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Occlusive splint therapy complication prevention

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Abstract. ***Introduction.*** Currently, occlusal split therapy has become widely used in dental practice for pathology of the temporomandibular joint and/or parafunctions (hypertonia) of the masticatory muscles. At the same time, no in-depth studies on the effect of occlusal splint therapy on the condition of tooth enamel, as well as the prevention of its demineralization have been conducted so far. ***The aim*** — to study the influence of occlusal splint therapy on the state of dental enamel and also to estimate the effectiveness of using the individual oral hygienic care for remineralization of dental enamel. ***Materials and methods.*** There were 45 women aged from 19 to 44 years old being under observation for 2 months who were treated by occlusal splint therapy for temporomandibular joint and/or masticatory muscles diseases and were periodically examined once a month for 60 days to estimate functional resistance of tooth enamel by means of TER-test. The 1st, control, group consisted of 20 people, who performed their usual 2 times daily routine individual oral hygiene during occlusal splint therapy. The 2nd, main group, consisted of 25 people who additionally used ASEPTA remineralizing dental gel after oral hygiene treatment. ***Results.*** Indexes of functional resistance of tooth enamel to acid before occlusal splint therapy in the 1st and 2nd groups patients were almost the same and comprised respectively 2,73±0,19 and 2,81±0,18 conventional units. Patients of the 1st group had the tendency to decrease the functional resistance of tooth enamel to 2,85±0,17 conventional units during the period of dynamic observation while the patients of the 2nd group had the functional resistance of tooth enamel significantly increased up to 1,02±0,18 conventional units that is the evidence of the effectiveness of the remineralizing gel for teeth during the occlusal splinting therapy. Daily use of remineralizing ASEPTA dental gel by the patients of the main study group 2 in the course of 2 months of occlusal splint therapy allowed to provide 36,3% increase of digital indices of tooth enamel resistance, which is an important factor of prevention of dental caries development.

Keywords: occlusal splint therapy, teeth, dental caries, prevention of dental caries, functional enamel resistance, remineralizing agents for teeth, pathogenetic method of dental caries prevention

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Обзор

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Профилактика осложнений окклюзионной сплинт-терапии

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Резюме. ***Введение.*** В настоящее время в стоматологической практике при патологии височно-нижнечелюстного сустава и/или парафункциях (гипертонии) жевательных мышц стали широко применять окклюзионную сплинт-терапию. В то же время до сих пор не проводились углубленные исследования о влиянии окклюзионной сплинт-терапии на состояние эмали зубов, а также профилактики ее деминерализации. ***Цель работы*** — изучить влияние окклюзионной сплинт-терапии на состояние эмали зубов и оценить эффективность индивидуальных гигиенических мероприятий по уходу за полостью рта в отношении реминерализации эмали зубов. ***Материалы и методы.*** Под наблюдением в течение двух месяцев находились 45 женщин в возрасте от 19 до 44 лет, проходивших лечение окклюзионной сплинт-терапией по поводу заболеваний височно-нижнечелюстного сустава и/или жевательных мышц. Пациенток на протяжении 60 суток периодически, 1 раз в месяц, осматривали для оценки функциональной резистентности эмали зубов, которую выполняли с помощью ТЭР-теста. В 1-ю, контрольную, группу исследования вошли 20 человек, осуществлявших в ходе окклюзионной сплинт-терапии обычную для них двукратную общепринятую индивидуальную гигиену полости рта в сутки. Во 2-ю, основную, группу исследования вошли 25 человек, которые после осуществления индивидуального ухода за полостью рта дополнительно использовали гель для зубов реминерализующий АСЕПТА. ***Результаты.*** До начала окклюзионной сплинт-терапии показатели функциональной резистентности эмали зубов к кислоте у пациентов 1-й и 2-й групп были практически одинаковыми и составили 2,73±0,19 и 2,81±0,18 усл. ед. соответственно. У пациентов 1-й группы за период динамического наблюдения отмечена тенденция к снижению функциональной резистентности эмали зубов до 2,85±0,17 усл. ед., в то время как у пациентов 2-й группы функциональная резистентность эмали зубов достоверно повысилась до 1,02±0,18 усл. ед., что свидетельствует об эффективности применяемого ими геля для зубов в ходе окклюзионной сплинт-терапии. Ежедневное использование пациентами 2-й группы исследования геля для зубов реминерализующего АСЕПТА в ходе двухмесячной окклюзионной сплинт-терапии позволило повысить показатели резистентности эмали зубов на 36,3%, что является важным фактором профилактики развития кариеса зубов.

