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REVIEW ARTICLE

Role of Facial Muscles in Complete Denture Prosthesis: A Review

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Abstract

We prosthodontist treat patients with complete denture prosthesis, that replaces missing teeth and maxillofacial tissues. A successful prosthesis requires balance between difeerent related factors and must fullfill the following criteria- of being in harmony with surrounding oral environment and orofacial musculature and preservation of remaining structures, re- stores masticatory efficiency; ability to perform during functions like deglutition, speech, respiration; and be aesthetically pleasing. Among these criteria maintaining harmony be- tween prosthesis and muscles and preservation of the same is of utmost importance and a challange to the dentist. Muscle action influences the fabrication of denture at every step beginning from impression making to jaw relations to teeth setting and finally successful retention, stability and comfortable wearing of denture. Similarly a properly constructed denture helps to restore the health of stomatognathic system of which muscle are a part. It helps muscle to function in its physiological limit and maintain tonicity. So in this review the role of facial muscles in complete denture prosthesis is presented here. (2018, Vol. 02; Issue 02: Page 56 - 62)

Key words: Muscles of facial expression, Buccinator, Modiolus, Orbicularis oris.

Introduction

"Muscle is of primary interest because it performs mechanical work." This is a statetment by Rahn and Heartwell (1). When muscles are stimulated, tension de- velops in the fibres and contraction oc- curs along the long axis of the fibres. This contraction of fibres is responsible for the development of forces which acts on the craniofacial tissues to perform me- chanical work.

According to GPT -8 Muscle is defined as an organ that by contraction produces movements of an organism: a tissue com- posed of contractile cells or fibres that af- fects the movements of an organism or part of the body.

There are several histological level of or- ganization seen in muscle – the basic

contractile unit in a muscle are myofi- brils. Myofibrils are packed together to form a single muscle fibre, which are sur- rounded by a layer of connective tissue called endomysium. Muscle fibres are grouped together to form bundle or fasci- culi. A layer of connective tissue sur- rounds each fasciculi as well as the spaces between the fasciculis is called the perimysium. Finally several fasciculi or bundles surrounded by a layer connective tissue called the epimysium, forms the muscle.

Most of the orofacial muscles are striated skeletal muscles. They comprises of both type -1 (slow) fibres and type -2 (fast) fi- bres, of varying proportion that reflects the function of that particular muscle. Most of the orofacial muscles have same properties like that of other muscles in the body which includes : Excitability, Con- traction, All or none law, Muscle tone, Muscle memory (2).

The oro-facial muscles influencing com- plete denture prosthesis are muscles of fa- cial expression, muscles of mastication, muscles of tongue, muscles of soft palate, pharyngeal muscles, suprahyoid muscles, infra hyoid muscles. In this review a detail description of facial muscles are only dis- cussed here.

Muscles of facial expression These muscles generally donot insert into the bone. They are subcutaneous in position and produces wrinkles or fold in the skin when they contract. They are re- sponsible for expression of different emo- tions of an individual. Morphologically they are remnants of panniculus carno- sus. Topographically and functionally they are divided into following groups ;

Epicranial, Circumorbital and Palpebral, Nasal, Buccol-labial groups.

Epicranial, circumorbital and palpebral, nasal groups of muscles are responsible for facial expression of different emotions of a person.

Buccinator, Orbicularis oris, Incisivus su- perioris and inferioris and Bucco- labial groups are of main concern to the Prostho- dontist as these muscles have immense influence on the fabrication and success- ful denture performance, aesthetics and patient compliance.

Orbicularis oris is the sphincter muscle of the mouth. It has no skeletal attachment except through the attachment of inci- sivus indirectly (3).

It is a composite muscle composed of :

- Intrinsic fibres: oblique fibres ex- tending from skin to mucosa of oral cavity
- Extrinsic fibres: derived from other facial muscles and arranged in three strata: Deepest – originates from incisivus superioris and infe- rioris, Intermediate – from buccina- tor and they decussates into oppo- site lips, Superficial – from levator and depressor anguli oris , their fi- bres cross each other at angle of mouth and passes to opposite lips.
- This layer also receives fibres form other muscles to form modiolus.

