Review Article Pol J Public Health 2019;129(3): 110-112

ILONA SZEWCZAK[1], BEATA KUBIĆ-FILIKS[2], JOLANTA SZYMAŃSKA[2]

# Treatment of lesions on the vestibular surfaces of permanent teeth with the use of liquid resin of low viscosity

**Summary**

One of the methods of treatment of initial stages of dental caries, lesions characterized by demineralization, and white spots on the vestibular surfaces of permanent teeth, is infiltration with liquid resin of low viscosity. It is a non-invasive method which is worth recommending and popularizing among patients.

On the basis of available literature the therapeutic method of infiltration with liquid resin of low viscosity is presented.

The use of resin of low viscosity allows for obtaining appropriate esthetic and functional appearance of teeth, which is a vital step in improvement of quality of social and professional life of patient.

**Keywords:** dental materials, resin infiltrant, tooth demineralization/pathology.

**DOI:** 10.2478/pjph-2019-0025

## INTRODUCTION

White spots and discolorations, especially those on the vestibular surfaces of upper and lower permanent teeth, are significant esthetic problem for patient. Lesions can be caused by intrinsic and/or extrinsic factors, they can concern both, teeth with vital pulp and those with endodontic treatment, and can regard one tooth or a few teeth. There are many causes of appearing of white spots on the teeth surfaces. A significant part of unaesthetic lesions on the labial surfaces of teeth, mainly located in the cervical area of tooth, is the effect of demineralization processes conditioned by dental caries [1,2].

Dental caries in considered to be an infectious, transmission disease caused by extracorporeal factors – microorganisms causing fermentation of carbohydrates provided with food. It involves mineralized tooth tissues, i.e. enamel, dentine and cement. Its result is demineralization of surfaces and disintegration of included organic substances. Initiation of carious process takes place on the ultrastructural level, concerns apatite crystals and is not clinically noticeable. Progression of the process leads to appearance of clinically (macroscopically) noticeable lesion – white carious spot (macula cariosa), and next, to loss of tooth tissues. A result of untreated disease is spreading lesions to dentine and bacterial invasion to the tissues situated deeper. An early stage of the disease is reversible and can be stopped if the conditions conducive to remineralization are created. Progression of the initial lesion in the form of white spot is prevented by use of activities involving effective removing of dental plaque, reducing frequency and amount of taken carbohydrates and using preparations containing fluoride [1,2].

In etiology of dental caries, the essential element is dental plaque, which is soft deposit, closely adjusted to teeth surface. Microorganisms present in biofilm create acids through the fermentation of extrinsic sugars, leading to change of pH of environment below 5.5, what results in demineralization of enamel. Main cariogenic bacteria are the following: *Streptococcus mutans*, *Streptococcus sobrinus*, *Streptococcus salivarius*, *Streptococcus mitis*, *Streptococcus sanguis*, while a special role in initiation of the disease is assigned to the bacteria, which are pioneers in colonization of acquired pellicle, i.e. *S. sanguis*, *Streptococcus oralis*, *S. mitis*. *S. mutans* is the most carious strain, however it constitutes only 2% of the initial bacterial flora. In the progression of lesions a significant role is played by *Lactobacillus acidophilus* strains [3]. The attention is also paid to contribution of *Candida* yeasts in etiology of dental caries, and especially vital is a role of *C. albicans* in creating biofilm on the teeth surface [4].

The cause of appearing white spots and discolorations on teeth surfaces can be also fluorosis, mottled enamel. It is a lesion characterized by hypoplasia, hypomineralization connected with chronic fluorine intoxication. The disorder may be caused by even small portion of fluorine taken for a long time, by incorrect combination of methods of endogenous fluorine prevention (e.g. giving patients tablets with fluorine in the areas of the optimal content of fluorine in drinking water) or by use of toothpastes for adults containing fluorine by children under 6 years old (there are cases when children eat toothpaste during brushing teeth). Under the enamel there appear the areas of extensive demineralization. Fluorine disturbs processes of mineralization and creation of the organic enamel matrix in all stages of tooth development [3].

[1] Student Scientific Association by the Department of Integrated Paediatric Dentistry of the Chair of Developmental Age Stomatology, Medical University of Lublin, Poland

[2] Department of Integrated Paediatric Dentistry of the Chair of Developmental Age Stomatology, Medical University of Lublin, Poland

Unaesthetic white spots might be also conditioned by hypoplasia of enamel, another words, its underdevelopment. The disorder happens if, due to dietary mistakes or gastrointestinal diseases, during the time of teeth development an organism does not get enough amount of nutrients, among others vitamins: A, D, K, C, or minerals: calcium, fluorine or magnesium. Hypoplastic lesions may also result from using some medicines, among others, tetracycline by pregnant women and in early years of the child's life. It is worth noticing that underdevelopment of enamel may indicate celiac disease. Hypoplastic teeth are more fragile, breakable, prone to chemical and mechanical damages. The risk of enamel underdevelopment is especially high in the first years of the child's life [2].

