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Electromyographic Evaluation of the Effect of Hard and Soft Stabilizing Appliances on Masseter and Anterior Temporalis Muscles in Asymptomatic Individuals

SUMMARY

Background/Aim: *Stabilization appliances have traditionally been used for the treatment of temporomandibular disorders and bruxism. The aim of this study was to evaluate the effect of two appliances (hard and soft) with different thicknesses on the electromyographic (EMG) activities of masseter and anterior temporalis muscles.* ***Material and Methods:*** *30 healthy subjects have been divided into two groups of 15, according to the appliance material used (soft, hard). For each subject in both groups, two appliances have been prepared with 3 mm and 6 mm thickness. EMG recordings of bilateral masseter and anterior temporalis muscles were taken for each appliance.* ***Results:*** *The results showed that, the decrease in average EMG values during maximum voluntary clenching with a 3-mm and 6-mm-thick hard appliance was statistically significant compared with the average EMG of maximum voluntary clenching in the intercuspal position. The increase in average EMG values during maximum voluntary clenching with a soft appliance of 3 mm and 6 mm thickness was statistically significant.* ***Conclusions:*** *The hard stabilization appliances decrease the activity of the masseter and temporalis muscles, while the soft appliances increase the activity of the masseter and temporalis muscles.*

Keywords: Temporomandibular Disorders, Hard Appliance, Soft Appliance, Electromyography

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Introduction

Occlusal appliances in dentistry have been used for the management and treatment of temporomandibular disorders (TMDs) and bruxism[1]. Occlusal appliances potentially modulate neuromuscular function, alleviate mechanical loading on the temporomandibular joint, and increase peripheral input to the central nervous system to decrease motor activity[2-4]. They also play an important role in the symptomatic treatment of TMD patients by allowing a change in the distribution of joint stress vectors and relaxation of muscle fibers[5]. The most common occlusal appliance used for the treatment of temporomandibular disorders and bruxism are removable hard stabilization appliances[2,6,7]. According to Okeson[8], the purpose of stabilization appliance is to eliminate any kind of orthopedic imbalance between the occlusal position and temporomandibular joint position that can be an etiological factor for TMDs. Furthermore, nocturnal muscle activity during bruxism and temporalis and masseter muscle activity during controlled clenching is significantly reduced using hard occlusal appliances[9,10].

Soft appliances are also used, although the diagnostic and/or therapeutic use in TMD compared to hard stabilizing appliances is controversial[4,11,12]. Some studies have reported that they can be used in patients complaining of hypersensitivity of their posterior teeth due to recurrent or chronic sinusitis, and to reduce or protect against injury to the oral structure in athletes[13]. Some studies have also reported that soft occlusal appliances relieve pain in the masticatory muscles[14-16]. Other studies directly comparing hard and soft occlusal appliances in TMD patients found no differences between the occlusal appliance groups in either self-reported symptoms or clinical findings[3,17]. Nevertheless, scientific evidence of their efficacy compared to hard stabilization appliances is needed.

Electromyography (EMG) has been the focus of interest in dental research because it allows the evaluation of the mechanical and electrical properties of the masticatory muscles[5]. Superficial EMG (sEMG) has been used to study the effects of various intraoral appliances on muscle function, to monitor daily parafunctional habits, and to measure muscle responses in patients with bruxism[18,19]. The use of sEMG is based on extracellular recording of motor unit action potentials using surface sensors, and the magnitude of the recorded energy is in the microvolt range[20]. The sEMG signal reflects muscle activity and is lower at rest and greater during isometric contraction[20]. The muscle parameters most examined with EMG in the studies are at rest, maximum clenching, and teeth grinding. It is more commonly used in studies to record the masseter and temporalis muscles (especially the anterior temporalis) because they are easily accessible via surface electrodes[18,21]. Evaluation of the spectral properties of masticatory muscles can provide valuable information for the diagnosis and treatment of TMD patients. Previous studies found that TMD patients had lower mean power frequencies of their masseter and temporalis muscles during clenching compared to control subjects[22].

