In addition to their cultural and aesthetic significance, earlobes can also provide important clinical information. For example, certain earlobe abnormalities, such as clefts or creases, may be associated with certain genetic syndromes or congenital malformations **(Kim et al, 2014).**

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.

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 **(Khalaf, 2008).**

Figure 1.13: Using Ear Lobes During Maxillomanibular Relationship Registration **(Khalaf, 2008)**

1.1.11 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 **(Arthur et al, 2009).**

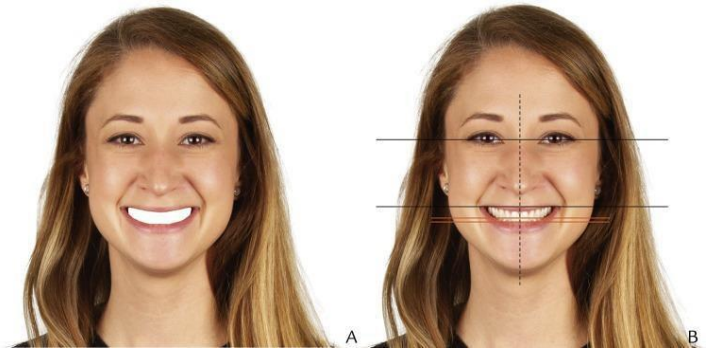

Figure 1.14: Interpupillary line **(Revilla et al, 2019)**

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.

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 1.15: Interpupillary Line with Fox Bite Registration **(Arthur et al., 2009)**

1.1.12 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.

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

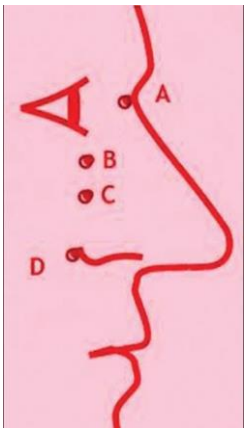

Figure 1.16: Anterior Reference Points **(Prince et al., 2013)**

1.1.13 Commonly used Posterior reference points:

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

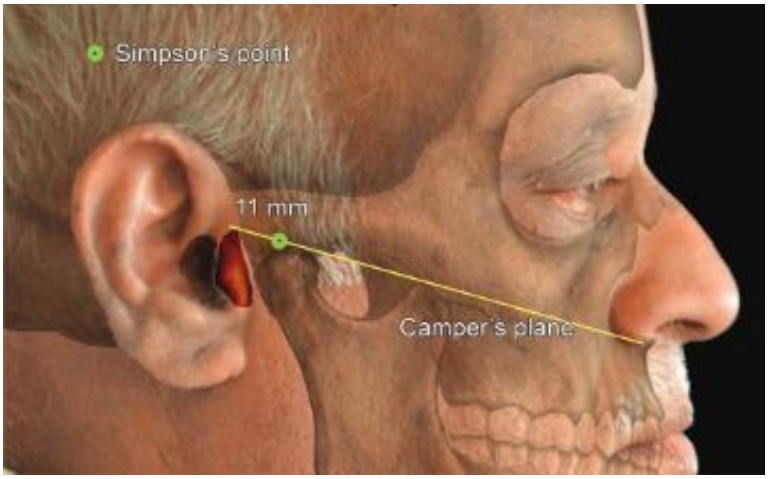

Figure 1.17: Simpson's point **(Rahmath et al., 2019)**

- Bergstorm Point***:*** A point 10 mm anterior to the center of the external auditory meatus **(Prakash *et al*, 2017).**

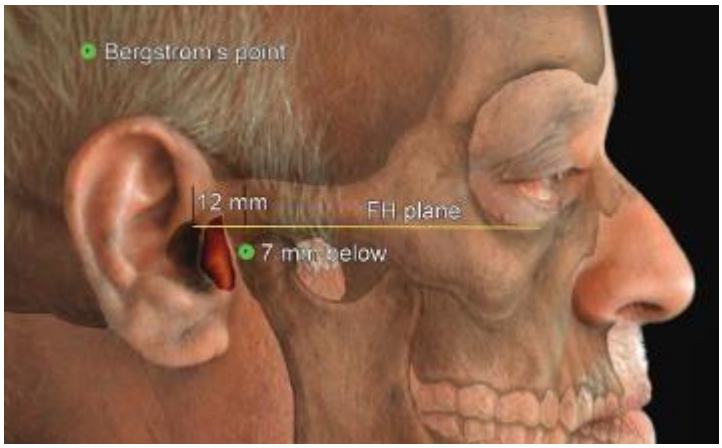

Figure 1.18: Bergstorm's point **(Rahmath et al., 2019)**

- 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.

