

Diverse Labial Flange Designs to Accomplish Lip Aesthetics in Conventional Complete Denture Prosthesis

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Received December 25, 2023; Revised January 28, 2024; Accepted February 04, 2024

Abstract This case series describes the multiple labial flange design to overcome the problem of providing adequate labial fullness by a complete denture prosthesis in patients who cannot due to some reasons undergo alveoloplasty of the maxillary residual alveolar ridge. The relation between the design and the particular case scenario has been presented under different denture flange design. Four different design types with case presentation include that of a gumfit denture, gumfit with stainless steel wire, gumfit with wire and acrylic and finally a flanged labial window complete denture prosthesis. Each case is different and covers multiple clinical variations of providing labial support using labial denture flange without totally constructing the labial flange. Each individual design has been discussed in the light of lip relation, the height of contour of the residual alveolar ridge, the labial undercut and finally the vestibular depth. These designs are simple and mostly done in the laboratory and can be customized for all patients depending upon the availability or non availability of the bone.

Keywords: complete denture, maxillary lip, orbicularis oris, esthetics, facial symmetry

Cite This Article: Vishwadeepak Singh, Rishabh Garg, Amit Siwach, Shuja Ur Rahman, Nishant Gaba, Noopur Rathi, Anchal Deep, Manas Singh, Roma Goswami, and Khurshid A Mattoo, "Diverse Labial Flange Designs To Accomplish Lip Aesthetics In Complete Denture Prosthesis." *American Journal of Medical Case Reports*, vol. 12, no. 2 (2024): 15-20. doi: 10.12691/ajmcr-12-2-2.

1. Introduction

An objective presentation that is pleasurable upon perception is the feature of 'beauty' or being 'beautiful'. When applied to the human face, it depicts a harmonious state where facial proportions lie in a well balanced relation to underlying skeletal/dental and adjacent structures. [1] Aesthetics (esthetics) is a philosophical set of principles that define the nature and appreciation of beauty. It basically represents a judgement/attitude/value that represents a particular pleasing feature of an object. [2] The word cheiloaesthetics (cheilo - lip, aesthetics - aisthetikos, of sense perception) is a portmanteau word operationally used in this article to represent the aesthetic characteristics of human facial lips that enhance or diminish facial appearance. Human face represents soft tissues that cover underlying cranium which is formed by a combination of two halves that fuse in the midline. [3] The symmetry of face can be analyzed in three different planes with each plane presenting a different degree and

level of symmetry. [4,5] Vertically the symmetry can be observed between two similar bilateral landmarks, examples being the canthus of the eye or the corners of the mouth. Asymmetrical landmarks will present less clinically perceptible changes unless they are grossly disturbed by either a congenital or acquired disorder. In the lateral plane, one side landmarks are compared to the opposite side and minor changes may be clinically perceptible since they have higher impact on facial aesthetics. An example being bells palsy patient smiling or a unilateral swelling on the face. The third plane is the anterior posterior plane (fronto caudal) which can create a perceptible asymmetry in association with the lateral plane symmetry. Individually, asymmetry in these planes is less perceptible since they are more pronounced when observed from the lateral side of the face. The significance of this symmetry on the face can be better understood by citing the example of maxillary and mandibular lip. The lips form the folds (skin, mucosa and muscles) at the oral cavity opening and despite the two lips being different in surface anatomy, size and shape they enhance the symmetry of the face. The symmetry of the lips is

perceived against the facial width, with fuller and wider lips contributing to gender attractiveness. [6] Both lips undergo several aging changes that range from less exposure of vermilion border, wrinkle formation and bulk loss. [7] Anatomically, lips occupy the lower third of the face with different surface mucosal coverings between the outer and inner portions that are attributed to its extra oral and intra oral exposure/functions. Extra orally lips are most active component of vocal facial expressions while intraorally they cover the teeth partially in a way that the face looks pleasant. [8]