There are a limited number of studies in the literature that have investigated the electromyographic effects of hard and soft occlusal appliances, with conflicting results. The aim of the present study was to compare the immediate effect of two different types of occlusal splints with two different thicknesses on masseter and anterior temporal muscle activities by electromyographic evaluation. Symptom-free subjects were selected to avoid the complication of variations that occur with TMD symptoms. The first null hypothesis was that there would be no significant differences between the impacts of hard and soft occlusal appliances on masseter and anterior temporalis muscle activities. The second null hypothesis was that muscle activity does not change with increasing thickness of the occlusal splints.

Material and Methods

The study was conducted on 30 healthy participants (14 males and 16 females) at the Faculty of Dentistry, Yeditepe University. Participants (age range 21-30 years) were included in the study if they had at least 28 permanent teeth, including the second molar, had Angle Class 1 occlusion, had no dental treatment in a period of less than 3 months, had no periodontal problems and no temporomandibular disorders, and agreed to participate. Participants who reported having pain related to systemic diseases, whiplash, therapeutic treatments affecting muscle activity, and trauma to the face and cervical spine in a period of less than 30 days were excluded. The study was approved by the Clinical Research Ethics Committee of Yeditepe University (approval No. 058) and was conducted according to the principles of the Declaration of Helsinki. Written informed consent was obtained from all participants.

Preparation of the hard and soft stabilization appliances

The 30 participants were randomly assigned to one of two groups (n=15) based on appliance material (hard stabilization appliance group: Group 1, soft appliance group: Group 2). Participants in both groups received two appliances with a thickness of 3 mm and 6 mm in the molar region. Two alginate impressions were made for each participant in the mandible and maxilla. The mandibular and maxillary casts were mounted in maximum intercuspation on a semi-adjustable articulator (Artex, Amman Girrbach) with a facebow transfer (Artex, Amman Girrbach).

For each of the 15 subjects in Group 1, two mandibular stabilization appliances made of heat-cured acrylic were fabricated in the dental laboratory. The hard stabilization appliance with a thickness of 3 mm (H3) was fabricated by opening the articulator pin by 3 mm and the hard stabilization appliance with a thickness of 6 mm (H6) was fabricated by opening the articulator pin by 6 mm with a pink layering wax (Cavex Set Up Regular). Then the wax template and mandibular cast were molded and hard acrylic resin (IMICRYL I.Q.15) was poured. For 15 subjects in Group 2, two soft appliances with thicknesses of 3 mm and 6 mm were fabricated from 3.0 x 125 mm and 4.0 x 125 mm round soft bioplastic material (BioplastR, SCHEU-DENTAL), respectively. The soft appliances were fabricated using a vacuum and pressure molding device (BiostarR, SCHEU-DENTAL). The occlusal contacts of the soft appliances were first adjusted in the articulator with 80-micron articulating paper by opening the articulator pin 3 mm (S3) and 6 mm (S6).

The bilateral posterior occlusal contacts of the appliances were adjusted with 80-micron articulating paper (Hanel, COLTENE) while the participants were seated in the upright position. For the hard stabilization appliance, canine disocclusion was established during lateral movements. Since it was not possible to adjust the eccentric contacts in the soft appliances, and static EMG recordings were obtained during maximum voluntary clenching of the teeth in maximum intercuspal position, the eccentric contacts were not adjusted in the soft stabilization appliances.

EMG recording and evaluation

EMG activity was recorded using a 4-channel EMG device (Biopac Systems, MP35), 4-mm Ag-AgCl electrodes (TP electrode, Shiled-EL254S), and a 4-mm Ag-AgCl ground electrode (TP electrode, EL254). Before EMG recording, the superficial electrode contact sites were cleaned with a 70-degree alcohol solution to remove the oil and dirt on the skin, and recording was performed after 5-6 minutes. EMG gel (Sigma Gel) was used to improve the contact of the superficial electrodes with the skin and to obtain low skin resistance. The electrodes were placed on the masseter muscle and the anterior temporal muscle (Figure 1). In the masseter muscle, the upper pole of the 4-mm-diameter electrodes (Ag-AgCl 4 mm TP electrode, Shield-EL254S) was placed toward the muscle fibers where the muscle was most swollen, and the electrodes were placed vertically along the anterior border of the temporalis muscle (corresponding to the coronal suture) toward the anterior muscle fibers of the temporalis muscle. The EMG device was calibrated to 5-1000 Hz. The sampling rate was set to 20 K (samples/second) and the recording interval to 10 seconds. After the EMG device was connected, the resistance was measured to check the integrity of the contact of the superficial electrode. The accepted value for resistance in this study was 20 ≤ K ohms.