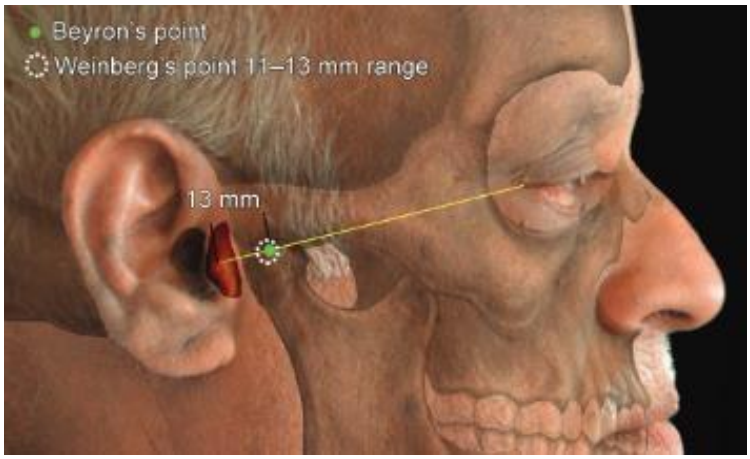

Figure 1.19: Beyron's point and Weinberg's point **(Rahmath et al., 2019)**

- 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 **(Prakash et al, 2017).**

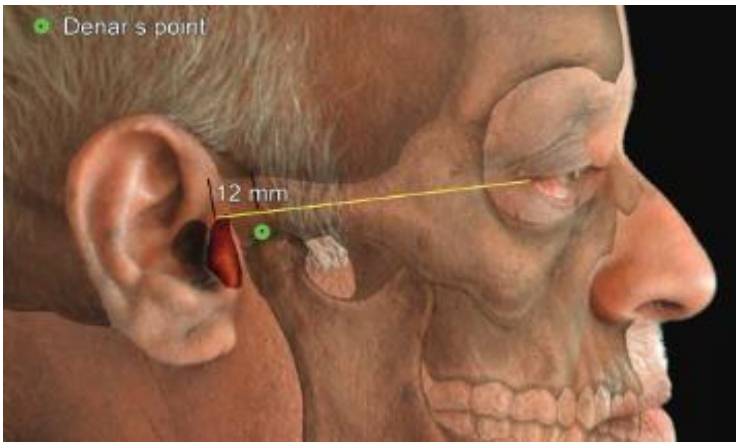

Figure 1.20: Denar's point **(Rahmath et al., 2019)**

- 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 **(Prakash et al, 2017).**

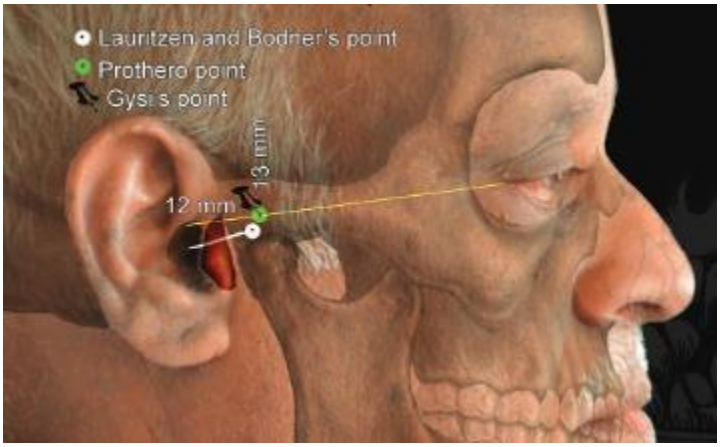

Figure 1.21: Gysi's point **(Rahmath et al., 2019)**

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.

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 **(Rao, 2015).**

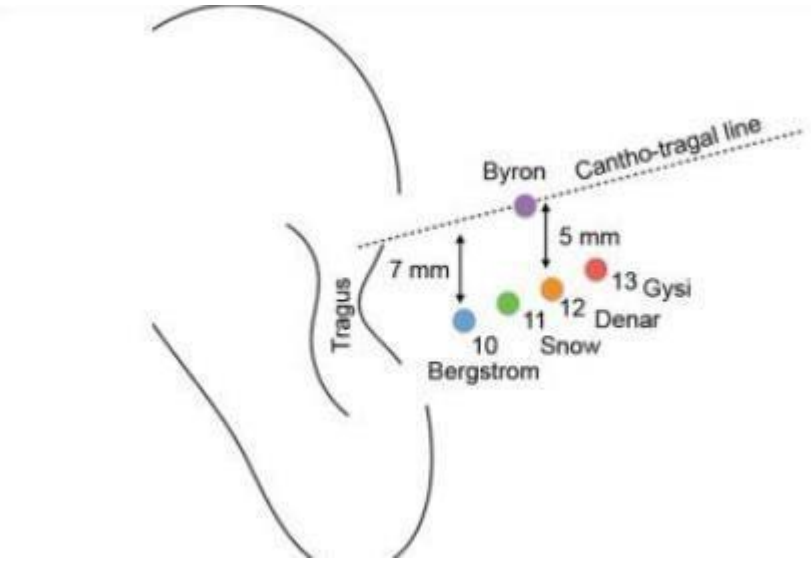

Figure 1.22: Posterior Reference Points **(Nallaswamy, 2017)**

1.1.14 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 **(Ozkan, 2019).**

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

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).**

1.1.15 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).**

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)**.

