



TECHNICAL FABRICATION AND CLINICAL APPLICATION OF ELCLIPSE OCCLUSAL SPLINTS

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Abstract

Introduction: The focus of this investigation is alternative methods of technical fabrication and clinical application of eclipse occlusal splints with light polymerization.

Purpose: The consideration of the fact that the bruxism is present in up to 90% of our population, led us to our goal to help these patients through exhibition of a method for fabrication of hard and soft occlusal eclipse splints whose indication is dependent upon the type of bruxism.

Material and methods: To evaluate the effectiveness of manufactured occlusal therapeutic appliances and to discern the advantages and disadvantages arising from this technique of preparation, we treated 120 patients divided into two groups which were again divided into two subgroups. The first subset of the first group of patients had masticatory muscles complaints, and in the second TMJ afflictions. The second group consisted of bruxism patients with solitary attrition in the first and additional hyperemia of the dental pulp in the second subgroup.

Results: Registration of the results was performed according to anamnestic data of the patients. After 6 months in the first group, first and second subset, ratio between recovered patients to treated patients was 8/14 and 6/10, in the second group the first and second sub-group was 4/26, 10/20. After 18 months this ratio in the first and second subset of the first group was 8/22 and 12/18, while the first and second subset of the second group was 0/30 and 2/28.

Conclusion: We conclude that the quality of technical development and clinical application of eclipse splints is better compared to the conservative method of making splints for occlusal treatment.

Indexing terms/Keywords: Eclipse occlusal splints, repositioning splints, solid occlusal splints soft occlusal splints, bruxism

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Introduction

Eclipse as a material composed of uretan oligomers is a part of a light polymerization system, where activation of the polymer is carried out at the wavelength of the visible light⁽¹⁾. It has a great application for various purposes in the dental medicine among which the preparation of occlusal eclipse splints indicated in patients with full clinical expression of bruxism and occlusal parafunctions, accompanied by dental pain, grinding and pains in the joints, myalgia, and persistent headaches⁽²⁾.

Solid occlusal splints are fabricated from resin used for making the Eclipse base plate with the goal to perform pressure relief to the TMJ and thus hinder the parafunctional movements of bruxism⁽³⁾

Soft or elastic occlusal splints are fabricated individually on a model of the patient's teeth using a soft elastic Eclipse resin⁽⁴⁾. The technique is heat pressing with softening of the semifabricated sheet of resin under the influence of thermal rays in a separate chamber and shaping over the working dental cast in the technical laboratory⁽⁵⁾.

Purpose:

The consideration of the fact that the bruxism is present in up to 90% of our population, led us to our goal to help these patients through exhibition of a method for fabrication of hard and soft occlusal eclipse splints whose indication is dependent upon the type of bruxism.

Materials and Methods

The investigation analyzed 120 patients divided into 2 groups according to the clinical manifestation of bruxism and the type of Eclipse occlusal splint used as therapeutic appliance.

The first group of 60 patients was those who had a more advanced type of bruxism with significant deterioration in the clinical manifestation. In 30 patients from this group was diagnosed advanced degrees of dental

attrition, sore areas in m. masseter, m. pterygoideus lateralis and m. temporalis and frequent headaches. The other part of this group consisted of 30 patients characterized by a certain degree of dental attrition, TMJ pain and myalgija. In these patients we indicated the fabrication of solid Eclipse occlusal splints. The second group included 60 clinical cases in which the condition was milder and with easier clinical course. In 30 patients from this group we diagnosed lower levels of attrition and only occasional headaches, even as rare as once a week. The second part of this group of 30 patients was characterized by attrition of tooth surfaces in the depths of the dental tissue from which stemmed a dental pulp hyperemia. This group was indicated for soft Eclipse occlusal splints. In the first group, in the first subset of patients we used solid occlusal splints categorized as



Figure 1. Fabricated and applied to patient eclipse stabilization splints

stabilization splints (Figure 1). In the second subset of patients the fabrication was



Figure 2. Fabricated and applied to patient eclipse repositioning splints

from the category of repositioning splints

(Figure 2). Patients were followed for a time period of 12 months. In the first 6 months, until the disappearance of symptoms examinations were performed every two weeks, by the end of the 6 months and with the alleviation of symptoms, the control checkups were performed at monthly intervals. Each patient had a chart with collected data about the development of their condition throughout the treatment according to the anamnesticly received information. The data consisted of three values: patients with afflictions, patients with lessened symptoms and patients without afflictions.

