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RESEARCH ARTICLE

EVALUATION OF CHEWING EFFICIENCY AND ELECTROMYOGRAPHY ACTIVITY OF MUSCLES OF MASTICATION OF PATIENTS WEARING COMPLETE DENTURE LINED BY FLEXIBLE ACRYL (RANDOMIZED CLINICAL TRIAL)

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Abstract

One of the goals that the prosthodontist has to achieve is to construct retentive and stable denture that subsequently enhances both function and esthetics. Subjective and objective contemplate provide controversial results of denture liners' influence on the masticatory ability. While results of some considerations indicated that chewing efficiency remarkably improves the chewing ability. Flexible acrylic resin liners offer better denture adaptation, patient satisfaction as well as denture retention due to its light weight and engaging more desirable undercuts. Aim of this study was to assess the flexible lining acrylic resin material's influence on the chewing efficiency and activity of masticatory muscles in complete denture wearers. Materials and methods: Twenty six completely edentulous patients were selected and were divided into two groups, Group I: patients wearing conventional heat cured acrylic complete denture. Group II: patients wearing conventional heat cured acrylic complete denture relined by soft acrylic versacryl. Chewing efficiency and Electromyography records taken for both groups at time of insertion, after first, second and third month. Results: time taken during swallowing decreased for patients wearing complete dentures lined with soft acrylic versacryl than conventional complete dentures. EMG activity for both the masseter and temporalis muscles were increased after the relining of the complete denture with soft liner (versacryl). However, EMG activity of the masseter muscle was higher than the temporalis muscle in both groups.

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Introduction:-

Edentulism is one of the major problems that has an impact on both patient and dentist. ⁽¹⁾An important goal that and stable prosthesis that subsequently enhances function and esthetic ⁽²⁾There are several methods that have been advocated to improve retention of complete dentures; one of such methods is relining of the denture. Many materials could be used, as plasticized acrylic resin, silicone rubbers, tissue conditioner and thermoplastic material.

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⁽³⁾Completely edentulous patients would suffer from bone resorption, temporomandibular disorders and hypotonicity of the muscles of mastication which would damage the masticatory process ⁽⁴⁾. Loss of natural teeth would have serious effects on the masticatory function; the masticatory apparatus would perform the chewing action. The masticatory apparatus consists of the teeth, jaws, muscles of mastication, and temporomandibular joint that would all be used in chewing. In completely edentulous patients, due to loss of teeth the muscles of mastication would play a major role in determining the chewing ability and efficiency of the patient ⁽²⁾

Methods to assess the masticatory efficiency: first Patient based out-comes: which includes Self reports of satisfaction and chewing function, Oral health related quality of life: (OHRQoL) and Diet and nutritional assessment. Second Objective out comes: 1) Sieve system this method is very complicated to perform, an improved version of this method was used in clinics for convenience ⁽⁵⁾. 2) Chewing gum it is a simple method for masticatory performance using a newly developed color-changeable chewing gum that changes color as mastication proceeds. ⁽⁶⁾ 3) Colorimetric method The material used for the masticatory efficiency evaluation was These beads were pigmented with violet fuchsin, The bead capsules were then chewed by the participants so that the fuchsin spread proportionally to the energy used in the grinding corresponded to the masticatory efficiency ⁽⁷⁾.

4) Image analysis It depends on the diameter of the particle size that have chewed by the patient, the patient was instructed to chew a soybean for a certain number of strokes then this particle is collected and directly measured by a graphic scanner and a computer A microscope was used to photograph the particles, that were amplified 14 times ⁽⁸⁾. 5) B-carotene gummy Jelly: The use of a sticky gelatin containing beta-carotene using this method, the surface area of the crushed gelatin was calculated by measuring the glucose or beta-carotene concentration dissolved in water. ⁽⁹⁾ 6) Mastication time: This is the simplest way for evaluation of the chewing efficiency it is calculated through the time taken from the beginning of mastication until all of a food bolus is swallowed, ⁽¹⁰⁾. 7) Electromyography: It has been concluded that relining would improve retention, stability and appearance in cases where there is loss of peripheral seal. Denture reline materials are divided into two categories according to material; hard and soft liners ⁽¹¹⁻¹³⁾.

Soft denture liners: Soft liners were used to improve denture retention by utilizing bilateral undercuts, and by improving the old denture fitness as they act as shock absorbers ⁽¹⁴⁾. While hard denture liners can be used when there is an adequate residual ridge, resilient mucosa, and mature and healthy supporting structures. These materials should be selected for the treatment of an unstable and ill-fitting denture ⁽¹⁵⁾. Several relining materials are being used for relining such as thermoplastic resin .which includes Soft liner and Flexible acryl.