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

1.1.16 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 **(Ravindra, 2012).**

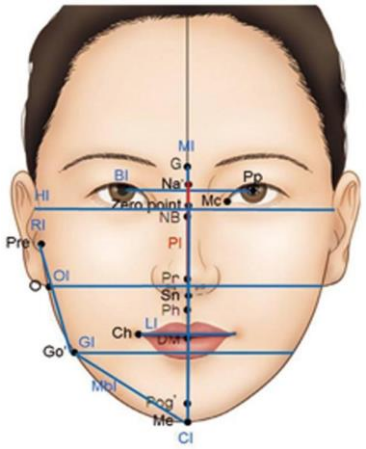

Figure 1.25: Extraoral Midline References **(Kang, 2015)**

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. 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).**

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)**.

1.2 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 **(Prakash et al, 2017)**.

Fig 1.26: Edentulous patient with dentures in place: (a) lateral view (b) facial view **(McCarthy et al, 2003)**

In the facial region, the patient's skeletal profile should be assessed with the dentures in situ (i.e. Class 1, 2 or 3) bearing in mind that, following loss of the occluding vertical dimension due to wear of the denture teeth, the mandible may appear prognathic. Take note of the muscle tone and assess lip support and the proximity of the chin to the nose in both facial and lateral views. If the patient has a neuromuscular disorder or has had a cerebrovascular accident (stroke), muscle tone should be carefully noted. The health of the tissues, particularly the lips and corners of the mouth, should also be assessed and any pathology diagnosed and treated **(McCarthy, 2003).**

1.2.1 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).**

Facial frontal photographs are an important tool in complete denture construction as they provide an accurate representation of the patient's face. These photographs are typically taken with the patient in an upright position, looking straight ahead, and with their teeth in centric occlusion.

1.2.2 The following landmarks were marked to analyze the face in the frontal photographs:

- midline
- commissures,
- interpupillary line

This information is then used to design the dentures to provide a comfortable fit, proper function, and natural appearance. In addition to aiding in the construction of the dentures, facial frontal photographs can also serve as a record

of the patient's appearance before and after treatment, which may be useful for future reference **(Zarb et al, 2012).**

1.3 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 was 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).**

1.4 Classification of facial forms:

- Ovoid.
- Tapering.
- Square.
- Combination of the above **(Prakash *et al*, 2017).**

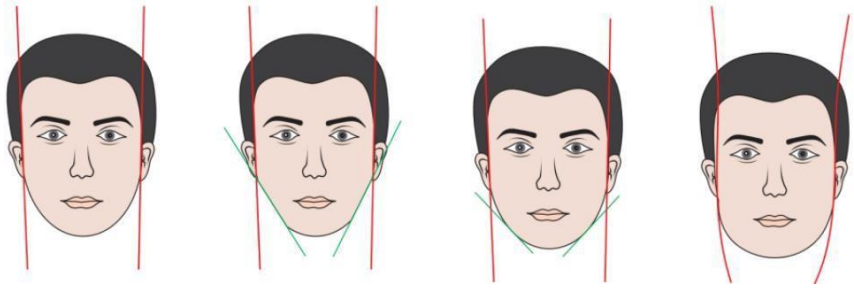

Figure 1.27: Facial Form Classification **(Prakash et al, 2017)**

1.5 Face-bow

The face bow is an essential tool for obtaining accurate maxillary jaw relation records in complete denture construction. It helps in transferring the spatial orientation of the maxillary arch to the articulator, which is used to mount the maxillary cast. This ensures that the denture teeth are arranged in the correct position with respect to the temporomandibular joint (TMJ) and the occlusal plane.

During the face bow transfer, the patient's maxillary arch is registered in relation to the hinge axis of the mandible, which is a theoretical point around which the mandible rotates. This allows for a precise registration of the maxillary arch in its functional relationship with the mandible, and helps to establish the correct centric relation and occlusal vertical dimension.

Proper use of the face bow in maxillary jaw relation recording is critical for the success of complete denture treatment, as it allows for the creation of dentures that are stable, functional, and esthetically pleasing **(Zarb,2013).**

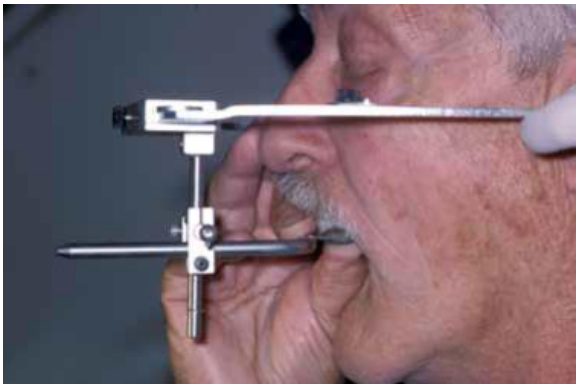

Figure 1.28: facebow record **(MacEntee, 2019)**

1.6 Steps of Complete denture construction

1.6.1 Impression stage

Facial landmarks are important to consider when taking primary impressions for complete dentures. Here are some of the most important facial landmarks to consider:

1.6.1.1 Interpupillary Line

The interpupillary line is an imaginary line that connects the centers of the pupils of the eyes, and it is important to record its location accurately during the primary impression stage. This is because the interpupillary line is used as a reference point to establish the midline of the maxillary denture and to ensure that the denture teeth are aligned with the patient's eyes and face.

