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A COMPARATIVE ELECTROMYOGRAPHIC STUDY OF TEMPORAL AND MASSETER MUSCLE IN CLASS I AND CLASS II DIVISION I CASES

Orthodontics

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ABSTRACT

Aim- The purpose of this study was to record the electromyographic activity of the temporalis and masseter muscles in normal and Angle's class II division 1 cases in maximal biting in intercuspal position and during chewing and to compare the activities of the two muscles in class II division 1 cases with those of normal occlusion. **Materials And Methods-** 15 subjects of Angle's class II division 1 malocclusion with deep anterior overbite, skeletal class II pattern with ANB angle greater than 4° and normal mandibular plane angle were selected. The 15 normal occlusion subjects had normal overjet and overbite with class I dental arch and normal mandibular plane angle. All the subjects were male of 9-15 years of age, with full compliment of teeth particular for that age, were free of any temporomandibular joint disorder and had no history of previous orthodontic treatment. Electromyographic activity of the temporal and masseter muscles of both sides were recorded during maximal biting in intercuspal position and during chewing of peanuts. The peak to peak amplitude was obtained from the raw EMG data using the integrated software. The average peak to peak amplitude in uv were used for statistical analyses. **Results And Conclusion-**The results revealed that there was no statistically significant differences in activity of the muscles of the right and left sides in both the groups. The activity of the masseter muscle in both maximal biting and chewing was significantly higher in class I group. In class II division 1 group although the masseteric activity was higher, it was not statistically significant. Comparison between the groups showed that the masseteric activity was significantly higher in class 1 group for both chewing and maximal biting. The temporalis activity was also significantly higher for class I group during chewing, but the difference in temporalis activity during maximal biting, although higher in class I group, was not statistically significant.

KEYWORDS

Class II Division 1, Class I, Temporalis and Masseter Muscles, Electromyography, chewing, maximal biting

INTRODUCTION

Since the inception of the human civilization man has sought after beauty and esthetics. The appearance of a person, particularly that of the face, has social and psychological implications. There has been a constant strive to ease the psychological problems created by malaligned teeth and poor facial proportions, to achieve a sense of well-being through improved dental and facial esthetics.

Orthodontists have separated normal and abnormal occlusion by anatomical tooth relations, which is a static classification dependent upon bony architecture and tooth position. However since the bony foundation which supports the teeth is powered and moved by muscle tissues, the dynamic aspects of the oral cavity cannot be excluded from consideration.

Recognition of this functional consideration gives rise to the question - is there a pattern of the functioning orofacial musculature which might possibly reflect the anatomical relationships of the teeth in their bony bases or does variation of tooth relationship result in characteristic pattern of muscle activity.

Muscle effects its function by contraction, that is, it moves, holds or produces tension by shortening or trying to shorten and is accompanied by chemical, thermal or electrical changes. The effect of muscle force is three dimensional, although most orthodontists consider it only in one vector.

Recording of electromyography is dependent on the electrical activity of the muscle. The resting membrane potential of muscle fibre is 70-80 mv with inside negative. The spontaneous release of acetylcholine from the nerve twigs, which join the muscles at the neuromuscular junction results in miniature end plate potential.

The end plate potential, which is of 4-8 mili second duration, when exceeds the threshold, initiates the action potential in a muscle. Electromyography refers to recording of action potentials of muscles firing singly or in groups. The muscle action potential propagates bidirectionally from the motor end plate at a velocity of 3-5 m/s. The muscle action potential can be recorded as a monophasic wave in a nonconducting medium. Recording in a conducting medium, the current flow generated by the potential is seen as relative positivity when recorded from a distance.

The muscle action potential when recorded by a needle electrode appears triphasic as the action potential approaches, crosses and leaves the recording electrode. The distance of recording electrode from the muscle fibres determines the rise time and fall of action potentials.

As the scope of orthodontics is being enlarged to include the evaluation and treatment of the entire stomatognathic system, the evaluation of muscle function is day by day becoming every bit as important as observing the intercuspation and occlusion of the teeth.

AIMS AND OBJECTIVES

Muscle activity, particularly that of the masseter and temporalis muscle has been studied by various researchers but no unanimity has been achieved concerning the function of the masticatory muscles in various skeletal form and occlusion of the teeth.

The objectives of this study are :

1.To study the electromyographic activity of the temporalis and masseter muscles in normal and Angle's class II division 1 cases in maximal biting in intercuspal position and during chewing.

2. To compare the activities of the temporal and masseter muscles in class II div I cases during maximal biting in intercuspal position and during chewing with those of normal occlusion cases.

MATERIALS AND METHODS

Sample Selection:

The sample for the study were selected from patients visiting the department of Orthodontics and the department of Pedodontics and Preventive Dentistry.

A total number of 15 subjects of Class II division I malocclusion and 15 subjects of class I normal occlusion were selected between the age group of 9-15 years. The mean age for class I group was 11.33 years and for the class II division I group was 12.13 years. All the subjects were male patients who had not received any orthodontic treatment previously and had full complement of teeth particular for that age without any extraction of teeth and were free of any temporomandibular joint disorders.

The selection of the samples were based on the following criteria:

A. Class II division 1 cases :
i. Clinical diagnosis of Class II division I malocclusion.
ii. Presence of deep anterior over bite.
iii. A skeletal class II pattern with ANB greater than 4°.
iv. Normal mandibular plane angle.