In turn, the underlying teeth are placed in such a way that proper support to the lips enhances facial aesthetics while inadequate support (complete edentulism) or improper support (bimaxillary protrusion) violates the pleasantness of a particular face. When teeth are lost, the underlying support for the lips is gone and the lips sag inwards, thereby enhancing the effects of aging like exaggerating wrinkles. [9] The problem of tooth loss is further compounded by the resorption of the maxillary residual alveolar ridge, which occurs superiorly and medially leading to a further palatal position of the anterior maxilla. [10] While restoring the facial appearance in such a critical area, the prosthodontist has to understand the dynamics of each component of the complete denture prosthesis especially their individual function. There are other complex problems when restoring lip support. Firstly, the esthetic needs of the patient and the dentist vary. [11] Secondly, the adequate acceptable lip support to be established is highly subjective and variation between the dentist and the patient have been shown to exist. [12,13] In a completely edentulous patient, the normal facial expression depends solely upon the lip support [14] provided by the anterior artificial teeth and the denture flange. [15,16] The relation between the edentulous ridge and the lips and the amount of vestibular space present in the anterior region is essential to determine whether the future denture flange and the anterior teeth can provide proper/adequate lip support or whether some surgical preparation will be necessary to achieve the aesthetic outcome. [17,18] Failure to recognize such observation during clinical examination places the dentist in a tricky situation whereby he has to modify the denture to some extent in order to have acceptable desired aesthetic results. These modified dentures have been termed as “gum fit dentures” and “ridge grip esthetic prosthesis” or “wing denture”. [19] To understand their use, one needs to have a brief understanding of alveolar bone loss after immediate extraction of the teeth. At times the residual alveolar bone in the maxillary anterior region is bulky and in close approximation to the maxillary lip. The intervening space between the maxillary lip and the underlying alveolar bone (labial cortical plate) is minimal or non-existent. Depending upon the height of contour of the residual alveolar bone, there will be variation in size and shape of the underlying vestibule. The vestibular space may allow accommodation of the labial flange of the complete denture prosthesis without being extended on to the height of contour in the same area. Based on the relation between the lip, height of contour of the residual alveolar ridge and the labial vestibule different complete denture labial flange designs can be prepared to create satisfactory esthetics.

This article in the form of a case series describes various labial flange/ gum fit designs that one can introduce in dental practice for patients who are reluctant to undergo surgical correction before complete denture fabrication. However, these situations can be avoided since flangeless dentures compromise retention of the denture. [20]

2. Case Series

A) Gumfit denture

This type of labial flange design for a complete denture prosthesis is in real sense a flangeless complete maxillary denture. The denture may have teeth directly placed on the ridge or may have a small extension of the flange over the ridge. Two cases are presented for understanding the clinical aspects of such situations. The first case is that of an elderly male patient aged 67 years who had recently extracted his maxillary anterior teeth and desired to have complete dentures. Extra oral examination did not disclose any negative clinical finding. The facial profile was convex (Figure 1A) while the lip relation was also normal (Class 1). At the time of recording jaw relations for complete denture prosthesis, while verifying the lip fullness and labial support provided by the occlusal rims, it was observed that the presence of the labial flange of the maxillary denture increased labial fullness.

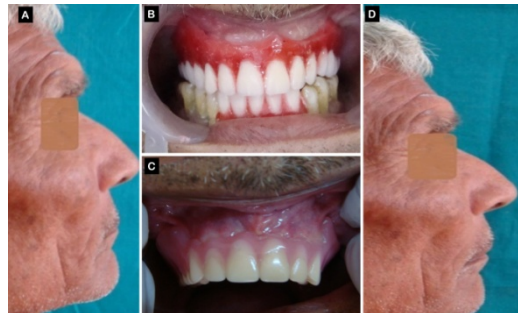


Figure 1. (A) Extra oral view showing a convex profile with maxillary lip slightly depressed (B) Labial flange removed from trial denture base during denture trial (C) Final maxillary complete denture without labial flange (D) The maxillary lip is slightly in front of the mandibular lip after wearing the maxillary complete denture

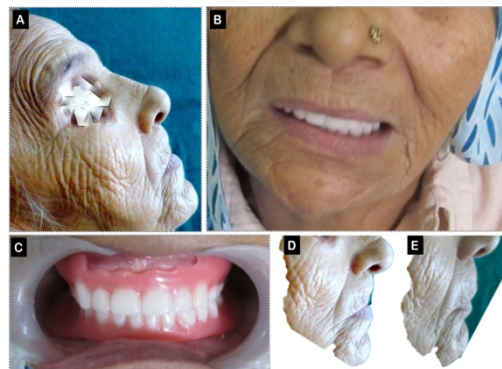


Figure 2. (A) Extra oral view showing pronounced maxillary labial fullness due to underlying bone (B) Trial denture with labial flange removed (C) Definitive complete denture prosthesis without labial flange (D) and (E) comparison in labial fullness between pre and post rehabilitation

This inadvertently also resulted in pulling of the lip up thus distorting the lip relations. Removal of the labial flange accomplished proper lip support which was verified at the time of denture trial (Figure 1B). The final denture was processed without the flange (Figure 1C) and once the denture was delivered, the maxillary denture provided proper lip support to the maxillary lip (Figure 1D).