To record the position of the interpupillary line accurately, the clinician can ask the patient to look straight ahead while holding a pencil or instrument at arm's length in front of the patient's eyes. The clinician can then use the pencil to mark the center of each pupil on the patient's face. The distance between these marks represents the position of the interpupillary line, which can be transferred to the primary impression using a facebow or other similar device **(Hobkirk, 2011).**

1.6.1.2 Commissural Line

The commissural line is an extra-oral anatomic landmark that can be used during the primary impression stage for complete denture construction. The commissural line is an imaginary line that connects the corners of the mouth, and it is

important to record its location accurately during the primary impression stage. This is because the commissural line is used as a reference point to establish the horizontal plane of the denture and to ensure that the denture base is level and stable in the patient's mouth.

To record the position of the commissural line accurately, the clinician can ask the patient to smile or make a "m" sound to identify the corners of the mouth. The clinician can then use a pencil or instrument to mark the corners of the mouth on the patient's face. The distance between these marks represents the position of the commissural line, which can be transferred to the primary impression using a facebow or other similar device.

It is important to note that the commissural line may not be completely horizontal in some patients, due to asymmetry or other factors. In these cases, the clinician should take care to record the natural orientation of the commissural line and adjust the denture accordingly to achieve a stable and comfortable fit **(Zarb, 2013).**

1.6.1.3 Midline of the Face

The midline of the face is an important reference point in the construction of complete dentures. It is used as a guide for determining the position of the denture teeth and ensuring proper esthetics.

During the primary impression stage, the clinician uses the midline of the face as a reference for determining the midline of the dental arches. This is done by asking the patient to smile and noting the position of the midline of the upper and lower lips. The clinician then marks the midline of the face with a pencil and transfers this to the

impression material.

By using the midline of the face as a reference, the clinician can ensure that the denture teeth are properly positioned with respect to the patient's natural anatomy, resulting in better esthetics and patient satisfaction **(McCord, 2012).**

1.6.1.4 Ala-tragus line

The ala-tragus line is an extra-oral anatomic landmark that can be used during the primary impression stage for complete denture construction. The ala is the wing-like cartilage at the base of the nose, while the tragus is the small, pointed cartilage in front of the ear canal. The line connecting these two points can be used to determine the antero-posterior dimension of the maxillary arch.

To record the position of the ala-tragus line accurately, the clinician can ask the patient to close their mouth and make a slight smile. The clinician can then place their finger on the patient's ala and another finger on the patient's tragus and ask the patient to open their mouth. The clinician can then measure the distance between these two points using a ruler or caliper.

The antero-posterior dimension of the maxillary arch can be determined by transferring this measurement to the primary impression using a custom tray. The custom tray should be extended posteriorly to the vibrating line, which is the junction between the hard and soft palate. This ensures that the posterior border of the denture base is accurately positioned and prevents over-extension of the denture **(Carlsson, 2004).**

1.6.2 Jaw relation

Jaw relation in complete denture construction is an important step to establish the correct relationship between the upper and lower jaws. The use of facial landmarks is crucial in determining the optimal jaw position for the patient. These landmarks include:

1.6.2.1 Temporomandibular Joint (TMJ)

During the jaw relation appointment, the clinician records the spatial relationship of the maxillary and mandibular arches in various positions, including centric relation (CR). CR is defined as the most retruded physiologic position of the mandible with respect to the maxilla. This position is important because it allows for the proper placement and orientation of the denture teeth, which affects the occlusion and stability of the denture **(Carlsson, 2017).**

1.6.2.2 Facebow

A clinician would use a facebow to record the spatial relationship of the maxillary arch to the transverse horizontal axis of the temporomandibular joint during the construction of complete dentures. This is typically done at the beginning of the denture fabrication process, after the primary impression has been taken and the custom tray has been made. The clinician would place the facebow on the patient's maxillary teeth or edentulous ridges and use it to transfer the spatial relationship of the maxilla to the articulator. The information obtained from the facebow record is then used to mount the maxillary cast on an articulator, which simulates the patient's jaw movements and allows for accurate construction of the denture **(McCord, 2020).**

1.6.2.3 Camper's plane:

This is an imaginary line that connects the tragus of the ear and the ala of the

nose. It is used to establish the initial orientation of the occlusal plane and to ensure that the denture teeth are positioned correctly in relation to the face **(McCord, 2020).**

1.6.2.4 Interpupillary line:

This is a horizontal line that connects the centers of the pupils of the eyes. It is used to establish the anteroposterior position of the occlusal plane and to ensure that the denture teeth are positioned correctly in relation to the eyes.

1.6.2.5 Midline of the face:

This is an imaginary line that bisects the face vertically, dividing it into two equal halves. It is used to ensure that the denture teeth are positioned correctly in relation to the midline of the face.