Ключевые слова: окклюзионная сплинт-терапия, зубы, кариес зубов, профилактика кариеса зубов, функциональная резистентность эмали, реминерализующие средства для зубов, патогенетический метод профилактики кариеса зубов

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INTRODUCTION

Currently, occlusal splint therapy has become widely used in dental practice for the management of temporomandibular joint (TMJ) disorders and/or parafunctions (hypertonicity) of the masticatory muscles [1–3]. Splints, also referred to as occlusal appliances or mouthguards, are placed on the dental arches of one or both jaws and alter the pattern of tooth occlusion as well as the position of the mandibular condyles within the glenoid fossae of the temporal bones. This contributes to the normalization of TMJ and masticatory muscle function and helps prevent excessive tooth wear [4–7]. Splints are usually fabricated from acrylic resin or silicone, and patients wear them for 8–24 hours per day depending on their intended purpose [3, 8, 9]. Prolonged use of splints creates a greenhouse-like effect beneath the appliance, promoting the proliferation of microorganisms capable of causing enamel demineralization, which may lead to the development of dental caries [10–12]. Therefore, adequate individualized oral and dental hygiene is an important aspect of splint use [7, 13, 14]. To date, no in-depth studies have been conducted on the effect of occlusal splint therapy on the condition of dental enamel or on the prevention of its demineralization.

AIM

To investigate the effect of occlusal splint therapy on the condition of dental enamel and to evaluate the effectiveness of individualized oral hygiene measures for the remineralization of dental enamel.

MATERIALS AND METHODS

Forty-five women aged 19 to 44 years with various TMJ disorders and/or parafunctions of the masticatory muscles who were prescribed silicone splints for the mandible were followed for three months. The patients were divided into two study groups. The first (control) group included 20 (46.51%) participants who, during splint therapy, performed conventional twice-daily individual oral hygiene consisting of tooth brushing with a manual toothbrush and toothpaste. The second (main) group included 25 (53.49%) participants who, after performing conventional individual oral hygiene, additionally used ASEPTA remineralizing dental gel (VERTEX JSC, Saint Petersburg, Russia). According to the manufacturer's information, the gel contains biomimetic hydroxyapatite, which promotes rapid and effective mineralization of hard dental tissues [1], making it a pathogenetically justified method for the prevention of this pathology. Using a toothbrush, the gel was distributed over the tooth surfaces and left in contact with the hard dental tissues for 1–2 minutes, after which the excess gel was spat out without subsequent rinsing of the oral cavity. Patients were instructed to perform oral hygiene in the morning after breakfast and in the evening after dinner before bedtime. After applying the remineralizing gel, they were advised not to eat or drink for 30 minutes.

To study the effect of occlusal splint therapy on dental enamel and to evaluate the effectiveness of individualized oral hygiene measures in terms of enamel remineralization, the enamel resistance test (TER test) proposed by V.R. Okushko [5] was used. Enamel resistance was assessed on one of the mandibular central incisors. The tooth crown was cleaned of possible plaque and dried, after which a 1% HCl solution was applied, creating a droplet up to 2 mm in diameter on the crown surface. After 5 seconds, the droplet was rinsed off with distilled water, the crown was dried with a cotton pellet, and a droplet of 1% methylene blue solution was applied to the etched area and immediately removed with a cotton pellet. Enamel acid resistance, i.e., its resistance, was then scored according to the intensity of staining that developed on the crown surface. The staining was compared with a standard 10-point blue color scale ranging from 0 (complete absence of staining of the etched area of the tooth crown) to 10 points (most intense blue staining of the etched area of the tooth crown). This examination was performed in each patient before the start of occlusal splint use and again after 30 and 60 days of use.

The significance of differences between mean values of independent samples was assessed using Student's t-test for normally distributed data and the Mann–Whitney test for non-normal distributions. Normality was assessed using the Shapiro–Wilk test. For statistical comparison of proportions, Pearson's χ^2 test with the Mantel–Haenszel likelihood correction was used. In all statistical analyses, the level of significance was set at $p<0.05$.

RESULTS

When enamel resistance was assessed in patients of Groups 1 and 2 before the initiation of occlusal splint therapy, the indicators of enamel functional resistance to acid were found to be virtually identical, amounting to 2.73±0.19 and 2.81±0.18 conventional units, respectively ($p \geq 0.05$). One month after the start of occlusal splint therapy, patients in the control group demonstrated a tendency toward decreased functional enamel resistance, which persisted throughout the two-month follow-up period (Fig. 1). After two months of occlusal splint therapy,

enamel functional resistance to acid in the control group was 2.85±0.17. Although this value still indicated high structural and functional enamel resistance [5, 10], the overall trend should be regarded as unfavorable, as it may contribute to the development of dental caries.

In patients of the main group, a significant trend toward increased enamel functional resistance to acid was observed throughout the entire study period (Fig. 1). Thus, 30 and 60 days after the initiation of occlusal splint therapy, enamel functional resistance improved to 1.56±0.19 and 1.02±0.18 conventional units, respectively ($p \leq 0.01$). Figure 2 presents the dynamics of TER test values in patients from the control and main study groups before treatment and during the 60-day period of splint therapy.

Silicone splints used for occlusal therapy impede the cleansing effect of saliva on the enamel surfaces located beneath the splint. Under conditions of routine oral hygiene alone, this contributed to a decrease in enamel resistance during the two months of occlusal splint therapy. This finding was demonstrated in patients of Group 1. Such an unfavorable trend in enamel functional resistance may become a predisposing factor for the development of dental caries in patients undergoing occlusal splint therapy, although the TER test value after two months of therapy still indicated high structural and functional enamel resistance in Group 1 patients.