Action- Orbicularis oris is the main mus- cle of lip. Intrinsic fibres helps in articu- lation of speech. Deep layer compresses the lip against the teeth and the superfi- cial layer protrudes the lip (3).

Buccinator- It is horseshoe shaped muscle that originates from the outer surface of alveolar process of maxillae and mandible opposite the molar teeth, and partly from

the pterygomandibular raphe a fibrous band arises which extends to maxillary tu- berosity.

Insertion –Fibres travels to the mesial as- pect of first molar and on reaching the an- gle of the mouth fibres get arranged into three layers: Upper group passes to upper lip and lower group into lower lip, while in- termediate layer decussate at modiolus and goes to opposite lips.

Action – It pulls the corner of mouth lat- erally and backward. A major function of this muscle is to keep cheeks taught. If this was not so then when the jaws close, the cheek would collapse and be caught within teeth. During mastication it con- tracts and places the food particles on the occlusal table from the buccal vestibule (3).

Incisivus superioris and inferioris arises from incisive fosae and blends with orbic- ularis oris. Its action is to make the vesti- bule shallow hence influence flange thick- ness and extension.

Zygomaticus major and minor arises from zygomatic bone and inserted into the an- gle of mouth. Its action is to draw the an- gle of mouth upward and laterally as in smiling (1).

Mentalis origin from incisive fosae and in- serted into the skin. Its action is protru- sion of lips. It makes lower vestibule shal- low when it contracts.

Levator anguli oris arise from maxilla below infra-orbital foramen and inserted into the angle of mouth where it intermin- gles with other muscles and extends into skin of lower lip. Its action is to raise the angle of mouth. Combined action with le- vator labii superioris and zygomaticus mi- nor muscles accentuates naso-labial fur- row, in expression of sadness (3).

Levator labii superioris arises from lower margin of orbit just above infra orbital fo- ramen and inserts into the upper lip. Its action is to elevate and evert upper lip and to increase naso-labial furrow (1).

Levator labii superioris alaeque nasi arises from maxilla and inserted into ala of nose by one slip and upper lips by another slip. Its action is to dilate nostril. It elevates and everts upper lip.

Depressor labii inferioris arises from oblique line of mandible and inserted into skin of lower lip. It pulls lower lip down- ward and laterally (3).

Depressor anguli oris arises from the pos- terior part of the oblique line of mandible and gets inserted in the angle of the mouth

, through which it extends further into the skin of upper lip. It draws the angle of mouth downward and laterally, as in ex- pression of sadness (1).

Risorius is a variable slip of muscle, arises from parotid fascia as a continuation of posterior fibre of platysma and inserted into angle of mouth. It retracts the angle of mouth in greening (3).

Role of facial muscles in expression of emotion

Emotions of joy – Joy or happiness re- flected in an individual in varying degree, depends upon the intensity of emotion ex- perienced and the emotional level of the person. It may range from quite warmth of a smile to a roaring laughter. In either sit- uation the *muscles* of the lips and cheeks play dominant role and their action is ac- companied by brightening and lightening of the eyes.

Smile - "Physically and psychologically a smile enhances ones outward appearance and tend to improve self confidence and

feeling of self worth". A smile may be of slight and momentary or intense and pro- longed, may or may not be accompanied by sound. It may be a facial overtone dur- ing speech, resulting in modification of certain speech sound.

During smiling following muscle actions are noted:

- Contraction of zygomaticus major – draws the angle of the mouth and modiolii upward and backward .
- Contraction of levator labii superi- oris – elevates the maxillary lips, corner of mouth and ala nasi.
- Risorius works in synergistic action with buccinator – draws the angle of mouth and modiolii backward, producing a greening expression which is seen in smiling and not in laughing.
- Orbicularis oris – acts as an *antag- onist* to the above mentioned mus- cle actions.
- During smiling there is slight eleva- tion of mandible, due to synergistic action of elevators of mandible thereby diminishing *inter-occlusal distance*.