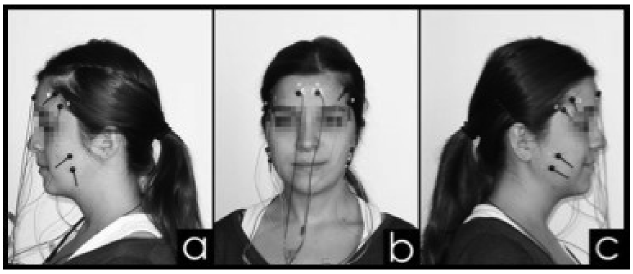

Figure 1. Placement of superficial electrodes

The locations of the electrodes and the calibration values set in the program were not changed during EMG recording. EMG potentials recorded in physiological resting position and during maximum voluntary clenching of the teeth with the surface electrodes placed bilaterally on the masseter and anterior temporalis muscles were integrated in microvolts (μV). EMG recordings for hard stabilization and soft appliances were performed in the same order:

1. 10 sec of EMG was recorded in physiological resting position:
2. 5 sec of EMG was recorded in the intercuspal position during maximum voluntary clenching of the teeth, and this recording was repeated three times.
3. 3 minutes rest 4. 5 sec EMG recording at 3 mm appliance during maximum voluntary clenching of teeth, and this recording was repeated three times.
5. 3 minutes rest 6. 5 sec EMG recording at 6 mm appliance during maximum voluntary clenching of teeth, and this recording was repeated three times.

Statistical analysis

Data analysis was performed using SPSS statistical software. In addition to the definitive statistical methods (mean, standard deviation), Paired sample t-test and Wilcoxon signed-rank test were used for within-group comparison of parameters. A p-value of <.05 was considered statistically significant.

Results

Thirty participants (14 males and 16 females) were included in the study. Participants were randomly divided into two groups of eight females and seven males. The mean age of participants in group 1 and group 2 was 25.57± 2.64 years (range, 21-30 years) and 25.68±2.70 years (range, 21-30 years), respectively. The decrease in electromyographic activity values (μV) with the H3 and H6 appliances compared with electromyographic activity values in the intercuspal position was statistically significantly high for all muscles, except for the values of the H6 appliance in the left masseter muscle (Table 1 and 2).

Table 1. Surface electromyographic activities (μV) of monitored muscles during maximum clenching in intercuspal position and with H3 appliance for Group 1

	Maximum clenching in intercuspal position Mean±SD	Maximum clenching with H3 appliance Mean±SD	P
Right Anterior Temporalis	446±175	307±165	**0.001****
Left Anterior Temporalis	386±178	220±133	**0.001****
Left Masseter	451±294	257±196	**0.006****
Right Masseter	414±245	254±168	0.001**

Paired Sample t test was used. **p<0.01
SD: standard deviation

Table 2. Surface electromyographic activities (μV) of monitored muscles during maximum clenching in intercuspal position and with H6 appliance for Group 1

	Maximum clenching in intercuspal position Mean±SD	Maximum clenching with H6 appliance Mean±SD	P
Right Anterior Temporalis	446±175	337±220	**0.006***
Left Anterior Temporalis	386±178	235±154	**0.001****
Left Masseter	451±294	325±246	0.063
Right Masseter	414±245	305±253	0.017*

Paired Sample t test was used. *p<0.05 **p<0.01

The increase in maximum clenching values with the S3 and S6 appliances compared to maximum clenching values in the intercuspal position was statistically significantly high for all muscles (Table 3 and 4).

Table 3. Surface electromyographic activities (μV) of monitored muscles during maximum clenching in intercuspal position and with S3 appliance for Group 2

	Maximum clenching in intercuspal position Mean±SD	Maximum clenching with S3 appliance Mean±SD	P
Right Anterior Temporalis	404±169	524±298	0.015*
Left Anterior Temporalis	363±174	488±221	**0.004****
Left Masseter	413±268	592±277	**0.001****
Right Masseter	461±309	667±349	0.001**

Paired Sample t test was used. *p<0.05 **p<0.01

Table 4. Surface electromyographic activities (μV) of monitored muscles during maximum voluntary clenching in intercuspal position and with S6 appliance for Group 2

	Maximum clenching in intercuspal position Mean±SD	Maximum clenching with S6 appliance Mean±SD	P
Right Anterior Temporalis	404±169	568±311	0.002**
Left Anterior Temporalis	363±174	548±324	**0.002****
Left Masseter	413±268	612±274	**0.001****
Right Masseter	461±309	735±363	0.001**

Paired Sample t test was used. **p<0.01

There was no statistically significant difference between the decrease in the percentage of maximum voluntary clenching of teeth with H3 and H6 appliances. (Table 5).