Solid repositioning splints are fabricated with the eclipse system in order to perform protrusion and fixation of the mandible in a previously clinically determined prognathous position and thus allow rehabilitation of TMJ and reduce the pathological pressure on the TMJ discus ⁽⁶⁾.

Hard stabilization splints are solid occlusal treatment appliances through which by their shape and manner of construction provide temporary removable contact between the teeth and the splint, ideal for muscles and TMJ and thus achieve miofascial relaxation, cessation of inflammatory processes and pain in the TMJ, ear, head and masticatory muscles ⁽⁷⁾.

During their preparation we paid obligatory attention that the minimal thickness of the occlusal splint should at least be 4mm. In case this increment of the height of the bite does not lead to a reduction of symptoms in the patient, we heightened the thickness of the occlusal splint ⁽⁸⁾.

Before the beginning of their fabrication, we must first do a necessary preparation of the working model cast. For this purpose we fill all subverting places of the working dental model with pink wax. The cast is then duplicated and a new studio model is produced. The working model is coated with Al-Cote ® or another insulating agent and left to dry or placed in a drying device. Then the model is placed in the conditioning oven (Figure 3) which serves to warm the working model and the materials that are applied against them. The translucent Eclipse resin for base plate fabrication is retrieved from its packaging before the working model is taken

out of the oven. The curved side of translucent base plate is placed with its bottom towards the top surface of the model. If it appears necessary, the working model is immediately returned to the oven for an additional 1 to 1.5 minutes for further softening of the resinous material from the base plate and is easier to adapt without trapped air. (Hint: if desired, a small strip of material can be adapted to occlusal / incisal surfaces of the model, before the rest of the adapted material). Eclipse material is adapted according to the design of fabrication and carefully smoothed with a finger. Excess material can be easily removed with an electric spatula, but also with any sharp knife to wax in order to nicely adapt the



Figure 3. Conditioning and fabrication of eclipse occlusal splints



Figure 4. Light polymerization of eclipse occlusal splints edge of the final fabrication. This excess can

be easily removed after the polymerization procedure. The working model is returned back to the articulator and the antagonists coated with Vaseline, and then we gently pater with the antagonists on the occlusal splint, until the pin of the articulator reaches the incisal saucer. If necessary, you can place an additional material on top of the primary deposition. When the pin touches the guard, it will enable laterl any movements in the articulator. The working model is removed from articulator and the fabrication is coated with glycerin. Immediately after being placed in Eclipse polymerization apparatus (Figure 4). Polymerization is carried out in a cycle that provides 10 minutes of exposure to light in the visible range of the spectrum and 6-minutes of cooling. After polymerization, the fabrication is left to cool at room temperature before washing off the glycerin. The model is brought back in the articulator to confirm occlusion one more time. After completion of polymerization, the working models along with fabrication are placed in water for 10-15 minutes for rehydratization and for easier removal. The fabrication is returned in the articulator. Modified solid occlusal rails manufactured by the eclipse system is adaptable and self adjustable to the occlusion of the patient. Repairs can be performed even clinically with the help of light polymerization acrylates. The term semifabricated refers to the ability to reshape according to the individual characteristics of the patient's teeth for an unlimited number of times, after being softened in hot water basin. This type of occlusal splints protects the teeth from the bruxing activity of the patients and the occurrence of attrition on their surfaces, but also have therapeutic effect on the rehabilitation of joint and masticatory muscles affected by the disorders in occlusion.

