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Chronic Trauma of Permanent Teeth: Diagnosis and Treatment

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Abstract

Chronic trauma can lead to cracks in the enamel and dentin or increased tooth abrasion. Diagnosis is carried out using optical systems and special lighting. Therapeutic methods include treatment of hyperesthesia, aesthetic restoration of teeth, if possible, normalization of occlusion. The amount of intervention depends on the degree of damage to the hard tissues. The minimum number of manipulations is performed while preserving dentin and enamel. We are talking about covering the tooth with fluoride-containing drugs. Maximum-includes the necessary stages of photo-curing composites. In some cases, orthopedic or surgical interventions are required.
Keywords: cracks of enamel and dentin, increased abrasion of the teeth, restoration of teeth

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Хроническая травма постоянных зубов: диагностика и лечение

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Резюме

Хроническая травма может приводить к образованию трещин эмали и дентина или повышенному стиранию зубов. Диагностика осуществляется с использованием оптических систем и специального освещения. Терапевтические методы воздействия

включают лечение гиперестезии, эстетическое реставрирование зубов, по возможности нормализацию окклюзии. Объем вмешательств зависит от степени повреждения твердых тканей. Минимальное число манипуляций производится при сохранении дентина и эмали (речь идет о покрытии зуба фторсодержащими препаратами), максимальное – включает необходимые этапы работы фотоотверждаемыми композитами. В ряде случаев требуется выполнение ортопедических или хирургических вмешательств.
Ключевые слова: трещины эмали и дентина, повышенное стирание зубов, реставрация зуба

■ INTRODUCTION

The relevance of any problem in medicine is due to the fact that there is a pathology, its prevalence, intensity, and possible complications. In this regard, the frequency of dental injuries in recent decades is the object of attention of domestic and foreign scientists [1, 2, 6]. Acute injuries are more often detected in children and young people as a result of participation in sports competitions, outdoor games, and extreme sports. Long-term effects (mechanical, physical, chemical) lead to chronic injuries. According to a number of foreign authors, the emphasis in the problem of dental health is shifting towards non-carious lesions of the hard tissues of the teeth, including increased Erasure, cracks [6, 7, 9].

In accordance with the results of research, traumatic dental injuries are registered in all age groups. Thus, 23% of the examined patients aged 10 to 70 years had injuries of various types of front teeth. According to the Russian literature, tooth cracks are found in more than 90% of the examined individuals. Chronic mechanical trauma, which leads to uneven Erasure of teeth at the age of 40 to 98 years, was found in 71.5–92.0% of the surveyed [6, 8]. Increased tooth Erasure in residents of Minsk reaches 38.6% in the age group from 55 to 64 years.

Retrospective analysis of outpatient patient records showed a significantly high incidence of trauma (13.2% of all treated teeth). At the same time, the prevalence of chronic tooth injury was 7.6%, and the prevalence of teeth with pathological erasability was 51.7% [1, 2].

Chronic tooth injury occurs when a weak force is applied for a long time. From local causes, aggressive mechanical effects (improper brushing of teeth, hard brush, abrasive toothpaste), increased occlusal load, malocclusion, and bad habits attract attention. Chewing or biting hard objects (such as a pencil, ice cubes, nuts, or candy) can cause cracks in the teeth, usurps on the incisors, and abrasion of enamel and dentin.

Chronic trauma includes cracks in enamel and dentin. However, such defects may be the result of a fast and high load (impact).

Chronic enamel cracks are present to a greater or lesser extent in almost all people over 25 years of age, regardless of gender [3, 9]. On "young" teeth, they are so thin that they are only visible due to the refraction of light in lateral or oral lighting. On the teeth of the older age group, the cracks are wider, have clear textural outlines, and moisture and pigments can penetrate them. Therefore, they are colored.

Many authors have developed classifications of cracks according to different principles: depending on the direction (vertical or oblique); anatomical position (bumps, cutting

edge, developing furrows, smooth surfaces, proximal surfaces); length (complete and incomplete); combinations of two or more parameters (for example, length and direction). Modern literature presents classifications that combine the studied features [3].