The second case (Figure 2A) presents a completely edentulous (long duration) elderly women who had never used the dentures. Clinical examination revealed inadequate maxillary lip support but extremely high maxillary labial fullness due to existing residual alveolar maxillary ridge (Figure 2A). Just when the fullness decreased, the remaining lip sagged deeply inside the oral cavity. The trial denture provided adequate support only when the labial flange of the maxillary denture was eliminated from the highest contour of the labial ridge (Figure 2B, C). In order to maintain the continuity of the maxillary lip, the labial flange in the maxillary denture was extended a little above than where an ideal gum fit denture would rest. The continuity of the lip support is exhibited in comparative photographs (Figure 2D and Figure 2E).

B) Gum Fit with stainless steel wire

One of the principal disadvantages of removing the labial flange is the loss of peripheral seal which in turn affects the retention of the maxillary complete denture which has to work against gravity. In order to minimize the retention loss, the labial undercuts in the labial vestibule can be used by engaging a stainless steel wire that is connected to the denture in the region of the buccal notch. Clinically, the patients who fall in this category have less space between the labial portion of the maxillary labial ridge and the overlying lips as seen in case number 3 (Figure 3) and case number 4 (Figure 4). There may be a bony undercut or there may be no undercut in the region (Figure 4A). When undercut is present (Figure 3A), a stainless steel wire with a round end can project from the adjacent resin and run on either side towards the center (Figure 3C) without joining the other side of the clasp. The wire arm can be adjusted to increase or decrease the labial fullness in the labial vestibule as shown in (Figure 3B). The use of the labial flange is not only to provide support labially but it also provides support by lifting the vestibule to an extent that imparts natural tonicity to the maxillary lip. However, one must be careful not to extend the wire deep into the flange in a way that the pressure of the lips will dislodge the denture through the wire. This can be carefully done by identifying the vestibular reflection of the labial mucosa on the master cast. The maximum height of the clasp should then be placed below this landmark. This ensures that undue pressure from the lips and the vestibule do not place on the bow of the wire. The second case presented is an example, as can be seen there are no undercuts present in the labial vestibule (Figure 4A), but because the patient's maxillary lip was long, it drooled down more. To enhance support it was decided that the maxillary lip in the labial vestibule needs to be raised vertically. The problem in this case was that the patient's facial profile did not accept placement of denture flange. The extent and amount to which the flange would be lifted was done during teeth arrangement (Figure 4B). The final denture (Figure 4C) can be seen to have

orthodontic wire clasps placed very high in the labial vestibule without having any ill effect on the patient's appearance (Figure 4D). The extension of the acrylic resin denture base can be anywhere on or above the height of contour on the labial aspect of the residual alveolar ridge. The labial flange extension in Figure 3 and Figure 4 are different and are dependent upon the labial fullness provided by the labial portion of the residual alveolar ridge.



Figure 3. (A) Extra oral view showing depressed maxillary lip in relation to mandibular lip (B) Extra oral view of final denture (C) Intra oral view showing stainless steel wire adapted within the depth of the labial vestibule



Figure 4. (A) Maxillary residual ridge with a bony undercut and a prominent labial cortical plate of the ridge (B) Final denture with simple stainless steel wire that was fabricated after (C) Denture trial was done (D) Post insertion denture showing adequate retention upon smiling.