Eclipse modified soft occlusal splints are fabricated from layers of soft and elastic resin material also used for the transparent base plate in the production of the total prosthesis according to this system (Figure 5). We begin the fabrication of the soft occlusal splints with the preparation of the working model. The subverting areas of the dental cast are filled with wax lingual, buccaly and interdently,

after which the working cast is duplicated. The new model is then trimmed and placed in articulator. The model is coated with Al-Cote[®] or another isolating agent and left to dry. According to its composition, the soft and elastic resin material is urethane metilacrylic and stearyl acrylate. It is translucent and comes in sealed packaging in a shaped pattern according to the limits of the dental arch. Eclipse[®] material of soft and elastic resin is removed from the package (it is desirable to cool under cold water for 15-30 seconds to facilitate removal of the packaging). The model is heated for 1-2 minutes in a conditioning oven or with a hot air gun. It must be heated until the material stands in its place. This applied compound adapt to occlusal and proximal surfaces of the model. The material is also pressed down the lingual and buccal surfaces if it is necessary. It is understandable that there is no need extension of the material below the level of its factory preset contours and boundaries. If this is done, the tips of the dental tubers from the cast may



Figure 5. Fabrication of soft eclipse occlusal splints penetrate the soft and elastic material and cross into the neighboring material of the transparent base plate . Any excess of the

resinous material is scratched off with a sharp instrument and then polymerized in Eclipse polymerization device for 4 minutes. Excess mass can be removed immediately after the polymerization procedure. The material of soft and elastic resin will not shift its position. When the material is heated, it is ready for the addition of the Eclipse translucent base plate. The Eclipse ® base plate is removed from its factory packaging and placed in an appropriate amount on the elastic mass. The Eclipse ® base plate is adapted only on the occlusal and incisal surface of the fabrication, and carefully smoothed with the help of a finger. There is no necessity to extend the base plate through the buccal and lingual side of the soft and elastic resin material. If necessary, the base plate is heated by the hot air gun for its easier adaptation. The transitional boundary between the soft and elastic resin material and the base plate is also smoothed with a hot air gun. The working model is again placed in articulator and the antagonists coated with Vaseline. Then we slowly pater the antagonists dental model on the material applied on the working model until the incisal pin touches the incisal saucer. If necessary, additional material can be added. When the incisal pin is placed down, the lateral movements of the antagonists on the splint can be performed. The model is removed from articulator and the whole splint is covered with glycerin. Immediately after this the splint is placed in the Eclipse apparatus for polymerization. Polymerization is carried out in a cycle consisting of 10 minutes exposure to light and 6 -minute cooling. After polymerization, the fabrication is left to cool at room temperature before the rest of the glycerin is being rinsed off. The working model is returned to the articulator and an examination of the occlusion is preformed. The splint with the working model is immersed in warm (54 ° C) water for 10-15 minutes to restore moisture in the plaster and to facilitate removal from the model. The fabrication is removed from the working model for rough preparation and polishing. The splint is again placed on the original studio model that had been duplicated at the beginning of the technical work (Note : the submerging of the fabrication in warm (54 °

C) water will soften the soft and elastic resin material from the Eclipse system and will help with the adaptation of the occlusal splint on the original model). In the end, the splint is ready to handing over to the patient, but the patient is given instructions to warm the occlusal splint in heated water basin of 54 ° C before each placement and removal of the splint from the mouth for its easier adaptation.

Results

Statistical processing of data obtained from this investigation is performed using the statistical package for PC Statistical for Windows, RELEASE 4,5-A, COPYRIGHT-StatSoft , Inc, 1993.