Combined cracks occur in teeth that have combined risk factors: malocclusion, complex restorations, fillings on 1/2 or more of the tooth crown, lower tooth moisture (devitalization, endodontics, age-related changes).

Food dyes easily penetrate cracks, causing limited surface or deep pigmentation, especially when exposed to nicotine. Dentin fractures with pulp damage cause diffuse discoloration of the tooth [1, 3, 7].

Such a chronic injury as local Erasure of enamel and dentin occurs due to orthodontic disorders with increased load on individual teeth. Irrational filling or prosthetics can also cause rapid loss of enamel. In some cases, local erasability is the result of bad habits: biting the tool (nail, pen); using the mouthpiece when Smoking; cracking nuts, clicking seeds, etc. hyperesthesia May be noted.

Systemic increased tooth abrasion is characterized by loss of hard tooth tissues in early and middle age [6, 8]. Develops against the background of malocclusion or General diseases. The reasons that affect the usefulness of hard tissues are hyperacid gastritis, parathyroid gland pathology, and other processes that can disrupt the mineral metabolism in the body. The number of risk factors that affect the intensity of pathological Erasure of teeth include the consistency of food and the nature of chewing. Any closing of the dentition (swallowing saliva, emotional compression of the jaws, bruxism-gnashing of teeth) is also considered a mechanical load [3, 6].

Pathological erasability is characterized by a rapid loss of hard tissues, a decrease in the height of the crown of the teeth. Occlusal trauma leads to chipped areas of the tooth, causes changes in the structure not only in hard tissues, but also in the pulp (Fig. 1). Reparative dentin is not formed, so a frequent symptom of increased erasability is hyperesthesia: sensitivity to various types of stimulus.

Rapid wear is mainly exposed to antagonizing teeth if their hard tissues are defective or if there is an increased mechanical load, as well as when both factors are combined.

When pathological Erasure occurs, atypical occlusal sites are formed with sharply pointed edges made of preserved enamel. As the process progresses, the teeth lose their anatomical shape, their crown is shortened, and the height of the bite decreases.

Fig. 1. Fracture of the crown of the tooth

These changes become characteristic differences depending on the shape of the bite. So, with a direct bite, as a rule, there is a horizontal Erasure of all teeth. Deep-promotes the development of a vertical form of pathological Erasure, in which the front teeth are thinned in the vestibular-oral direction, and may not be shortened. For orthognathic occlusion, mixed forms are natural. You can switch from one view to another.

Radiographically, if there is a pronounced pathological Erasure, the volume of the pulp may not change or there is an obliteration of the pulp chamber and channels. It is possible to form dentils, both wall-mounted and free-lying.

Pathological Erasure of teeth should be differentiated from natural physiological processes: age-related changes in intact dentition, occurs much slower and at an older age. With an active functional load, the first distinct signs of erasing the antagonizing sections of the incisors and canines appear by the age of 20. Then the Erasure facets appear on the mounds of molars and premolars. In this case, the process of loss of hard tissues proceeds fairly evenly within the dentition.

At the age of 40–49, 43.5% of people have I–II degree of erasability and 56.6% have II – III degree. In 50–59 years, the I–II degree of Erasure is registered only in 6.8%, II–III – in 59.1%, and the remaining 34.1% – Erasure. III–IV degrees. After 60 years, almost all persons are characterized by high tooth wear, namely, not lower than III–IV degree. Parallel to the Erasure of the antagonizing surfaces, the proximal sides wear out slowly. As a result, the shape and length of the dental arches change. The vestibular-lingual dimensions remain the most constant.

The condition of the patient's teeth with significant loss of teeth, cannot serve as a criterion of age. The more teeth that are missing from the dentition or are compensated for by dentures, the more uneven the Erasure. Regardless of age, erasability can range from grade I to grade IV, both within the age group and within the dentition.

Diagnosis and treatment of chronic tooth injury requires high professionalism of the dentist and availability of modern equipment, tools, and materials [1, 4, 8].

