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Effectiveness of Treating Dental Caries in Children With Icon Technology

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Abstract: In children, carious defects in permanent teeth often form against the background of focal demineralization of teeth. Traditional treatment of caries involves complete removal of enamel with signs of demineralization. This approach to treatment led to a significant loss of hard tissues and weakening of the supporting structures of the teeth.

Currently, treatment of focal enamel demineralization is carried out by remineralizing therapy or fluoridation. However, this approach requires multiple visits and does not guarantee good results, especially with low patient competence in following recommendations for brushing teeth, nutrition, and using flosses.

The article presents the results of treatment of children with focal enamel demineralization on permanent teeth. Topographic features of the location of focal enamel demineralization on the vestibular surfaces of teeth are determined. The technique of conducting the technology of infiltration of demineralized enamel in combination with rational oral hygiene is described, allowing in one visit to "preserve" the carious process, provided that a pseudo-intact layer of enamel is preserved.

The conducted study revealed high caries-static efficiency of the ICON infiltration method due to adequate sealing of pores in the demineralization focus.

Keywords: caries, demineralization, fluorization, infiltration

As is known, today, caries is one of the most common diseases in the world (over 95% of people) [1,5,7,11]. Diagnostics and prevention of the development of the carious process are still considered important and not fully understood problems in modern dentistry. It has been proven that caries is a multi-stage process [3,5,7,13] and a combination of risk factors and time is necessary for the formation of a cavity.

The task of dentists today is to maximally preserve the patient's own dental tissues and prevent the pathological process at an early stage of its development [2,4,6,12].

The most important task of treating focal demineralization of enamel (FDE) of teeth is to eliminate the aesthetic defect associated with local discoloration of teeth in the smile zone. Minimally invasive treatment methods are more often used to treat early stages of dental caries (DC), while its developed forms require excision of a significant volume of hard tissues of the teeth (HTD), which adversely affects the macroarchitecture and biomechanics of the tooth. The carious process in HTD develops in stages, gradually affecting enamel and dentin, involving the pulp in the process, which mainly determines the choice of treatment methods: minimally invasive (remotherapy [1]), deep fluoridation, air-abrasive and ultrasonic preparation [6], microabrasion [5]); surgical and restorative [2]. A fundamentally new minimally invasive technology for treating focal demineralization of tooth enamel (FDE) is the caries-infiltration (CI) technology with the light-cured composite material icon [8], the principle of which is based on impregnating the FDE zone with a special infiltrant, carried out after preliminary etching of the superficial, relatively highly mineralized - "pseudo-intact" layer of enamel. The basis of passive infiltration is the ability of the highly fluid composite to penetrate into the intercrystalline pores of the enamel throughout the entire volume of the affected area and thereby strengthen - reinforce the demineralized enamel framework, preventing further progression of the process [1,8,9,10].

The aim of the study. To evaluate the effectiveness of treating initial carious lesions of hard dental tissues in children using the caries infiltration method.

Materials and methods.

To study the effectiveness of treating focal enamel demineralization (FED) by infiltration, using ICON technology, 2 groups of children aged 7-10 years were formed - the first group and 10-13 years old, the 2nd group. The choice of this age is based on the fact that during this age period, active eruption, growth and formation of the roots of permanent teeth in children occurs. This period is characterized by physiological maturation of enamel (mineralization) and can last from 2 to 5 years, and throughout the entire period of mineral maturation (especially during the first year after eruption), teeth need careful and effective care.

A comprehensive assessment of the results of treatment of dementia using ICON technology was determined for 160 permanent teeth.

The inclusion criteria were: the presence of caries at the stage of chalky spot - according to the topographic classification or enamel caries according to the ICD classification (K.02.0); the absence of pathological changes in the periodontium.

A clinical examination of the oral cavity was carried out according to the standard scheme with filling out an individual card, determining the value of the KPUz, KPUp index. The intensity of demineralization in caries was assessed by staining chalky spots with a 2% solution of methylene blue according to the 10-point Aksamit scale. To assess the hygienic state of the oral cavity, an index for assessing dental plaque was used - young children [10].

According to the indications, they were prescribed the following complex of conservative treatment and preventive measures:

1. Improving the hygienic condition of the oral cavity (a) Individual oral hygiene; b) Professional oral hygiene by including oral hygiene lessons).
2. Normalization of the nature and regime of nutrition (elimination of the carbohydrate factor).
3. Infiltration of ICON technology.
4. Dispensary observation.