The results are shown in Table 1. In the first group of patients, in the first subset, at the time of delivery of the Eclipse occlusal splints patients complained of myalgia originating from the masticatory muscles and the presence of frequent headaches. This was the prior condition of every 30 (100 %) patients. On each subsequent examination, in these patients, the clinical expression of the disease gradually improved. The achieved results were evaluated of through clinical examination of patients and anamnestic data after 6 months of treatment with Eclipse occlusal splints. As it can be seen from Table 1 complete elimination of the afflictions was observed in 14 (46.66%), reduction of symptoms in 8 (26.66%), and symptoms were unchanged in 8 (26.66%) of the total number of patients. After the expiration of the 18 month period of treatment with Eclipse occlusal splints, 22 (73.33%) patients reported a loss of all kind of symptoms, and in the remaining 8 (26.66%) we observed clinical improvement. Patients in the first group in the second subset in the beginning of therapy were diagnosed with temporomandibular joint disorder in all 30 (100%) patients. On the regular check-ups and visits in the first group, the second subset of patients as shown in Table 1 even after 6 months we observed considerable rehabilitation of the TMJ through anamnestic data in 10 (33.33%) patients.

Table 1. Treatment efficiency values for patients wearing eclipse occlusal splints

Treatment with Eclipse occlusal splints	TABLE 1.											
	I GROUP						II GROUP					
	I Subgroup of patients			II Subgroup of patients			I Subgroup of patients			II Subgroup of patients		
	With afflictions	Lessened afflictions	Without afflictions	With afflictions	Lessened afflictions	Without afflictions	With afflictions	Lessened afflictions	Without afflictions	With afflictions	Lessened afflictions	Without afflictions
Beginning of treatment	30 (100%)	0 (0%)	0 (0%)	30 (100%)	0 (0%)	0 (0%)	30 (100%)	0 (0%)	0 (0%)	30 (100%)	0 (0%)	0 (0%)
6 months from beginning of treatment	8 (26.66%)	8 (26.66%)	14 (46.66%)	14 (46.66%)	6 (20%)	10 (33.33%)	0 (0%)	4 (13.33%)	26 (86.66%)	0 (0%)	10 (33.33%)	20 (66.66%)
18 months from beginning of treatment	0 (0%)	8 (26.66%)	22 (73.33%)	0 (0%)	12 (40%)	9 (60%)	0 (0%)	0 (0%)	30 (100%)	0 (0%)	2 (6.66%)	28 (93.33%)

These patients reported cessation of the crepitating sound originating from the joints, regaining of mobility in the jivial joint and the termination of pain in the joint and ear. After the 6 month of treatment period, the joint symptoms had been weakened in the remaining 6 (20%) patients, and in 14 (46.66%) patients were still present. Reevaluation of the effectiveness of therapy with Eclipse occlusal splints was carried out after 18 months, when it was determined complete loss of symptoms in 18 (60%), and reduction of symptoms in 12 (40%) of patients.

In the second group of patients the effect of the occlusal splints was less pronounced because of the milder clinical picture, but we observed stagnation in loss of healthy tooth substance. In the second group, first subgroup at the moment of delivery of the soft eclipse occlusal splints in all 30 (100%) patients was diagnosed dental attrition because of the present bruxism without associated complications. After the 6 month treatment period, as it can be seen in Table 1 elimination of symptoms was determined in 26 (86.66%) patients, while reduction of symptoms in 4 (13.33%) patients. During the re-evaluation of the results after the expiration of the 18 month period we determined a stagnation of the disorder in 30 (100%) of treated patients. In the second subset of the second group of patients shown in Table 1 at the treatment beginning, we diagnosed dental pulp hyperemia because of the sudden wear of solid tooth substance in 30 (100%) patients. This was a supple reason for justifiacion for the use of soft Eclipse splints. At the moment of the reregistration of patient status after 6 months it was determined total alleviation of symptoms in 20 (66.66%) patients, and reduction of symptoms in 10 (33.33%) patients. After the expiry of 18 months from the start of the therapy a total recovery with preservation of the vitality of the dental pulp in 28 (93.33%) and only 2 (6.66%) patients with requirement for endodontic treatment.