3. Gum Fit with Combined Wire and Resin

While in the previous section, it has been mentioned that wire can be used to lift the vestibule up and support the lips and the same can be fabricated during denture processing. However, the laboratory procedure for such modification of denture often does not get the desired results, since the movements of the wire within the denture mould either displaces the wire or alters the clinically established position. Another drawback of the previous design is that it does not allow dynamic adjustments, the adjustment that is possible is by bending the wire. This often does not yield desired results. To overcome such drawbacks, the same wire that is placed within the denture can be modified by adding increments of self cure denture base acrylic resin. This can be done

even if the wire has not been incorporated in the first instance (Figure 5A). The self cure can be adjusted on all sides of the wire (Figure 5B) to enhance retention, to improve support or to help the vestibule be lifted vertically. A patient treated with a modified complete denture (clear acrylic heat cure denture base resin) with modified flange (wire/resin) is shown in (Figure 6). In this patient, there was an adequate labial undercut present in the labial vestibule, while the maxillary lip was long that drooled down without support (Figure 6A). The labial cortical plate did not tolerate the presence of labial flange, therefore the labial flange was modified using the wire/resin modification (Figure 6B) which not only allowed to raise the lip vertically but also the elimination of the flange over the protruded ridge thus allowing the proper lip support during functional movements (Figure 6C).

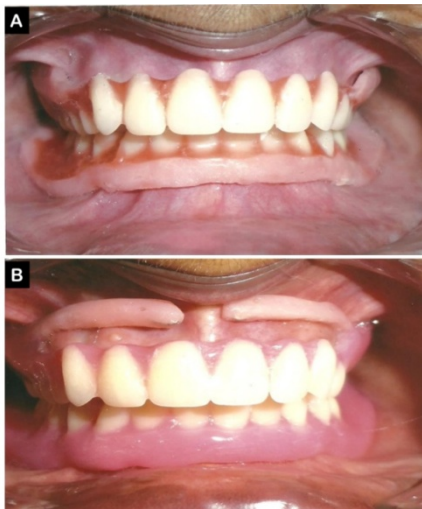


Figure 5. (A) Teeth arrangement with labial denture flange removed (B) Final complete denture with stainless steel wire reinforced labial flange

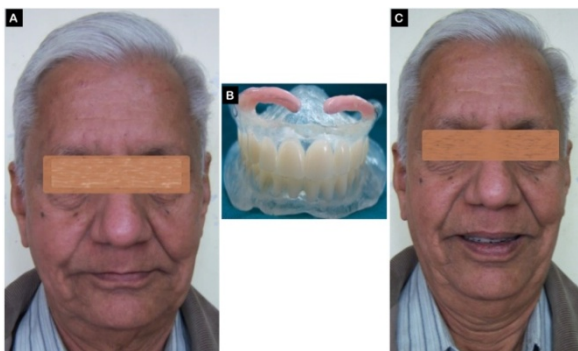


Figure 6. (A) Extra oral view showing inadequate labial support in maxillary lip (B) Denture flange made of stainless steel wire and acrylic resin (C) Extra oral view after wearing the prosthesis

4. Window Flange

Used in cases where the labial alveolar ridges are irregular, well build (Figure 7A) and maintain the lip support even after extraction. The resorption is slow, and the vestibule space will be normal. In such cases, creating a window within the labial flange of the denture (Figure 7B) can accommodate the convexity of the labial ridge and continue supporting the lip at that (Figure 7C) area.

Normal flanges in such patients give a puffy appearance to the maxillary lip (Figure 8A), while removal of the flange decreases the lip fullness (Figure 8B), more appropriate is to utilize the undercut present in the labial vestibule to enhance retention allowing a window in the labial flange of the denture (Figure 8C,D). Clinically however, it is important to let the patient know that there is a possibility of such modifications as there are patients who may not like such modifications and reject the denture (Figure 9 A-C). The design requires evaluation of the depth of undercut of the diagnostic cast, and analysis that it would accommodate the superior component of the flange.