■ PURPOSE

To improve the efficiency of diagnostics of chronic dental trauma.

■ MATERIALS AND METHODS

Diagnosis and treatment of chronic injuries of the teeth was carried out with the use of modern dental equipment, tools and materials.

Cracks of teeth were detected by careful visual examination and the use of optical systems: monocular and binocular magnifier. In the absence of staining, the detection of cracks was facilitated by directional lighting: lateral and from the oral cavity.

The "delamination" syndrome of the tooth deserved special attention. Patients sought help because they were susceptible to stimuli, especially cold ones, without precise localization. Clinical examination did not detect sensitivity in the cervical region, primary or secondary caries, or open pulp under the seal on the x-ray. To identify the causal tooth, pieces of ice in a paper wrapper were used, which are applied to the buccal or lingual surface in the area of sensitive teeth. The surface with a crack is a trigger zone, so there is intense pain in the tooth. Sometimes the pressure on the affected hillock with the instrument provoked an attack. Removal of the entire seal led to the detection of a crack along the affected mound or at the bottom of the cavity.

Knowledge of the classification of cracks allowed us to choose the best methods of diagnosis and treatment. In some cases, it was necessary to remove the load between the antagonists. In the case of the sensitivity of tooth cracks was carried out by coating them with fluoride varnish. Cracks that grow in depth and in length, when complaining of pain from temperature, chemical stimuli or for the purpose of aesthetics, were treated in "live" teeth by dissection and restoration. Deep cracks, chips and fractures of the tooth crown required covering them with an artificial crown. Some cracks had a negative prognosis of treatment and outcome, therefore, the tooth was subject to removal. Prevention of the appearance and development of cracks was provided by eliminating risk factors with subsequent control.

The diagnosis of increased tooth Erasure was based on the loss of hard tissues within the enamel or dentin (cutting edge, bumps), a decrease in the height of the bite, and in some cases, changes in the temporomandibular joint.

The degree of tooth Erasure was evaluated as follows: 0 – no Erasure; I – Erasure site within the enamel; II – Erasure site on the enamel and spot exposure of dentin; III – erased dentin site; IV – Erasure of the tooth to the equator; V – opening of the tooth cavity.

The main differential features that distinguish pathological Erasure from physiological ones were the young age of the patient, rapid loss of enamel and dentin with the formation of sharp, uneven edges of worn areas with the development of hyperesthesia, and in some cases, pulpitis (traumatic or concrementous).

If the cause of chronic tooth wear was an incorrect bite, then the restoration of the teeth was preceded by their orthodontic movement or an increase in the bite by orthopedic methods.

The volume of therapeutic interventions depended on the degree of wear of the tooth crown, manipulations were performed in accordance with clinical protocols, as well as instructions for the use of materials.

The teeth were prepared with diamond borons of various shapes and grain sizes (NTI). Restoration was carried out with a light-curing ceramic-based filling material (silicon oxide filler) Admira fusion and Admira Flow (VOCO), which has a low polymerization shrinkage and high aesthetic properties. For the treatment of hyperesthesia, the fluoride varnish Bifluorid 12 and Profluorid Varnish were used.

■ RESULTS

The results of the study are given on clinical examples. The use of optical systems (binocular magnifier or monocular) with 2.5–10× magnification, as well as a digital camera, made it possible to detect microcracks and cracks in the enamel (Fig. 2).

When choosing the optimal treatment method for hyperesthesia of teeth with cracks, the origin of this symptom, its severity and prevalence were taken into account. The given clinical example was characterized by hyperesthesia of incisors that were covered with fluoride varnish.

In the next clinical case, a survey of complaints and anamnesis made it possible to diagnose chronic pulpitis. It became possible to identify the cause after tooth preparation. Along the entire distal wall up to the bottom of the pulp chamber, a crack of enamel and dentin was detected. Endodontic treatment with restoration of the crown was required.