Dissscusion

The results of this study clearly show that the eclipse occlusal splints regardless if they are manufactured from solid material or modified soft occlusal splints have therapeutic effect on all of the complications associated with bruxism. Given that the solitary prosthetic care is insufficient, if the complications are not promptly resolved fabrication of these rails is more than justified. From the results we can come to the realization that the use of soft occlusal rails has the greatest efficiency. During the therapy of the patients from the second group in the first subset, we achieved a recovery of 26 (86.66%) patients after the first 6 months and 30 (100%) patients after 18 months of treatment. The success of the therapeutic effects of the treatment in this group is not perceived in the therapeutic process itself but in the reduction of the patient symptoms in this group. Although surveys indicate on the unquestionable preventive effects that the eclipse occlusal splints have on the vitality of the pulpal tissue even in 28 (93.33%) patients after 18 months of therapy, there is a certain percentage with necessity for endodontic treatment 2 (6.66%). The weakest effects from the eclipse occlusal splints as can be seen from Table 1 were achieved in patients with temporomandibular dysfunction or in 10 (33.33%) patients after the first 6 months and 18 (60%) at the expiry of 18 months from the beginning of the therapeutic procedure. Eclipse occlusal splints have also shown to be a useful tool in therapy of muscle disorders in patients with bruxism. They show effectiveness in 14 (46.66%) after the first 6 months, and 22 (73.33%) patients after 18 months, which is far better result compared to therapy to pathological states of temporomandibular joint. Other investigations made with occlusal splints from different materials show that although the occlusal splints can help with the protection against attrition, the effectiveness of intraoral appliances in the reduction of nocturnal activity in the jaw muscles and craniofacial pain upon awakening is vague^(10, 11 &12). When effectiveness of the occlusal splints in the treatment of sleep bruxism is

considered at individual level, some authors noted a decrease, no effect or even increase of muscle activity^(13, 14). A common clinical observation is that occlusal splints even if regularly worn a considerable level of muscle activity will continue to persist^(15, 16). Occlusal splints reduce muscle activity associated with bruxism during sleep but the effects are only temporary^(17, 18). There are also variations of occlusal splints, such as the "nociceptivnata trigeminal inhibitor" (NTI) splint that have demonstrated in a recent study to reduce EMG activity during sleep without significant effects on pain originating from TMJ⁽¹⁹⁾. It was previously emphasized that the monotreatment with occlusal splints in order to reduce the muscle activity associated with bruxism may not result in the anticipated improvement or symptoms⁽²⁰⁾.

Conclusion

A particular advantage of the eclipse system is that the composition of this material has the presence of methyl, ethyl, propyl and butyl monomers. Resin materials of the eclipse system can be used independently as in the fabrication of occlusal splints or to be layered one over the other as in the fabrication of total dentures, and yet not to act adversely on the oral tissues. Regardless of the method of preparation, they show remarkable flexibility, resistance to moisture and stains, color stability and improved resistance to dental plaque. Among the disadvantages, we can include the low life expectancy of two years, and little resistance to ambient daylight. The process of polymerization is shortened because it avoids the previous molding of a wax pattern which is characteristic of all the conservative techniques of fabricating occlusal splints. It also skips the phase of the investment and casting of the occlusal splint. The quality and aesthetics of the final fabrication are better than those obtained with the standard technique for making acrylic appliances for occlusal therapy and show exquisite mechanical properties. Because of mechanical stability and resistance to pressure, this material is recommended for the fabrication of occlusal splints such as stabilization splints or repositioning splints.