Daily use of ASEPTA remineralizing dental gel by patients in Group 2 throughout the 60-day period of occlusal splint therapy resulted in a positive trend in enamel resistance indicators. These values differed significantly from those observed in Group 1 as early as 30 days after treatment initiation ($p \leq 0.05$), although according to the TER test assessment criteria they also indicated high structural and functional enamel resistance [10]. Nevertheless, for patients in Group 2, a favorable trend in TER test values can be confidently stated, indicating an increase in enamel functional resistance. This is likely to contribute to the prevention of dental caries development in patients using silicone dental splints (occlusal appliances) during occlusal splint therapy.

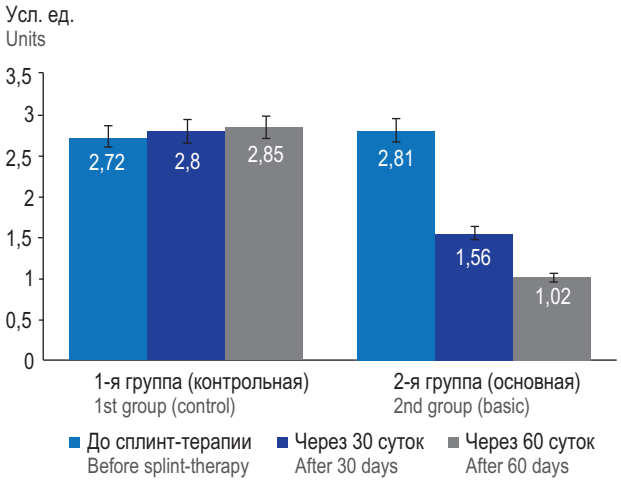


Fig. 1. **Functional acid resistance of tooth enamel in the control and main groups during follow-up (figure by the authors of this article)**

Рис. 1. Показатели функциональной резистентности эмали зубов к кислоте у обследованных контрольной и основной групп исследования на протяжении динамического наблюдения (рисунок авторов данной статьи)

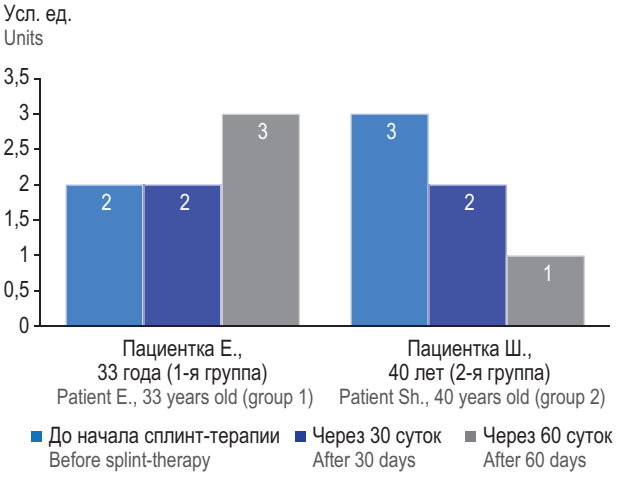


Fig. 2. **Changes in tooth enamel acid resistance in two patients from Groups 1 and 2 during follow-up (figure by the authors of this article)**

Рис. 2. Динамика показателей функциональной резистентности эмали зубов к кислоте у двух обследованных пациентов из контрольной и основной групп исследования на протяжении динамического наблюдения (рисунок авторов данной статьи)

CONCLUSION

1. Under conventional individual oral hygiene measures during occlusal splint therapy with silicone splints, a decrease in the functional resistance of dental enamel is observed, which may become a predisposing factor for the development of dental caries.

2. The use of the modern Russian-made ASEPTA remineralizing dental gel containing biomimetic hydroxyapatite makes it possible to increase the functional resistance of dental enamel by 36.3% over a 60-day period of occlusal splint therapy, which is an important factor in the prevention of dental caries. Therefore, the inclusion of ASEPTA remineralizing dental gel in individual oral hygiene measures may be recommended for patients during prolonged use of splints.

ADDITIONAL INFORMATION

Author contribution. A.K. Iordanishvili — developed the research concept, wrote the initial draft of the manuscript, performed the statistical analysis, and provided scientific and technical editing; A.A. Serikov — collected the research material, conducted the clinical study, analyzed the obtained results, and wrote the article text.

All authors made a substantial contribution to the conception of the study, acquisition, analysis, interpretation of data for the work, drafting and revising the article, final approval of the version to be published and agree to be accountable for all aspects of the study.

Competing interests. The authors declare that they have no competing interests.

Consent for publication. Written consent was obtained from the patient for publication of relevant medical information within the manuscript.

ДОПОЛНИТЕЛЬНАЯ ИНФОРМАЦИЯ

Вклад авторов. А.К. Иорданишвили — разработка концепции исследования, написание исходного текста, выполнение статистического анализа, научное и техническое редактирование; А.А. Сериков — сбор материала, проведение клинического исследования, анализ полученных результатов, написание текста статьи.

Все авторы внесли существенный вклад в разработку концепции, проведение исследования и подготовку статьи, прочли и одобрили финальную версию перед публикацией.

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