Another example relates to the increased abrasion. Patient N., 43 years old, complains about a decrease in the height of the front teeth crowns. Previously, artificial crowns

A **B**

Fig. 2. Crack of the tooth

were made for 12, 13, 14, 23, 24 teeth. The original picture is shown in figure 3. This clinical situation involves the production of veneers on erased incisors. After mechanical treatment of the vestibular surface of the enamel with a fluoride-free Klint paste, the color of the teeth is determined by comparing intact areas with the color standards of the Admira Fusion photocomposite.

Since optimal shapes play an important role in ensuring the quality of restoration, odontoscopy was performed, and the vertical and horizontal dimensions of the teeth were measured. We planned a geometric shape and a drawing of the cutting edge.

Preparation was carried out with cylindrical diamond borons, and fine – grained borons smoothed the surface. Sharp edges, rounded protrusions. The surfaces were thoroughly washed with a stream of water.

"Total etching" was performed in accordance with the instructions. Adhesive preparation was performed, for which the prepared area of the incisors was treated with Futurabond u resin.

A **B**

Fig. 3. Increased abrasion of teeth

When modeling restoration, a thin layer of opaque filling material was used to simulate the volume of dentin lost during erasability. They marked the lower border of the base layer, which does not reach 0.5–1.0 mm to the level of the cutting edge, which will create a transparent layer.

The prepared opaque base, which fills in the shape and volume of the lost dentin of the tooth, was covered with enamel shades of the material. The slope of the vestibular area in the area of the cutting edge was formed at an angle of 10o. the smooth vestibular surface was Modeled. The transparent composite was distributed taking into account the individual type of enamel transparency: a 1.0 mm wide layer emphasized the cutting edge and the corners of the crown.

Immediately after the aesthetic design was made, it was processed. Removal of the surface hybrid layer and contouring was performed with diamond (with a red ring) borons of cylindrical, cone-shaped shape. Then the preparation was continued with a diamond boron (with a yellow ring) with a grain size of 15 microns. After that, ultra-thin diamond burs (with a white ring) with a grain size of 8 microns were used.

Polishing of the vestibular surface was carried out with polishing heads of various shapes. The final stage of treatment is the treatment of tooth tissues with a fluoride-containing drug Bifluorid 12. Artificial crowns on adjacent teeth have a yellowish tinge in the image.

The following clinical case shows less pronounced Erasure of the front teeth (Fig. 3). However, the patient wants to restore them in their original form, which coincides with the opinion of the dentist. Teeth are cleaned mechanically with Klint fluoride-free paste, and enamel shades of Admira Fusion light-curing composite are selected. Preparation is minimal: from the equator to the cutting edge in the form of a bevel. Fine-grained diamond borons smooth the surface. For adhesive preparation, the Futurabond m self-etching system is used.

The third clinical example is a combination of an erased cutting edge with a gum recession and a bare neck of the 11th tooth.

Minimal preparation of the vestibular surface in the direction of the cutting edge and the posterior area is required. Adhesive preparation of the tooth was performed. A photopolymer (A2 enamel shade and transparent) was used to model missing tooth sections. The manipulations were completed by processing the restoration and coating the enamel with Bifluorid 12.

In all clinical examples, patients were satisfied with the result.

■ CONCLUSION

Knowledge of the clinical manifestations of enamel and dentin cracks allows you to choose the right methods of diagnosis and treatment. In some cases, immediate balancing or lifting of the load between the antagonists is required. Small cracks can be covered with varnish for the prevention of hyperesthesia and of development of carious process in them. Cracks that grow in depth and length, as well as completed ones, are treated by dissection and restoration. According to the indications, a therapeutic, insulating gasket or temporary filling is used.

Treatment of pathological erasability (increased Erasure of teeth) is carried out in two main directions. The first of them includes measures aimed at normalizing mineral metabolism in the body in General and tooth enamel in particular (remineralizing

therapy). The second-provides a set of interventions to reduce hyperesthesia, restore the anatomical shape of the teeth, eliminate traumatic occlusion, and normalize the height of the bite. Restoration is carried out in accordance with the mandatory stages of work with photo-cured composites. In cases where defects in hard tissues cannot be compensated with fillings and tabs, the teeth are covered with crowns.

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