Acknowledgments

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References

1. Daniel A. Paesani et al. *Bruxism theory and practice*: Quintessence publishing. USA. 2010
2. Dylina TJ. A common sense approach to splint therapy. *J Prosthet Dent*. 2001; 86: 539-545. Boero RP. The physiology of splint therapy: a literature review. *Angle Orthod*. 1989; 59: 165-180.
3. Okeson JP. The effects of hard and soft occlusal splints on nocturnal bruxism. *J Am Dent Assoc*. 1987; 114: 788-791.
4. Ramford S, Ash M. *Occlusion*. 3rd ed. Philadelphia, Pa: WB Saunders Co. 1983. Manns A, Rocabado M, Cadenasso P, et al. The immediate effect of the variation of anteroposterior laterotrusive contact on the elevator EMG activity. *Cranio*. 1993; 11: 184-191.
5. Holmgren K, Sheikholeslam A, Ruse C. Effect of a fullarch maxillary occlusal splint on parafunctional activity during sleep in patients with nocturnal bruxism and signs and symptoms of craniomandibular disorders. *J Prosthet Dent*. 1993; 69:293-297.
6. Nitzan DW. Intraarticular pressure in the functioning human temporomandibular joint and its alteration by uniform elevation of the occlusal plane. *J Oral Maxillofac Surg*. 1994; 52: 671-679.
7. Piper M. *Manual for Intermediate to Advanced TMD Treatment*. St Petersburg, Fla: Center for Advanced Dental Study. 1999; 1-17.
8. Pierce CJ, Weyant RJ, Block HM, Nemir DC. Dental splint prescription patterns: a survey. *J Am Dent Assoc* 1995; 126:248-254.
9. Lindfors E, Magnusson T, Tegelberg A. Interocclusal appliances: indications and clinical routines in general dental practice in Sweden. *Swed Dent J* 2006; 30: 123-134.

10. Paesani D, Westesson PL, Hatala M, Tallents RH, Kurita K. Prevalence of temporomandibular joint internal derangement in patients with craniomandibular disorders. *AmJ Orthod Dentofacial Orthop* 1992; 101:41-47.
11. Lobbezoo F, Lavigne GJ. Do bruxism and temporomandibular disorders have a cause-and-effect relationship? *Orofac Pain* 1997; 11:15-23.
12. Marbach JJ. The “temporomandibular pain dysfunction syndrome” personality: fact or fiction? *J Oral Rehabil* 1992; 19:545-560.
13. Yap AUJ. Effects of stabilization appliances on nocturnal parafunctional activities in patients with and without signs of temporomandibular disorders. *J Oral Rehabil* 1998; 25: 64-68.
14. Chung SC, Kim YK, Kim HS. Prevalence and patterns of nocturnal bruxofacets on stabilization splints in temporomandibular disorder patients. *Cranio* 2000;18:92-97.
15. Holmgren K, Sheikholeslam A, Riise C. Effect of a full- arch maxillary occlusal splint on parafunctional activity during sleep in patients with nocturnal bruxism and signs and symptoms of craniomandibular disorders. *J Prosthet Dent* 1993; 69:293-297.
16. Koriath TWP, Bohlig KC, Anderson GC. Digital assessment of occlusal wear patterns on occlusal stabilization splints: a pilot study. *J Prosthet Dent* 1998; 80:209-213.
17. Lavigne GJ, Rompre PH, Montplaisir JY. Sleep bruxism: validity of clinical research diagnosis criteria in a controlled polysomnographic study. *J Dent Res* 1996; 75: 546-552.
18. Kydd WL, Daly C. Duration of nocturnal tooth contact during bruxing. *J Prosthet Dent* 1985; 53:717-721.
19. Lavigne GJ, Rompre PH, Montplaisir JY, Lobbezoo F. Motor activity in sleep bruxism with concomitant jaw muscle pain: a retrospective pilot study. *Eur J Oral Sci* 1997; 105:92-95.
20. Solberg WK, Clark GT, Rugh JD. Nocturnal electromyographic evaluation of bruxism patients undergoing short term splint therapy. *J Oral Rehabil* 1975;2: 215-223.