1.6.2.6 Incisal edge position:

The position of the incisal edges of the denture teeth is critical for esthetics and function. The clinician must consider the position of the patient's natural teeth, lip support, and phonetics when determining the position of the incisal edges.

By considering these facial landmarks during the jaw relation appointment, the clinician can establish the correct orientation of the occlusal plane and ensure that the denture teeth are positioned correctly in relation to the patient's face. This is important for achieving proper esthetics, function, and patient satisfaction **(McCord, 2020).**

1.6.3 Try in

The try-in stage in complete denture fabrication is an important step to ensure that the denture fits properly and achieves the desired esthetics. During this stage, the denture base and teeth are set up in wax for the patient to try in the mouth. One of the key aspects of the try-in stage is the evaluation of facial landmarks to ensure that the

denture achieves proper esthetics and function. The clinician will evaluate various facial landmarks such as:

1.6.3.1 Facial Midline

The facial midline is an important landmark during the try-in appointment for complete dentures. The midline of the face is an imaginary line that bisects the face vertically, dividing it into two equal halves. It is used to ensure that the denture teeth are positioned correctly in relation to the midline of the face.

During the try-in appointment, the clinician will place the wax denture in the patient's mouth to evaluate the fit, esthetics, and occlusion. The clinician will check the position of the denture teeth in relation to the facial midline by comparing it to the patient's natural midline or a reference point, such as the philtrum or the midline of the nose. If the denture teeth are not positioned correctly in relation to the facial midline, adjustments can be made to ensure proper alignment.

Proper alignment of the denture teeth in relation to the facial midline is important for achieving good esthetics and patient satisfaction. If the teeth are not aligned properly, the denture may appear unnatural or unbalanced, which can negatively impact the patient's self-esteem and confidence. Additionally, improper alignment can affect the function of the denture, making it more difficult for the patient to speak and chew properly **(Larsson,2009).**

1.6.3.2 Lip Line

The lip line is an important landmark during the try-in appointment for complete dentures. It refers to the position of the patient's lips when they are at rest and during different movements such as speaking, smiling, and laughing. It is an important consideration in the selection of the size, shape, and arrangement of the artificial teeth.

During the try-in appointment, the clinician will evaluate the position and contour of the patient's lips with the wax denture in place. The clinician will assess the lip line by asking the patient to perform different movements and expressions, such as smiling and pronouncing certain sounds. The clinician will ensure that the position and contour of the artificial teeth are in harmony with the patient's lips and facial features.

Proper evaluation and adjustment of the lip line are important for achieving good esthetics and patient satisfaction. If the lip line is not properly evaluated or adjusted, the denture may appear artificial or unbalanced, which can negatively impact the patient's self-esteem and confidence. Additionally, improper evaluation and adjustment can affect the function of the denture, making it more difficult for the patient to speak and chew properly **(Zarb et al, 2013).**

1.6.3.3 Smile Line

The smile line is an important facial landmark during the try-in appointment for complete dentures. It refers to the line formed by the upper border of the patient's upper lip when they smile. It is an important consideration in the selection of the size, shape, and arrangement of the artificial teeth.

During the try-in appointment, the clinician will evaluate the position and

contour of the patient's smile with the wax denture in place. The clinician will assess the smile line by asking the patient to perform different movements and expressions, such as smiling and pronouncing certain sounds. The clinician will ensure that the position and contour of the artificial teeth are in harmony with the patient's smile and facial features.

Proper evaluation and adjustment of the smile line are important for achieving good esthetics and patient satisfaction. If the smile line is not properly evaluated or adjusted, the denture may appear artificial or unbalanced, which can negatively impact the patient's self-esteem and confidence. Additionally, improper evaluation and adjustment can affect the function of the denture, making it more difficult for the patient to speak and chew properly **(Fisher et al, 2010).**

1.6.4 Insertion

The insertion of complete dentures is a critical step in the process of complete denture construction. Proper insertion of dentures can significantly affect the patient's comfort, function, and esthetics. The following facial landmarks are particularly important in ensuring the proper insertion of complete dentures:

1.6.4.1 Facial Midline

During the insertion appointment of complete dentures, the facial midline is an important consideration. The facial midline is an imaginary line that divides the face into two equal halves. It is an important reference point for the position and orientation of the artificial teeth.

To ensure proper orientation of the artificial teeth, the clinician will evaluate the position of the facial midline by asking the patient to perform different movements and expressions, such as smiling and speaking. The clinician will then

adjust the position of the denture to ensure that the artificial teeth are properly aligned with the patient's facial midline.

Proper orientation of the artificial teeth with respect to the facial midline is important for achieving good esthetics and patient satisfaction. If the artificial teeth are not properly aligned with the facial midline, the denture may appear artificial or unbalanced, which can negatively impact the patient's self-esteem and confidence. Additionally, improper orientation can affect the function of the denture, making it more difficult for the patient to speak and chew properly **(Fisher et al, 2010).**

1.6.4.2 Mento-labial sulcus:

The depth and contour of this landmark help to determine the proper height and placement of the lower denture.