A smile may terminate with face returning to state of repose and modiolii in neutral position. There is also contraction of orbic- ularis oris and relaxation of others (4, 5). *Laughter* - A smile may progress to laugh- ter, characterized by wide opening of mouth and separation of teeth. Lightroller in describing laughter says that modioli are drawn cranially and laterally and max- illary lip forms a straight line or slightly convex orally stretching from one modioli to other. He suggested maxillary teeth are exposed as far laterally as first molar and cranially as far the gingiva which may even be exposed. The distance between the nasal septum and vermillion border of lips is decreased. Nasolabial fold deepens and its cranial part becomes horizontal Man- dibular lip bowed downward with marked concavity but teeth are not exposed (5).

Emotion of distress - In distress the mouth is firmly closed with corners of mouth ex- tending downward. This is achieved by tensing of muscle inserted in the modioli and fixes the modioli pushing of mandib- ular lip under and against maxillary lip by orbicularis oris muscle action. Mandibu- lar lip becomes broader laterally and in doing so produces crease that continues downwards. This gives the appearance of angle of mouth dragged downward and laterally (5).

Influence of these facial muscles in complete denture prosthesis

Orbicularis oris - This muscles rest on the labial flange and gingival third of anterior teeth. Its tone is detemined by the support it receives.

Buccinator - In the lower jaw buccinator muscles becomes part of denture bearing area. Fortunately, the action of buccinator does not dislodge the denture directly be- cause the muscle fibres contract in a line parallel to plane of occlusion, but they are at right angle to the fibres of masseter. So when masseter is activated it pushes the buccinator medially against the den- ture border in the distobuccal area. This is a dislodging force and the denture should be contoured to accommodate this interaction of muscles. This contour in denture base is called masseteric groove. The position of the attachment of buccina- tor muscle in upper jaw determines the vertical height of disto-buccal flange of

maxillary denture. The middle fiber of the buccinator muscle tense anteroposteriorly during mastication to move a bolus of food inward between the opposing posterior teeth and then to press against their buc- cal surfaces to hold it there as the jaws close in mastication (4).

In complete denture prosthesis, it helps in retention of maxillary denture. Buccal surface of the maxillary denture which in- cline inward from the border towards the teeth, is in direct contact with the lateral forces from the contracting buccinator muscle. The force exerted on an inclined plane may be broken down into two com- ponents.One component act in the direc- tion parallel to the inclined plane. The other component, called normal force, acts perpendicularly to the inclined plane. So a greater superiorly directed normal com- ponent of the force will help in retention of the denture (6).

Modiolus - (LATIN, "A HUB OF AWHEEL")

- It is a fibro muscular mass formed by the convergence of various muscles towards a focus just lateral to the buccal angle. It can be palpated most effectively by using the opposed thumb and index finger to compress the mucosa and skin simultane- ously. It is formed by nine muscles (4).

They are divided into two groups

1. Cruciate modiolar muscles - Zygo- maticus major, Levator anguli oris, Depressor anguli oris, Platysma pars modiolaris.
2. Transverse muscles - Buccinator, Risorius, Orbicularis oris, Inci- sivus superior & inferior.

Action of modiolus: The contraction of modiolus presses the corner of the mouth against the premolars so that the occlusal table is closed in front. Food is crushed by the premolars and molars and it does not escape at the corner of mouth unless sev- enth nerve damage (Bell's palsy) has oc- curred.

Prosthetic significance:

- Border molding: The functional movements are made during the border moulding procedure by holding the modiolus with thumb and index finger.
- It helps in establishing the *height of occlusal plane* of occlusal rim. Corners of the mouth are marked on the occlusal rims to provide the dentist and technician with ante- rior landmarks for the height of first premolars.
- The convergence of the muscles of facial expression into the modiolus makes it a muscular knot of consid- erable strength with a wide versatil- ity of movement up, down, forward and back. Situated as it is at the angle of the mouth, it is in a strate- gic position to unseat mandibular dentures and sometimes maxillary dentures as well.