B. Normal occlusion cases :
i. Class I dental arch.
ii. Normal overjet and overbite.

METHODS:

Electromyographic activity was recorded using the R.M.S. emg ep Mark II electromyographic unit with integrated software. Before each recording session, the procedure was explained in detail to the patient and guardian to allay anxiety and fear. The subjects were asked to wash their face with soap and water. The skin over the muscles *w*as cleaned with alcohol and dried thoroughly. The subjects were seated comfortably in a shielded room free of outside influences. Bipolar silver disk surface electrodes *w*ere used. Electrode placement was done by palpating the muscles during voluntary clenching and relaxation. A electrolyte jelly was applied to the electrodes and the electrodes were placed and secured with the help of micropore. The ground electrode was placed on the fore-arm. For recording the muscle activity in maximal biting in intercuspal position – the subjects were asked to close their jaws in centric occlusion as forcibly as possible. Five recordings of each side were made per subjects for both the muscles. The peak to peak amplitude was obtained from the raw EMG data of each of the five recordings using the integrated software and the mean value of both the right and left sided measurements were taken for statistical analysis. For recording of muscle activity during chewing, the subjects were asked to chew five pea nuts. No instruction was given as how to chew the nuts so as not to interfere with the normal chewing activity of the subjects. Muscle activity for ten consecutive chewing cycles from the middle of the chewing phase was taken and the peak to peak amplitude was calculated using the software. As none of the subjects had unilateral chewing pattern both the right and left side activity was recorded for both the masseter and temporalis muscles.

RESULTS AND ANALYSES

The peak to peak amplitude in uv, obtained from the raw EMG data, for masseter and temporalis muscles of both sides during maximal biting in intercuspal position and during chewing, for both class I and class II division 1 cases were recorded. The average values calculated from this data were used for statistical analysis Although it was found that for masseter muscle the average values of the right side was higher than that of the left side for both maximal biting and chewing and for the temporalis muscle the left side value was higher than that of the right side for both maximal biting and chewing the differences in average values were not statistically significant. Similarly the differences in average values for the right and left sides in maximal biting and chewing for the two muscles in class II division 1 cases *w*ere also not statistically significant.

The comparison between the average EMG activities between the two groups i.e., class I and class II division I were assesed. It was seen that the average EMG activity for both the muscles in maximal biting and chewing were higher in class I sample than in class II division 1 cases.

DISCUSSION

The most difficult factor in orthodontic etiology to quantify and thus investigate scientifically is the behaviour of the orofacial musculature.

Researchers turned to electromyography in their quest for a measuring instrument which would accurately record the activity of the muscles surrounding the dentition. Electromyography, which started with Galvani's experiments in applied physiology as early as 1786 and was introduced to dentistry by R.E. Moyers in 1948, has been improved and standardized with the result that it is now possible to work with quantitative methods in the evaluation of the EMG data but because of diversity of samples, recording techniques for different muscles, types of electrodes and equipments used the results of various muscle studies have often been conflicting making comparison among studies difficult. So, in this study, every effort was made to keep the method and variables in sampling as simple as possible.

As various investigators like Gerstner and Parekh reported sex differences in muscle activity, so only male subjects were selected for the study. Many investigators like J.P. Moss found difference in muscle activity between adults and children. So, only children between age group of 9-15 years were selected for this study. Great variation in muscle activity during chewing and maximal biting was found with variation of mandibular plane angle. So, subjects with normal mandibular plane angle were selected for both class I and class II division 1 cases.

In the present study, there was no statistically significant variation in activity of the muscles in right or left side in both maximal biting and chewing in normal as well as in class II division 1 cases. This was in contrast to the study by Hans Pancherz who found a marked variation in activity between the right and left sides in both class I and class II division 1 subjects. The difference may be due to the fact that, in the present. study, none of the subjects had unilateral chewing pattern.

CONCLUSION

The purpose of this study was to record the electromyographic activity of the temporalis and masseter muscles in normal and Angle's class II division 1 cases in maximal biting in intercuspal position and during chewing and to compare the activities of the two muscles in class II division 1 cases with those of normal occlusion.

15 subjects of Angle's class II division 1 malocclusion with deep anterior overbite, skeletal class II pattern with ANB angle greater than 4° and normal mandibular plane angle were selected. The 15 normal occlusion subjects had normal overjet and overbite with class I dental arch and normal mandibular plane angle. All the subjects were male of 9-15 years of age, with full compliment of teeth particular for that age, were free of any temporomandibular joint disorder and had no history of previous orthodontic treatment.

Electromyographic activity of the temporal and masseter muscles of both sides were recorded during maximal biting in intercuspal position and during chewing of peanuts. The peak to peak amplitude was obtained from the raw EMG data using the integrated software. The average peak to peak amplitude in u*v w*ere used for statistical analyses.

The results revealed that there was no statistically significant differences in activity of the muscles of the right and left sides in both the groups. The activity of the masseter muscle in both maximal biting and chewing was significantly higher in class I group. In class II division 1 group although the masseteric activity was higher, it was not statistically significant. Comparison between the groups showed that the masseteric activity was significantly higher in class 1 group for both chewing and maximal biting. The temporalis activity was also significantly higher for class I group during chewing, but the difference in temporalis activity during maximal biting, although higher in class I group, was not statistically significant.

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