1.6.4.3 Naso-labial fold:

The depth and contour of this landmark help to determine the proper height and placement of the upper denture.

1.6.4.4 Lip Line

During the insertion appointment of complete dentures, the lip line is an important consideration. The lip line refers to the position of the upper and lower lips at rest and during smiling. The clinician must ensure that the denture teeth are properly positioned with respect to the lip line to achieve good esthetics and patient satisfaction. To evaluate the lip line, the clinician will ask the patient to smile and show their teeth. The clinician will then evaluate the position of the denture teeth and make adjustments as necessary to ensure that the teeth are properly positioned with respect to the lip line.

Proper positioning of the denture teeth with respect to the lip line is important for achieving a natural-looking smile. If the teeth are too short or too long, or if they are not positioned correctly with respect to the lip line, the denture may look unnatural and may negatively impact the patient's self-esteem and confidence **(Schwartz-Arad et al, 2003).**

1.6.4.5 Smile Line

The smile line is an important consideration during the insertion appointment of complete dentures. The smile line refers to the position of the upper lip and the visibility of the upper teeth when the patient smiles. Proper positioning of the denture teeth with respect to the smile line is important for achieving good esthetics and patient satisfaction.

To evaluate the smile line, the clinician will ask the patient to smile and show their teeth. The clinician will then evaluate the position of the denture teeth and make adjustments as necessary to ensure that the teeth are properly positioned with respect to the smile line.

Proper positioning of the denture teeth with respect to the smile line is important for achieving a natural-looking smile. If the teeth are too short or too long, or if they are not positioned correctly with respect to the smile line, the denture may look unnatural and may negatively impact the patient's self-esteem and confidence **(Nallaswamy et al, 2011).**

1.6.4.6 Buccal Corridor

The buccal corridor is an important consideration during the insertion appointment of complete dentures. The buccal corridor refers to the space between the corners of the mouth and the posterior teeth when the patient smiles. Proper

positioning of the denture teeth with respect to the buccal corridor is important for achieving good esthetics and patient satisfaction. To evaluate the buccal corridor, the clinician will ask the patient to smile and show their teeth. The clinician will then evaluate the position of the denture teeth and make adjustments as necessary to ensure that the teeth are properly positioned with respect to the buccal corridor.

Proper positioning of the denture teeth with respect to the buccal corridor is important for achieving a natural-looking smile. If the teeth are positioned too far posteriorly, the buccal corridor may appear too wide, giving the patient a "sunken-in" appearance. If the teeth are positioned too far anteriorly, the buccal corridor may appear too narrow, giving the patient a "toothy" appearance **(Izadi et al, 2017).**

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. Plays a crucial role in achieving optimal esthetics and function for complete denture patients. 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.

Chapter Three References

References

Abi-Ghosn, C., Zogheib, C., Younes, R. and Makzoume, J. (2014). *The Ala-Tragus Line as a Guide for Orientation of the Occlusal Plane in Complete Dentures.* The Journal of Contemporary Dental Practice, 15, pp.108-111.

Andrews, J. D., Berger, T., Elston, D., & Neuhaus, I. (2015). *Andrews' diseases of the skin: Clinical dermatology (12th ed.)*. Elsevier Health Sciences.

Arnett, GW. and McLaughlin, RP. (2004). *Facial and dental planning for orthodontists and oral surgeons.* St. Louis: Elsevier.

Arthur, GH., Silva, AL. and Bonfante, EA. (2009). *Interpupillary line with fox bite registration.* The Journal of Prosthetic Dentistry, 102(6), pp.388-390.

Auada Souto, MP. and Souto, LRM. (2021). *An unusual adverse event of botulinum toxin injection in the lower face.* Journal of Cosmetics Dermatology, 20, pp.1381-1384.

Avelar, J. M. J. (2013). *Ear reconstruction*, chapter 12 page 204-207.

Bass, NM. (1991). *The esthetic analysis of face.* European Journal of Orthodontics, 13, pp.343-350.

Bidra, AS., Uribe, F., Taylor, TD., Agar, JR., Rungruanganunt, P. and Neace, WP. (2009). *The Relationship of Facial Anatomic Landmarks with Midlines of the Face and Mouth.* The Journal of Prosthetic Dentistry, 102(2), pp.94-103.

Bissasu, M. (1999). *Use of lingual frenum in determining the original position of mandibular anterior teeth.* The Journal of Prosthetic Dentistry, 82(2), pp.177-181.

Boucher, CO. (1974). *Complete Denture Prosthodontics. 3rd ed.* St. Louis, MO: Mosby.

Boyanov, B. (1970). *Determining vertical dimension of occlusion and centric relation.* The Journal of Prosthetic Dentistry, 24, pp.18-24.

Carlsson, G. E., & Raghavendra, S. (2017). *Complete Denture Prosthodontics: A Manual for Pre-Clinical and Clinical Procedures*. Springer.