All patients were taught the rules of brushing their teeth using a standard method and additional items for individual oral hygiene (toothbrushes, floss, rinses). Before infiltration, teeth were cleaned using a brush, polishing paste and floss. To minimize oral humidity and visualize the area of the stain in enamel caries, the surgical field was isolated using a cofferdam system [1,6,7,13].

The attachment for treating vestibular surfaces was screwed onto the Icon-Etch syringe and Icon-Etch, an etching gel of 15% hydrochloric acid, was applied to the vestibular surface using it (1.5-2 turns of the piston correspond to the required amount of material). Icon-Etch was left to act for 3 minutes, then rinsed with water for 30 seconds. The affected area was dried with dry air from an oil-free compressor. To better open the pores, Icon-Etch was applied again to the vestibular surface of the tooth affected by caries for another 3 minutes, after which it was rinsed with water for 30 seconds and dried with dry air.

To create optimal conditions for the adhesion of polymer resins, it is necessary to completely remove moisture that is present in the enamel pores after rinsing with water and subsequent drying. For this purpose, ethanol was applied to the treated areas by screwing the application cannula onto the Icon-Dry syringe. Approximately half of the syringe contents were applied to the lesion and left to act for 30 seconds. Then they were dried again with dry, degreased air.

The next stage of treatment is the actual infiltration of the lesion. To do this, a special nozzle was screwed onto the Icon-Infiltrant syringe. Before applying the infiltrant, it is necessary to turn on the lamp of the dental unit.

Icon-Infiltrant was applied with a slight excess to the lesion (1.5-2 turns of the piston approximately correspond to the required amount of material). The material was left to act for 3 minutes. Icon-Infiltrant was polymerized from all sides for at least 40 seconds.

To reduce polymerization shrinkage and increase microhardness, the material was applied a second time, screwing a new nozzle onto the Icon-Infiltrant syringe. It was left to act for 1 minute and the material was polymerized from all sides for at least 40 seconds. The cofferdam was removed. The surface was polished using special Shophy heads (Japan).

Results of the study and discussion.

During the examination it was established that the majority of ODEs were more often located on the vestibular surface of the frontal teeth on the central incisors of the upper jaw 65.9%; lower jaw 34.4%, on the lateral incisors of the upper jaw 64.5%; lower jaw 35.6%.

It is obvious that demineralization was more often localized on the teeth of the upper jaw ($p<0.001$). Almost equally often, foci were detected on the central and lateral incisors of the upper jaw (65.9% and 64.5%, respectively), and canines were affected significantly less often. A similar pattern was observed on the teeth of the lower jaw. More often (59.0%), one focus of demineralization was determined, in 24.8% of teeth - 2-3 isolated carious spots; in 17.1% of teeth, multiple spots (more than three foci) were detected. More often (51.2%), demineralization manifested itself as a single, fairly bright white spot, which indicated an acute course of caries, and 94.6% of foci had clear, well-contoured borders against the background of unchanged enamel.

During clinical examination of the oral cavity of children after caries infiltration, after 1 month of observation, the absence of new carious cavities and ODE was noted: on the existing chalky spots, the shine was restored, a symptom of probe sliding on a smooth surface was noted, which is an indicator of a positive result.

Before caries infiltration, pretty spots, when stained with a 2% methylene blue solution, were stained blue of varying intensity on the blue color scale (from 5 to 9 points), but after a month of using the ICON technology, no staining occurred (0 points).

The ODEs practically disappeared, and the color of the infiltrated enamel matched the native color of the crown. The children performed adequate oral hygiene using manual toothbrushes of medium hardness and Blend-a-MedProExpert medicinal toothpaste. Undoubtedly, the color and opalescence of the infiltrated enamel improved due to good hydration with saliva. The smallest number of unsatisfactory results (17.1%) was detected after six months. Good results were noted in 82.9%. The overall picture did not change significantly over 12 months of observation.

The key to successful treatment of caries at the chalky spot stage is strict oral hygiene. The study demonstrated a high level of effectiveness of the proposed method. This indicates a high caries-static effect of the method of infiltration with a mixture of resins on a methyl methacrylate basis due to adequate sealing of the pore system in the demineralization focus.

Conclusion.

Thus, the use of the new ICON technology, based on the infiltration of demineralized enamel with a highly fluid light-curing composite, for the treatment of early stages of caries, provides excellent and good results in the immediate and long-term observation periods. The composite cured in the demineralized enamel framework not only strengthens the structure of the damaged enamel, but also provides the necessary aesthetic effect of the treatment. The caries infiltration technique allows you to "preserve" the carious process in one visit, provided that the pseudo-intact enamel layer is preserved, which brings this method to a leading position.

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