Flexible acryl is a heat sensitive resin used for relining of dental prosthesis to improve retention, esthetics and patient comfort. The rigidity of versacryl is controllable by varying the proportions of the softener and hardener, allowing an infinite range of consistencies: from very soft while heated to as hard as denture base ⁽¹⁶⁾ Does the flexible lining acryl resin for complete dentures will affect the chewing efficiency and activity of muscles of mastication?

Materials and Methods:-

Twenty six male completely edentulous patients aged from 45-60 years were selected. Patients were medically free from any neurological disorder that might affect the neuromuscular system such as Parkinsonism Paralytic disorders and Diabetes Mellitus, and they also have Angle class I maxillo-mandibular relationship. Patients were randomly divided into two equal groups: Group I: patients wearing conventional heat cured acrylic complete dentures. Group II: the conventional heat cured acrylic complete dentures were relined by soft acrylic versacryl. Conventional steps of complete denture fabrication were carried out for both. For groups II After the final impressions were made, a 2mm layer of modeling wax (wax spacer) was adapted on the master cast with four windows at the canine and first molar areas. A duplicate of this modified master cast (with the spacer adapted on it) was made, in order to construct occlusion block for this group.



Fig. 1:- Modified Cast with Occlusion Block.

Before denture delivery, a lower Functional wash impression for group II patients was carried out. Border molding of the lower denture was carried out, and then a final closed mouth impression was made using a medium rubber base consistency while the patient wearing the upper denture and closing in centric relation. After setting of wash the impression was removed from the patient mouth, then disinfected and poured with hard stone. Then it was flaked, the impression material was removed from the fitting surface of the lower denture, then Versacryl material was mixed according to the manufacturer's instructions and then injected in the space between the cast and the fitting surface of lower denture. Processing and curing was carried out conventionally. The lower denture was then finished and polished.

Chewing efficiency was recorded by calculating the "Mastication time" which is the time taken for the patient to chew 3 grams of peanuts of equal size from the first stroke till the complete swallowing, in addition to recording the muscle activity for temporalis and masseter muscles during the chewing process using electromyograph device. These records were taken for both groups at time of insertion, after first, second and third month.

Results:-

Chewing efficiency:-

At Baseline and After 1, 2 and 3 months, showed higher chewing efficacy and a lower values of mastication time for both Group I and II.

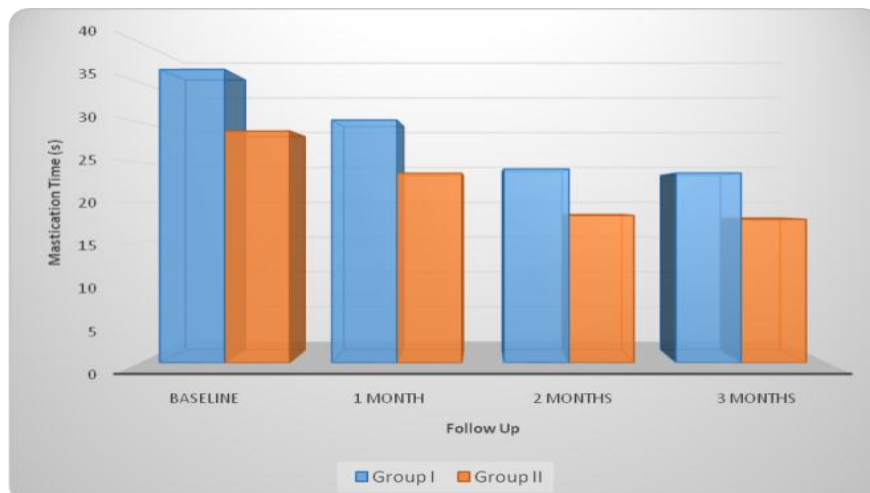


Fig. 2:- A Bar chart showing mean Mastication time (s) for both Group I and Group II at different follow up intervals.

Electromyography:-

Masseter Muscle At Baseline and after 1,2 and 3 months Group II showed higher muscle activity values compared to Group I with EMG muscle activity values for both Group I and II.