Carlsson, G. E., & Rangert, B. (2004). *Pre-extraction Prosthodontics. In J.*

Hobkirk, L. W. C. Chow, & K. E. Phillips (Eds.), Prosthetic Treatment of the Edentulous Patient (pp. 53-64). Blackwell Publishing Ltd.

Christopoulos, C. (2011). *Mouth Anatomy.* Medscape References.

Clark, JR., Hutchinson, I. and Sandy, JR. (2001). *Functional Occlusion: II. The role of articulators in orthodontics.* Journal of Orthodontics, 28(2), pp.173-177.

Drake, RL., Vogl, W. and Mitchell, AWM. (2010). *Gray's Anatomy for Students. 2nd ed*. Elsevier.

Duncan, SF., Radford, DR. and Smith, ID. (2012). *Interocclusal records: a review of the literature.* The Journal of Prosthetic Dentistry.

Fisher JG, Zacher GA. (2010) *Complete dentures: from planning to problem solving.* Quintessence Publishing Company;.

Gates, GN. and Nicholls, JI. (1981). *Evaluation of mandibular arch width changes.* The Journal of Prosthetic Dentistry, 46(4), pp.385-392.

Gupta, A. (2018). *Perio-Esthetics and Implant Prosthodontics in Anterior Rehabilitation.* Educreation Publishing.

Heartwell, CM. and Rahn, AO. (1992). *Syllabus of Complete Dentures. 4th ed.* Pennsylvania: Lea & Febiger, pp.1-43, 277-305.

Hobkirk, J., & Jayasooriya, P. (2011). Essentials of complete denture prosthodontics. CRC Press.

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

Izadi, A., Shetty, S., Krishna, B. A., Naik, S., & Sargod, S. S. (2017). *Evaluation of the Buccal Corridor Space in the Esthetic Smile: A Pilot Study*. Journal of Clinical and Diagnostic Research, 11(2), ZC01-ZC04.

Johnson, T., & Wood, D. (2015). *Techniques in complete denture technology.* Wiley-Blackwell.

Kang, S. H., Kim, M. K., Kim, J. H., Park, H. K., & Kwon, H. B. (2015). *Extraoral midline references for dental midline determination in edentulous*

patients: A review. Journal of Advanced Prosthodontics, 7(3), 228-233.

Karad, A. (2014). *Clinical orthodontics: Current concepts, goals and mechanics.* Elsevier Health Sciences.

Kassab, N. H. (2013). *Estimation of different facial landmarks as a guide in intercanine distance determination (clinical study).* Al–Rafidain Dent J., 13(2), 305-308.

Khalaf, B. S. (2008). *Ear lobes as facial landmarks for determining the occlusal plane.* Journal of Baghdad College of Dentistry.

Kim, J. W., & Lee, D. H. (2014). Earlobe rejuvenation: a review. Archives of plastic surgery, 41(3), 193-198.

Kobayashi, T., Yamamoto, K., & Miyazaki, Y. (2008). *Relationship between the position of artificial teeth and the perception of facial esthetics in complete denture wearers.* Journal of Prosthetic Dentistry, 100(6), 465-470. doi: 10.1016/S0022-3913(08)60266-6

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

Larsson, P., & Johnsson, T. (2009). *Choice of facial midline position for edentulous patients related to the sagittal jaw relationship*. The Journal of Prosthetic Dentistry, 102(5), 319-325.

Latta Jr, G. H. (1988). *The midline and its relation to the anatomic landmarks in the edentulous patient.* Journal of Prosthetic Dentistry, 59(6), 681-683.

Lauritzen, A. G., & Bodner, G. H. (1961). *Variations in location of arbitrary and true hinge axis points.* Journal of Prosthetic Dentistry, 11(2), 224-229.

Lens, A. (2008). *Ocular anatomy and physiology.* Slack Incorporated.

Lorena, S. C., Faber, J., Marques, L. S., de Carvalho, R. M., de Souza, R. F., & Borges, A. H. (2017). *Position of the most prominent point of the inferior lip in different facial patterns.* American Journal of Orthodontics and Dentofacial Orthopedics, 151(5), 887-892.

MacEntee, M. (2019). *The complete denture (2nd ed.).* Quintessence Publishing.

Makzoumé, J., Abi-Ghosn, C., & 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.

Mayeaux Jr, E. J. (2009). *The essential guide to primary care procedures.* Lippincott Williams & Wilkins.

McCarthy, S., & Allen, F. (2003). *Quintessentials of dental practice – 12 prosthodontics – 2 complete dentures from planning to problem-solving.*

McCord, J. F., & Grant, A. A. (2012). *Complete denture manual.* John Wiley & Sons.

McCord, J. F., & Grant, A. A. (2020). *Complete Dentures: From Planning to Problem Solving.* Quintessence Publishing Company.

McGee, G. F. (1947). *Use of facial measurements in determining vertical dimension.* Journal of the American Dental Association, 35(3), 342-350.