Table 5. Intra-group differences expressed in percentage for Group 1

	Maximum clenching with H3 appliance Mean±SD (Median)	Maximum clenching with H6 appliance Mean±SD (Median)	P
Right Anterior Temporalis	-33.4±23.8% (-30.3)	-27.8±36.1% (-26.9)	0.334
Left Anterior Temporalis	-43.4±25.7% (-29.2)	-38.4±35.8% (-41.1)	0.532
Left Masseter	-39.3±27.9% (-43.8)	-36.5±37.9% (-35.6)	0.609
Right Masseter	-37.1±25.5% (-31.5)	-30.8±32.6% (-27.2)	0.394

Wilcoxon sign test was used. p<0.05

There was no statistically significant difference between the increase in the percentage of maximum voluntary clenching of teeth with S3 and S6 appliances. (Table 6).

Table 6. Intra-group differences expressed in percentage for Group 2

	S3 Mean±SD (Median)	S6 Mean±SD (Median)	P
Right Anterior Temporalis	28.1±26.2% (20.3)	40.4±34.5% (32.2)	0.233
Left Anterior Temporalis	41.4±40.0% (28.3)	50.5±49.2% (40)	0.334
Left Masseter	65.6±78.7% (43.1)	69.9±65.4% (71.5)	0.776
Right Masseter	104.1±198.5% (37.5)	119.3±189.8% (53.6)	0.125

Wilcoxon sign test was used. p<0.05

Discussion

The use of hard stabilization appliances for bruxism and TMD treatment is supported by scientific data[6,7]. Soft appliances are also used in dentistry, although there is no scientific basis for their effectiveness and efficiency compared to hard stabilization appliances[12]. Many studies have reported that occlusal appliances should be made of hard acrylic material and that soft material appliances increase muscle activity[23-25]. Therefore, the aim of the present study was to compare the direct effect of hard or soft intraoral appliance materials and the change in vertical dimension of the appliance on the electromyographic activities of bilateral masseter and anterior temporalis muscles.

Previous studies have reported that the use of hard stabilization appliances can eliminate or reduce the signs and symptoms of TMD, decrease the EMG activity of the anterior temporalis and masseter muscles in individuals with TMD, and establish muscle symmetry between the right and left sides[12,26-29]. Researchers reported in their studies that the myoelectrical activity of the mandibular elevator muscles during maximum clenching of the teeth was lower with the hard stabilization appliance than without the appliance[20,21]. Hiyama *et al.*[26] also observed that maximum EMG activity decreased in subjects with nocturnal bruxism when the hard stabilization appliance was used. The results of the present study, which showed a decrease in EMG activities of the bilateral masseter and anterior temporalis muscles during maximum voluntary clenching with a hard stabilization appliance, are consistent with previous studies.

In contrast to hard stabilization appliances, the diagnostic and/or therapeutic use of soft appliances for TMD and bruxism is controversial. Harkins *et al*.[30] reported that long-term and inappropriate use of soft appliances may increase TMD symptoms, increase nocturnal muscle activity, and cause undesirable occlusal changes. Similarly, there was an increase in EMG activities of the bilateral masseter and anterior temporalis muscles caused by soft appliances during maximum teeth grinding. Thus, the null hypothesis was rejected.

Several studies have investigated the effects of different occlusal appliance thicknesses on EMG activities of the masticatory muscles[10,21,31]. However, the thickness of occlusal appliances developed to achieve efficiency and muscle relaxation is controversial[21]. Abekura *et al.*[31] reported that a splint with a vertical thickness of 3 mm decreased the integrated EMG values of the masseter and temporalis muscles more than a splint with a vertical thickness of 6 mm in patients with bruxism. On the other hand, 3- and 6-mm splints were found to be effective in treating muscle hyperactivity, as their clinical behavior was similar in asymptomatic subjects in another study[21]. It has been reported that masseter and temporalis muscle activity decrease with increasing splint thickness[32]. In the present study, a greater decrease was obtained in all muscles with the H6 appliance compared with the H3 appliance; however, the difference was not significant. In contrast to hard appliances, the S6 appliance caused a greater increase in all muscle activity compared to the S3 appliance; however, the difference was not significant. The second null hypothesis was rejected.