This may occur if the arch form of teeth and the flange are too wide and restrict the freedom of movement of the modiolus. Hence the lower denture requires to be made narrow in the premolar area so that the pressure of the modiolus may be max- illary dentures taken by the upper den- ture, due to it's greater retention and re- sistance to lateral movement (4).

Influence of muscles of facial expression on the borders of maxillary dentures

Labial flange of the denture - lies in the la- bial vestibule area extending from buccal frenum in the canine region of one side to the other side. It is divided into two halves by the labial frenum in the midline. The labial frenum is a fold of mucous mem- brane and contains no muscle and has no action on its own. Relief is given to allow the frenum to pass through it (1).

The main muscle of the lip is orbicularis oris, which forms the outer surface of la- bial vestibule. Its tone depends on the support it receives from flange and posi- tion of the teeth.

On the other way round, as the fibres of the muscle runs in horizontal direction, the extent of the impression and thus the vertical height and thickness of flange is determined by this muscle action indi- rectly. The patient is advised to pucker the lips and suck to record the muscle activ- ity.

Buccal flange of the denture – It lies in the buccal vestibule extending from the buc- cal frenum to hamular notch .

Buccal frenum – It is in relation with three muscles

1. Levator anguli oris – which lies be- neath the frenum and affects its po- sition.
2. Orbicularis oris – which pulls the frenum forward.
3. Buccinator – pulls it back.

Buccal frenum is recorded either passively by pulling the cheek upward, outward, downward and inward, backward and for- ward simulating the movements of the fre- num.

Buccal vestibule – Width of the vestibule is influenced by the action of buccinator. Distobuccal end of flange is affected by the masseter and coronoid process.

Hamular notch area is influenced by ac- tion of buccinator and suprior constrictor into pterygomandibular raphe. When the mouth is open wide, pterygomandibular raphe becomes taut and pulled forward and overextension of the denture may traumatise the tissue (1).

Influence of facial muscles of expression on th borders of mandibular dentures

Labial flange of the denture – It lies in the labial vestibule which extends from buccal frenum of one side to the other and divided by labial frenum in midline.

Labial frenum – It contains a band of fi- brous connective tissue that helps to at- tach to orbicularis oris. Hence this frenum is active and proper relief must be given to permit its movement. Hence the lip is lifted outward upward and inward during border moulding. The depth of the den- ture flange in the labial vestibule depends on the amount of bone resorption and the insertion and action of the muscles (4).

Orbicularis oris also influences the flange thickness. When the mouth is open wide it becomes stretched narrowing the sulcus and if the flanges are thick it will displace the denture. Similarly flange thickness would affect the lip support and aesthet- ics.

Mentalis elevates the skin of the chin and the lip outward. It renders the vestibule shallow. Thus it influences the thickness of the flange. It is capable of dislodging the denture if the ridge resorption is more and

height of the ridge is same as that of the fornix of the vestibule (1).

Buccal flange of the denture – It lies on the buccal vestibule that extends from buccal frenum to the retromolar pad. Buccal fre- num overlies the depressor anguli oris which moves it vertically and horizontally. Buccal vestibule is influenced by the buc- cinator muscle which is attached to the buccal shelf and the external oblique ridge. Denture should completely cover the buccal shelf despite the fact that it rest on buccinator because fibres of buccinator runs parallel to the base and it contract parallel to the border and not perpendicu- lar to it.

Distobuccal area of the vestibule is influ- enced by the action of masseter which press inward against the buccinator, thereby reducing space in that area.

The distal extension of the denture base is up to the retromolar pad , which is lined by thin non keratinised epithelium and sub-mucosa containing glandular tis- sues, fibres of the temporalis, attach- ments of the buccinator and superior con- strictor in the pterygomandibular raphe. When the patient opens the mouth, the pterygomandibular raphe is pull forward and overextension of denture base may cause dislodgement of the denture (4).

Conclusion

Successful denture construction and com- fortable wearing of the prosthesis is de- pended on various factors but amongst all, role of muscles are influential one, and fa- cial muscles are important for coordina- tion between prosthesis performance and facial expression of emotion. Their action must be understood and recorded at all step of fabrication of prosthesis.

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