REVIEW ARTICLE

NEUROMUSCULAR SYSTEM AND COMPLETE DENTURES

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ABSTRACT:
One of the most important structure involved in dental treatment is the neuromuscular system, as it is predominant factor in esthetics and masticatory efficiency. Effect of this apparatus is an important criteria for evaluating the desirability of various procedures in construction of removable and fixed prosthesis including impression making, jaw relations, teeth arrangement and occlusion.
Keywords- Neuromuscular system, muscles, complete dentures, masticatory system.

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INTRODUCTION

The function of masticatory system is complex. A highly refined neurologic control system regulates and coordinates the activities of entire masticatory system consisting primarily of nerves and muscles, known as neuromuscular system. The musculature is involved directly in several important phases of prosthodontic treatment. Most obvious is of course, the action of muscles as prime movers of the mandible and hence as the power of repeated occlusion of the teeth. In addition they are also active during mastication, deglutition, and speech. They exert a direct and indirect influence upon the peripheral extension, shape and thickness of denture bases, the positions of teeth both horizontally and vertically, and facial appearance. Hence,a basic understanding of the anatomy and function of the neuromuscular system is essential.[1]

Brill in 1957 explained the general features of the structure and function of the neuromuscular system and stated that if complete dentures are to be of any use for patient, it was essential that they meet the basic requirements set up by the neuromuscular function of the masticatory mechanism.[2]

DENTURE AND MUSCULATURE

Muscles have an appreciable effect on denture retention. It transcends in importance all other factors responsible for denture retention, at least in those cases where the bony foundation of a lower denture is greatly resorbed.Fish, Matthews, Thouren,Strack, Eisenring, Dorier, Lammie, Stokstad, and others have pointed out that muscle function is important instabilizing dentures, it seems that no one has singled out this factor in denture retentionfor experimental investigation.[3]

Brill et al in 1965 stated that the stability of a lower denture is dependent on the manner in which the surrounding musculature relates to the different surfaces and borders of the denture and divided them into two groups: (1) those muscles which primarily dislocate the denture during activity, and (2) those muscles that fix the denture by muscular pressure on its secondary supporting surfaces (Table I).[4]

NEUROMUSCULAR SYSTEM AND IMPRESSION MAKING

Good sound prosthodontic servicecannot, of course be accomplished without accurate impressions which is one of the principal factor in mandibular stability as stated by Fish.

Barone in 1963 described Tench's Neuromuscular Concept involving sucking and swallowing movements in recording impression to bring the denture base in harmony with the physiologic behaviour of muscles adding stability to the dentures and to develop complete passive contact of all impression borders to the basal seat tissues passively filling all marginal spaces and compatible with function.[5]

Collett in 1970 stated that the masseter muscle is of greater concern than the buccinator and requires special attention. It is located lateral to the buccinator muscle. Its fibers run vertically and press against the distal aspect of the buccinator

when it contracts. If the denture border is overextended in this region it will cause soreness when the masseter muscle contracts to close the mouth. The occlusion of the teeth at this time will prevent dislodgment of the denture.[6] Faber in 1984 described various ways in which muscles and their functional activity affects the impression procedure

(A) Muscle power- selective pressure impression technique allowing coverage of buccal shelf and pear shaped pads should be used in patients with above average muscular forces.

(B) Anatomic attachment height- in patients with preprosthetic surgery contraindicated, unfavourable attachment height provides less basal seat area for physical factors of retention, consequently poor prognosis.

(C) Valve seal borders-proper border extensions are inescapable for impression making especially in mandible. Labial and buccal musculature are primarily dislodging muscles. While lingual musculature is capable of both dislodging and proving good border seal, if functionally accommodated. Mylohyoid muscles tenses during deglutition. Therefore, impression techniques that do not border mold the lingual flange by swallowing can produce lower dentures with vague, arbitrary lingual flange.[7]

ROLE OF NEUROMUSCULAR SYSTEM IN MANDIBULAR MOVEMENT

Mandibular movement occur as a complex series of interrelated three dimensional rotational and translational activities determined posteriorly by Temporomandibular joints, anteriorly by maxillary and mandibular teeth and overall by the neuromuscular system.[8] Muscles are responsible for mandibular movement and fixation or stabilization on a given position, so the movement will be smooth and coordinated from one position to another. They receive impulses from the central nervous system at conscious and subconscious level, resulting in voluntary and involuntary activity respectively. Impulses at subconscious level including the reticular system, also regulates muscle tone, which plays primary role in the physiologic rest position of the mandible.[9] Mehringer et al in 1973 also stated that Functional mandibular movements especially during mastication and swallowing, are directed by three determinants i.e. neuromuscular system, occlusal and cuspal guidance, and right and left temporomandibular joint function.[10]

ROLE OF NEUROMUSCULAR SYSTEM IN JAW RELATIONS

Solane in 1952 described that maxillomandibular relationship in vertical dimension is complex rather than consideration of two halves of masticatory apparatus, affected by muscular function, propriopathic receptors and mandibular axis. Mandibular axis is a fixed factor while other two can accommodate through training.[11]

Block in 1952 described two factors influencing muscular tensions. The first was mechanical disharmony between the occlusion and centric jaw relation and the second factor was psychic.[12]