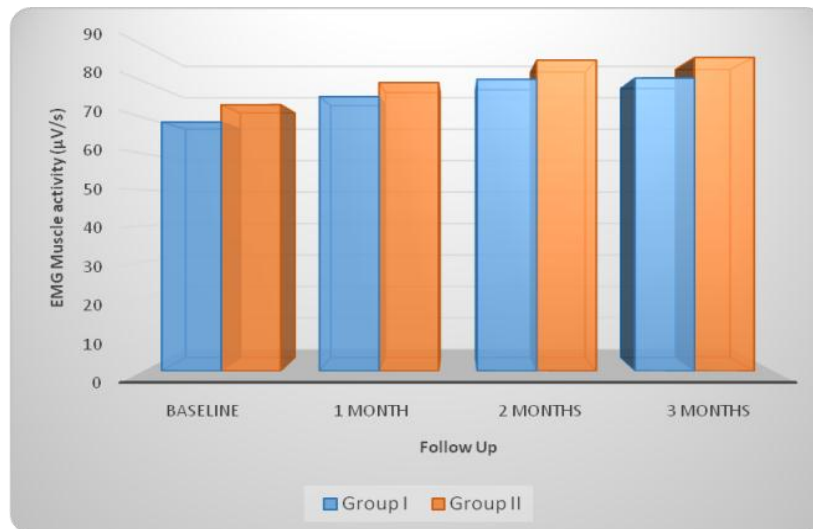


Fig. 3:- A Bar chart showing mean EMG Muscle activity ($\mu\text{V/s}$) of the Masseter muscle for both Group I and Group II at different follow up intervals.

Temporalis Muscle At Baseline and After 1,2 and 3 months, Group II showed higher Muscle activity values compared to Group I with EMG muscle activity values for both Group I and II.

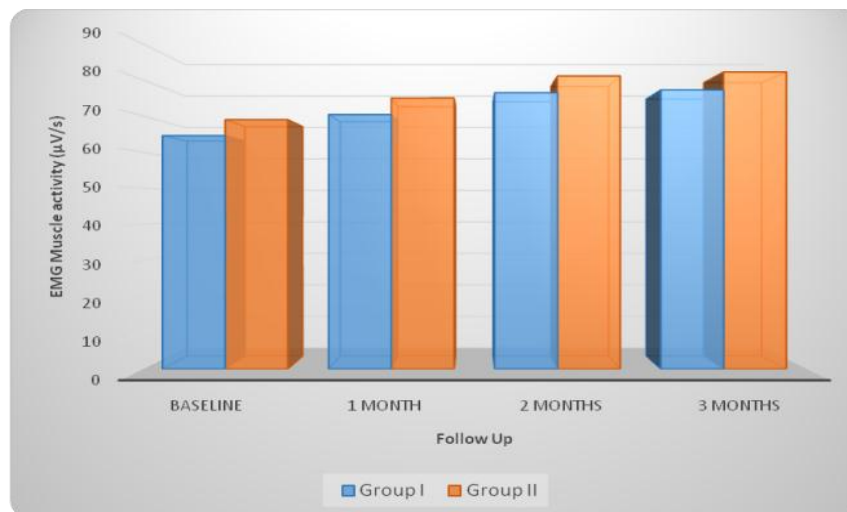


Fig. 4:- A Bar chart showing mean EMG Muscle activity ($\mu\text{V/s}$) of the temporalis muscle for both Group I and Group II at different follow up intervals.

Discussion:-

The results of this study showed that EMG activity, of both the masseter and temporalis muscles, increased after the relining the complete denture with soft liner (versacryl) and EMG activity of the masseter muscle was higher than the temporalis muscle in both groups at the same time there was a decreased in time taken during swallowing while patient wear complete dentures lined with soft acrylic versacryl than conventional complete dentures.⁽¹⁷⁾ The majority of the denture complaints are concerning the lower denture. This is due to the high rate bone resorption and the reduced denture-bearing area⁽¹⁸⁾. Relining may have increased stability and retention of mandibular dentures, which gradually augmented strength and muscular effort and consequently increased electromyographic activity, as greater energy was expended by muscles to perform the requested action⁽¹⁹⁾. It was found that found that, after

relining, muscles functioned more rhythmically, movements were easier and occlusal forces increased during mastication of peanuts⁽²⁰⁾. It has been reported that complete denture wearers were able to adapt their mastication to hardness of food substance by increasing the number of strokes and duration of masticatory sequence⁽¹⁸⁾. An obvious observation in the current study was that the activity of the masseter muscle was higher than that of the temporalis muscle in all cases. This could be related to the different anatomy and mode of action of each muscle. This result is confirmed by⁽²¹⁾ who explained that the fibers of the masseter muscle are shorter than those of the temporalis muscle. This makes the masseter muscle more powerful and has a greater influence on the dentures during chewing as compared to the temporalis muscle⁽²²⁾.

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