McMillan, A. S., Barbenel, J. C., & Quinn, J. H. (1970). *Measurement of occlusal face height by dividers.* Journal of Prost

Mirmohammadi, H., Saberi, E. A., Zarei, M., & Rashedi, B. (2016). *The effect of the position of artificial teeth in the maxillary central incisor region on the perception of esthetics by dental students and laypeople*. Journal of Prosthetic Dentistry, 116(6), 891-898.

Murali, R. V., Satish, V., & Reddy, V. C. (2018). *Use of tragus as a landmark for denture fabrication. Journal of pharmacy & bioallied sciences*, 10(Suppl 2), S147-S150.

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

Nallaswamy D. (2017*). Textbook of Prosthodontics. 2nd ed.* JP Medical Ltd.

Nallaswamy, D., & Mohan, M. (2011). *Prosthodontics in clinical practice: A guide to diagnosis and treatment*. Jaypee Brothers Medical Publishers.

Nazirkar, G., Marathe, A. S., & Pund, M. (2019). *Use of Tragus as an Anatomical Landmark in the Prosthodontic Treatment*. Journal of Krishna Institute of Medical Sciences University, 8(4), 79-83.

Özkan, Y. (2019). *Complete Denture Prosthodontics: Treatment and Problem Solving.* Springer.

Ozkan, YK. (2019). *Smile line analysis and its impact on restorative dentistry.* European Journal of Dentistry, 13(3), 472-476.

Ozkul, T., Ozkul, M., Akhtar, R., Al-Kaabi, F., and Jumaia, T. (2009). *Software Tool for Measurement of Facial Parameters.* The Open Chemical and Biomedical Methods Journal, 2(1), 69-71.

Paquette, JM. (1966). *A simple procedure for the determination of mandibular tooth position.* Journal of Prosthetic Dentistry, 16(2), 221-224.

Parimala, B. and Prithviraj, D. (2006). *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.*

Prince, CA, Smith, KG, and Latta, GH Jr. (2013). *Anterior reference points for complete denture prosthetics.* The Journal of Prosthetic Dentistry, 110(4), 243-247.

Rahmath, AE, Arun Kumar, KV, Nair, KCK, Al Kheraif, AA, and Vohra, F. (2019). *Simpson's index and point revisited: a review.* Biomedical Journal, 42(2), 89-96.

Rahn, A., Ivanhoe, J., and Plummer, K. (2009). *Textbook of Complete Dentures.* Blacklick: McGraw-Hill Companies.

Rangarajan, V. and Padmanabhan, T. (2017). *Textbook of ProsthodonticsE Book. 2nd ed*. Elsevi.

Rao, J. (2015). *QRS for BDS 4th Year - Prosthodontics.* Elsevier India.

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.

Rhodes, G. (2006). *The evolutionary psychology of facial beauty.* Annual Review of Psychology, 57, 199-226.

Rokaya, D., Bhattarai, B., Suttagul, K., Kafle, D., and Humagain, M. (2018). *Mentolabial sulcus: An esthetic-based classification.* Journal Of DattaMeghe Institute Of Medical Sciences University, 13(1), 16.

Rosenstiel, SF, Land, MF, and Fujimoto, J. (2004). *Contemporary Fixed Prosthodontics (4th ed.).* St. Louis, MO: Mosby.

Saladin, K., (2011). *Human anatomy (3rd ed.).* McGraw-Hill.

Sarandha, D. L., Barabde, A. S., & Gupta, N. (2017). *The use of tragus as a reference point in complete denture fabrication.* Journal of Indian Prosthodontic Society, 17(1), 63-68.

Savin, J. A., Savin, L. A., & Lee, M. W. (2018). *Canthus tragus line. In Dermatologic surgery* (pp. 615-616). Elsevier.

Schwartz-Arad, D., & Samet, N. (2003). *The diagnostic denture: A prelude to successful prosthodontic rehabilitation.* Quintessence Publishing Company.

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.

Sharry J.J (1962) *Complete edentulous prosthodontics.* McGraw Hill Book. Inc.USA:pp. 351-54, 187-90.

Sheila S, Lens P. (1997) *External eye anatomy. In: Krachmer JH, Mannis MJ, Holland EJ, eds.* Cornea: Fundamentals, Diagnosis and Management. 1st ed. St. Louis: Mosby;:29-47.

Simpson JW, Hesby RA, Pfeifer DL, Pelleu GB. (1984) *Arbitrary mandibular hinge axis locations.* J Prosthet Dent;51(6):819–822.

Standring, S. (2016). *Gray's anatomy: The anatomical basis of clinical practice.* Elsevier Health Sciences.

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

Woelfel, J.B., & Scheid, R.C. (1990). *Dental Anatomy: Its Relevance to Dentistry.*

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

Zarb, G. A., Bolender, C. L., Eckert, S. E., & Jacob, R. F. (2012). *Prosthodontic treatment for edentulous patients: complete dentures and implant-supported*

prostheses. Elsevier Health Sciences.

Zarb, G. A., Bolender, C. L., Eckert, S. E., Fenton, A. H., & Jacob, R. F. (2013). *Prosthodontic Treatment for Edentulous Patients: Complete Dentures and Implant-Supported Prostheses.* Mosby.

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