Conclusions

The immediate activity of the temporalis and masseter muscles is increased by the soft appliances regardless of their thickness. The decrease in EMG activity of the temporalis and masseter muscles by hard stabilization appliances supports the use in TMD and bruxism. Based on the benefits, it seems reasonable to recommend the use of a hard acrylic resin occlusal appliances over a soft appliance in bruxism patients to reduce muscle activity. Muscle activity decreased with increasing thickness of the hard occlusal appliances, but this difference was not statistically significant. Future research should investigate the effects of occlusal appliance thickness on muscle activity to interpret this result clinically. This study was conducted in healthy subjects. Long-term randomized controlled trials with larger samples are needed to investigate the effects of the appliances in both healthy subjects and subjects with temporomandibular disorders.

References

1. Ferreira FM, Cézar Simamoto-Júnior P, Soares CJ, Ramos AMdAM, Fernandes-Neto AJ. Effect of occlusal splints on the stress distribution on the temporomandibular joint disc. Braz Dent J, 2017;28:324-329.
2. Roark AL, Glaros AG, O'Mahony AM. Effects of interocclusal appliances on EMG activity during parafunctional tooth contact. J Oral Rehabil, 2003;30:573-577.
3. Pettengill CA, Growney MR Jr, Schoff R, Kenworthy CR. A pilot study comparing the efficacy of hard and soft stabilizing appliances in treating patients with temporomandibular disorders. J Prosthet Dent, 1998;79:165-168.
4. Limchaichana N, Nilsson H, Petersson A, Ekberg E. Resilient appliance-therapy treatment outcome in patients with TMD pain correlated to MRI-determined changes in condyle position. Cranio, 2009;27:185-193.
5. Tecco S, Quinzi V, Nota A, Giovannozzi A, Abed MR, Marzo G. Electromyography-guided adjustment of an occlusal appliance: Effect on pain perceptions related with temporomandibular disorders. A controlled clinical study. Diagnostics (Basel), 2021;11:667.
6. Tartaglia GM, Moreira Rodrigues da Silva MA, Bottini S, Sforza C, Ferrario VF. Masticatory muscle activity during maximum voluntary clench in different research diagnostic criteria for temporomandibular disorders (RDC/TMD) groups. Man Ther, 2008;13:434-440.
7. Visser A, Naeije M, Hansson TL. The temporal/masseter co-contraction: An electromyographic and clinical evaluation of short-term stabilization splint therapy in myogenous cmd patients. J Oral Rehabil, 1995;22:387-389.
8. Okeson JP. Management of temporomandibular disorders. 6.ed, Mosby-Year Book, Inc., St. Louis, 2008.
9. Savabi O, Nejatidanesh F, Khosravi S. Effect of occlusal splints on the electromyographic activities of masseter and temporal muscles during maximum clenching. Quintessence Int, 2007;38:e129-132.
10. Akat B, Görür SA, Bayrak A, Eren H, Eres N, Erkcan Y, Kılıçarslan MA, Orhan K. Ultrasonographic and electromyographic evaluation of three types of occlusal splints on masticatory muscle activity, thickness, and length in patients with bruxism. Cranio, 2020;1-10.
11. Wright EF, Schiffman EL. Treatment alternatives for patients with masticatory myofascial pain. J Am Dent Assoc, 1995;126:1030-1039.
12. Ferrario VF, Sforza C, Tartaglia GM, Dellavia C. Immediate effect of a stabilization appliance on masticatory muscle activity in temporomandibular disorder patients. J Oral Rehabil, 2002;29:810-815.
13. Cohenca N, Roges RA, Roges R. The incidence and severity of dental trauma in intercollegiate athletes. J Am Dent Assoc, 2007;138:1121-1126.
14. Karakis D, Dogan A, Bek B. Evaluation of the effect of two different occlusal splints on maximum occlusal force in patients with sleep bruxism: a pilot study. J Adv Prosthodont 2014;6:103-108.
15. Seifeldin SA, Elhayes KA. Soft versus hard occlusal splint therapy in the management of temporomandibular disorders (TMDs). Saudi Dent J 2015;27:208-214.