Boos in 1952 stated that rest position is the neutral centre of the masticatory musculature and closing from that position includes a coordination of muscle function.[13]

Lammie et al in 1959 advocated the use of muscular position over hinge position as there would be no stretchimposed on the ligament and preservation of physiologic joint action. In contrast**Baskar and Davenport** recommended retruded position over muscular position as it is more consistent, closer to an acceptable intercuspal position and not affected by posture and teeth to teeth relation.[14,15]

Lytle in 1964 described a method of recording tentative vertical relation of occlusion by neuromuscular perception of an edentulous patient using central bearing device under proper guidance, further evaluated by aesthetics, phonetics and functional requirements. The stretch reflex action and proprioceptive mechanism of muscles, ligaments of temporomandibular joint plays important role in patient's perception of mandibular position.[16]

Tueller in 1969 stated that the length of the closing muscles of mastication is changed duringthe opening and closing of the jaws, the physiologic factors in muscle structureshould provide a basis of study of muscle efficiency at varying maxillomandibularpositions.[17]

Graser in 1976 conducted a study to obtain information about the terminal hinge position (THP) and the neuromuscular position (NMP) on 25 edentulous patients. The difference between the two positions was evaluated anteroposteriorlyand mediolaterally to determine horizontal differences and reproducibility between days and concluded that there was a discrepancy between the THP and the NMP for all edentulous subjects examined with NMP is anterior and medial or lateral to the THP, and not as reproducible as the THP.[18]

Faber in 1984 defined physiologic rest as a position in which the muscles of elevation and depression are in a state of tonic contraction sufficient only to maintain an upright position when the patient is at ease.[7]

Table I: Location and Effect of the Musculature Limiting the Lower Denture Space

Dislocating muscles	Fixing muscles
Vestibular	
Massater	Buccinators
Mentalis	Orbicularis oris
Incisivuslabiiinferioris	
Lingual	
Internal pterygoid	Genioglossus
Styloglossus	Lingual longitudinal
Palatoglossus	Lingual transverse
Mylohyoid	Lingual vertical

Basker and Davenport also described the association of tongue with respiration and its influence on the rest position of mandible.Following extraction of teeth and resorption of the alveolar bone,the tongue spreads laterally into the edentulous space impeding the posterior oral seal. In response, the mandible disposes to rise, thus allowing the posterior oral seal to be re-established.[14]

ROLE OF NEUROMUSCULAR SYSTEM IN TEETH ARRANGEMENT

The memory patterns of facial expression develops within the neuromuscular system when the patient had natural teeth are continued or reinforced so the patient's original appearance is maintained. The proper repositioning of the orbicularis oris muscle is essential for denture esthetics. The effects of time cannot be totally erased, nor should they be, but improved esthetics can be accomplished regardless of age.

The two buccinators and the orbicularis form a functional unit that depends on the position of dental arches and the labial contours of the mucosa or the denture base for effective action which get impaired with the loss of teeth. Because these muscles of expression are no longer supported at their physiological length, contraction of the unsupported fibres does not produce normal facial expression. However, when these muscles are correctly supported by complete dentures, impulses coming to them from the central nervous system cause a shortening of the fibres that allows the face to move in a normal manner.

The Neutral zone is that area in potential denture space which exists when all the natural teeth have lost where the forces of the tongue pressing outwards are neutralized by the forces of the cheeks and lips pressing inward. These muscular contraction during the various functions of chewing, speaking, and swallowing, they vary in magnitude and direction in different individuals. Failure to recognize the cardinal importance of tooth position and flange form and contour often results in dentures which are unstable and unsatisfactory, even though they were skilfully designed and expertly constructed. The coordination of complete dentures with neuromuscular function is the foundation of successful, stable dentures.[19,20]

Fish in 1933drew the attention towards the cameo or polished surfaces of dentures and highlighted the importance of the muscular function of the tongue, cheeks, and lips as being critical factors for denture stability.[21]

Numerous authors have described prosthodontic management with the neutral zone technique for patients undergoing mandibular surgical reconstruction, segmental mandibulectomy,brain surgery, marginal mandibulectomy,maxillectomy and partial glossectomy and for those with severe neurological disorders, Parkinson's disease, and severely resorbed residual ridge and mandibular continuity defects.[22,23,24,25]

NEUROMUSCULAR CONCEPT OF OCCLUSION

An important criteria for evaluating the desirability of an occlusal position is its effects on the neuromuscular apparatus. Neuromuscular or Myocentric occlusion is the terminal point in space at which, with the mandible in rest position, subsequent isotonic muscle contraction raises the mandible through the interocclusal space along the myocentric trajectory which coincides with centric occlusion. Its registration can only be performed by balanced and relaxed musculature.[26]

CONCLUSION

Dental treatment not only involves teeth and oral condition, but also facial expressions, head and neck musculature and temporomandibular joints. One of the most important structure involved is the neuromuscular system, as it is predominant factor in esthetics and masticatory efficiency. Neuromuscular apparatus consist of musculature

and associated nerves. Effect of this apparatus is an important criteria for evaluating the desirability of various procedures in construction of removable and fixed prosthesis including impression making, jaw relations, teeth arrangement and occlusion.Thus various procedures in construction of removable and fixed prosthesis should be harmony with the neuromuscular system and successful treatment in prosthodontics depends upon this harmony.

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