5. Discussion

A case series that includes modification of labial flanges to accommodate different types of maxillary residual alveolar ridges has been presented. Each case presented unique clinical case scenarios with minor variations between the amount of labial undercut, the height of contour of the labial cortical plate of the residual ridge, the amount of vestibular space present between the ridge and inner mucosa of the maxillary lip. Due to a variable and complicated bone resorption pattern, the maxilla is known to create unique obstacles. [20] A maxillary resorption pattern which is chiefly superior and medial often creates clinical situations where the overlying soft tissue support remains inadequate impairing the overall facial aesthetics. invariably most of the bone resorption takes place on the labial side of the alveolar bone since palatal side has dense and thick compact bone. [21] The labial flange actually replaces the amount of labial bone lost due to resorption. Lip support must be differentiated from labial fullness since both are different features and have a different anatomical basis. Labial fullness is provided by the flange thickness at the end while lip support is provided by the whole length of the labial flange. The lip support is also dependent upon the tonicity of the muscles in and around the lips which include orbicularis oris as major muscle with others like depressor anguli oris, depressor labii inferioris, mentalis, levator labii superioris, levator angularis and risorius. [22] A uniform level of tonicity in these muscles is achieved through the modiolous the position of which is also altered when teeth are lost thereby altering the surface tonicity of the muscles of the lip. Clinically, it is imperative to determine the role of these factors as contributing to the loss of lip support. Irrespective of the cause of loss of lip support, the denture flange can provide the necessary required lip support which is guided by the relation between the maxillary and mandibular vermilion border of the lips in anterior and posterior direction. [23] It is also significant to remember that changes in modiolous brings about changes in the corner of the mouth and the two corners may fall out of vertical plane in such cases thereby causing an asymmetry. [24] This can be restored by lifting the modiolus up with the denture flange but is limited by the presence of buccal corridor in the area. Minor improvements can be achieved only by raising the vestibule rather than increasing the thickness of the flanges in the area.



Figure 7. (A) Intra oral view showing prominent multiple bony protuberances from residual alveolar ridge (B) Bony protuberances in the maxillary anterior region within the flanged window



Figure 8. (A) Bony excess showing prominent labial fullness in the absence of denture (B) Removal of labial flange (C) creation of the window in the labial flange of maxillary denture (D) Maxillary and mandibular dentures



Figure 9. (A) Preprosthetic extra oral view (B) Post denture insertion (C) Intra oral view showing maxillary gum denture with modified labial flange (window)

The same mechanism is also responsible for functional changes like in facial expressions. Facial expression changes between dentulous and edentulous states. [25] When natural maxillary anterior teeth are present, they oppose the effect of combined contraction of orbicularis oris and buccinator muscle. Since orbicularis oris has three muscle groups, and all are circular, the minimal tonic contraction of these is resisted by the labial surface of maxillary anterior teeth. Once the teeth are lost, the circular muscle falls or collapses resulting in shifting of the modiolous medially and posteriorly thus affecting the facial expression. [26] Lip support in natural teeth depends on many factors other than the position of anterior teeth. The cervical edge contours, the amount of bone resorption in the area, lip thickness, lip and nose length, morphology of the cartilaginous part of lower nose, angle to the nasal tip and projection of the chin all contribute to overall lip support. [27,28,29,30,31,32,33]

Presently, while recording the jaw relations in a complete denture patient, labial fullness and lip support are determined by placing an occlusal rim in the patient's mouth and then determining the amount of lip support that will be required. While the maxillary lip is raised from its position, the mandibular lip is still in its unsupported position since the mandibular occlusal rims have to be inserted after vertical dimensions have been established. Such a lacuna in jaw relations can be overcome by checking and verifying the lip support once again after vertical dimensions have been established and lower occlusal rims can be inserted in its proper place. This will overcome the problems that arise as a result of establishing lip support for maxillary arch alone.

The types of flangeless dentures presented in this case series are to be used when patients cannot or is not able to undergo surgical correction of the alveolar bone. The practice of alveoplasty after anterior tooth extraction needs consideration by the oral surgeon to fulfill prosthodontic requirements. For both specialities, more focussed attention to minor details in the maxillary anterior region need to be given.

6. Conclusion

The complete denture prosthesis is customized prosthesis therefore the modified flange designs presented in these cases do not specify any rule. Each individual patient has its own characteristics and therefore each patient will have their own limitations which clinicians must identify before following a particular design. Identification of the problem is purely determined through clinical examination especially the extra oral examination in such cases. Modification of flange design has though one significant advantage in that it avoids the alveoplasty procedure which in itself causes further bone loss. Therefore, modified flange designs must be considered as a form of preventive prosthodontic practice which by all means is a conservative clinical procedure.

ACKNOWLEDGEMENTS

The authors hereby would like to thank the staff and students of the postgraduate section of the department of Prosthodontics and the dental technicians for their selfless continuous support towards the completion of the cases.

Conflict of Interest

None

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