16. Kashiwagi K, Noguchi T, Fukuda K. Effects of soft occlusal appliance therapy for patients with masticatory muscle pain. J Dent Anesth Pain Med, 2021;21:71-80.
17. Truelove E, Huggins KH, Mancl L, Dworkin SF. The efficacy of traditional, low-cost and nonsplint therapies for temporo- mandibular disorder: a randomized controlled trial. J Am Dent Assoc, 2006;137:1099-1107.
18. Ries LG, Alves MC, Bérzin F. Asymmetric activation of temporalis, masseter and sternocleidomastoid muscles in temporomandibular disorder patients. Cranio, 2008;26:59-64.
19. Dworkin SF, Turner JA, Mancl L, Wilson L, Massoth D, Huggins KH, LeResche L, Truelove E. A randomized clinical trial of tailored comprehensive care treatment program for temporomandibular disorders. J Orofac Pain, 2002;16:259-276.
20. Tecco S, Tetè S, D'Attilio M, Perillo L, Festa F. Surface electromyographic patterns of masticatory, neck, and trunk muscles in temporomandibular joint dysfunction patients undergoing anterior repositioning splint therapy. Eur J Orthod, 2008;30:592-597.
21. Pita MS, Ribeiro AB, Garcia AR, Pedrazzi V, Zuim PR. Effect of occlusal splint thickness on electrical masticatory muscle activity during rest and clenching. Braz Oral Res, 2011;25:506-511.
22. Tartaglia GM, Lodetti G, Paiva G, De Felicio CM, Sforza C. Surface electromyographic assessment of patients with long lasting temporomandibular joint disorder pain. J Electromyogr Kinesiol, 2011;21:659-664.
23. Sheikholeslam A, Holmgren K, Riise C. Therapeutic effects of the plane occlusal appliance on signs and smptoms of craniomandibular disorders in patients with nocturnal bruxism. J Oral Rehabil, 1993;20:473-482.
24. Chung SC, Kim YK, Kim HS. Prevalence and patterns of nocturnal bruxofacets on stabilization appliances in temporomandibular disorder patients. Cranio, 2000;18:92-97.
25. List T, Helkimo M. Acupuncture and occlusal appliance therapy in the treatment of craniomandibular disorders. II. A 1 year follow-up study. Acta Odontol Scand, 1992;50:375-385.
26. Hiyama S, Ono T, Ishiwata Y, Kato Y, Kuroda T. First night effect of an interocclusal appliance on nocturnal masticatory muscle activity. J Oral Rehabil, 2003;30:139-145.
27. Scopel V, Alves da Costa GS, Urias D. An electromyographic study of masseter and anterior temporalis muscles in extra-articular myogenous TMJ pain patients compared to an asymptomatic and normal population. Cranio, 2005;23:194-203.
28. Nascimento LL, Amorim CF, Giannasi LC, Oliveira CS, Nacif SR, Silva Ade M, Nascimento DF, Marchini L, de Oliveira LV. Occlusal appliance for sleep bruxism: an electromyographic associated to Helkimo Index evaluation. Sleep Breath, 2008;12:275-280.
29. Chandu A, Suvinen TI, Reade PC, Borromeo GL. The effect of an interocclusal appliance on bite force and masseter electromyography in asymptomatic subjects and patients with temporomandibular pain and dysfunction. J Oral Rehabil, 2004;31:530-537.
30. Harkins S, Marteney JL, Cueva O, Cueva L. Application of soft occlusal appliances in patients suffering from clicking temporomandibular joints. Cranio, 1988; 6:71-76.
31. Abekura H, Yokomura M, Sadamori S, Hamada T. The initial effects of occlusal splint vertical thickness on the nocturnal EMG activities of masticatory muscles in subjects with a bruxism habit. Int J Prosthodont, 2008;21:116-120.
32. Manns A, Miralles R, Cumsille F. Influence of vertical dimension on masseter muscle electromyographic activity in patients with mandibular dysfunction. J Prosthet Dent, 1985;53:243-247.

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