Carious white spots, which mean decalcifications of enamel occurring around the orthodontic locks localized on the vestibular surfaces of teeth in the gingival area, are complication after orthodontic treatment and require conservative treatment. Depending on the severity of disease, it can be either professional fluorine prevention, or mechanical preparation of carious lesion and esthetic filling of the cavity. When left untreated, they may progress and even lead to the loss of structure of the tooth hard tissues. What is significant for the patients, is unaesthetic appearance of affected teeth [5].

The presence of orthodontic locks predisposes to cummulation of dental plaque, food debris on the teeth surfaces. Development of demineralization lesions is additionally stimulated by non-compliance of principles of proper oral hygiene for the persons treated with fixed braces. Presence of elements of fixed braces makes it harder to conduct hygienic procedure and limits buffering and cleaning activity of saliva. Clinically noticeable white demineralization spots may develop within 4 weeks (average time between the following orthodontic visits). According to the studies, dental plaque in patients treated with fixed braces has lower pH than in patients without orthodontic treatment. A change of content of oral bacterial flora – increase of number of Lactobacillus acidophilus was also proved. Lesions the most frequently appear in the upper and lower lateral incisors, lower canines and upper first molar teeth [5].

## AIM

The aim of the work was presentation of the use of liquid resin of low viscosity in conservative treatment of lesions, being an effect of impaired mineralization, and discolorations on the surfaces of vestibular permanent teeth, on the basis of the available literature.

### Method of infiltration with resin of low viscosity

Introduction a new technology of infiltration of initial carious lesions into the dental market makes it possible to treat them without necessity to use invasive techniques in those cases, when topical application of fluorine compounds is ineffective. The method of infiltration of caries with resin of low viscosity fills the gap between the preventive-remineralizing methods and radical preparation of lesion with esthetic filling of the cavity. It is applicable in carious lesions localized in enamel without loss of tissues, crossing the enamel-dentine border, with the scope up to 1/3 of outer layer of dentine. Those lesions are clinically manifested as white carious lesions [6-8].

In the procedure of infiltration, capillary forces are used to transport light-hardening resin to interior enamel. This material is characterized by high penetration rate, high surface tension and low viscosity. Into the created in enamel microporosities, resin penetrates, which, after light polymerization, creates a diffusion barrier inside the initial carious lesion. This modern method gives possibilities for treatment of such lesions on the smooth surfaces of teeth (vestibular and proximal), without necessity of mechanical preparation of cavity and filling it with compound or glass-ionomer materials. It should not be used in treatment of lesions, for which the first choice treatment is remineralization, as infiltration blocks an access to the lesion for fluoride ions. Such microinvasive treatment is possible by using Icone (DMG Hamburg, Germany). The Icon set includes Icon-Etch (mixture of $H_2SiO_3$, 15-20% HCl, surfactant), Icon-Dry (95-100% ethanol), Icon-Infiltrant (composite resin) and special applicators (depending on the set: to vestibular surfaces Icon Vestibular or to proximal surfaces Icon Proximal Surface) [7-13].

### Course of procedure

Teeth surfaces are cleaned with a toothbrush with the low-speed head and toothpaste without fluorine. The gums are secured with cofferdam and infiltration is conducted with the use of an appropriate Icon set (to vestibular or proximal surfaces).

With a special applicator, the etchant Icon-Etch is put. After 2 minutes the etchant is removed with a swab and for 30 s mouth is rinsed with water from water air blower. Next, on the dry surface Icon-Dry is used. After 30 s interchangeably rinse (Icon-Infiltrant) is applied. After 3 minutes and removal of rinse excess, the surface is lighted for 40 s in the polymerisation lamp. After that, again infiltrant is put for 1 minute and after removal of excess, it is lighted for 40 s. After the procedure is finished, the prepared surfaces are polished using rubber on the low-speed head. Proper oral hygiene is recommended to the patient.

## DISCUSSION

Infiltration with liquid resin of low viscosity is an indirect method between remineralization procedures and treatment with removal of mineralized tooth tissues. Icon preparation can be successfully used in treatment of white spots and discolorations on the teeth surfaces, with unknown etiology or complications after orthodontic treatment. This method does not require mechanical preparation of cavity nor administering local anaesthesia in patient [12,14].

The therapeutic and esthetic effect of infiltration with resin of low viscosity depends on the level of demineralization of tooth tissues, what is confirmed by own authors' experiences. Spots characterized by initial lesions are totally eliminated after the procedure, while enamel defects are not restored, what is confirmed by own authors' experiences concerning a patient with idiopathic lesions. In the case of not deep lesions, without loss of tissues, esthetic effect is very good, as obtained by the authors in the patient with lesions after orthodontic treatment. If the lesions on the teeth surfaces do not have explained etiology and expansion, the loss of mineralized tissues accompanies them, therefore the result of treatment with the method of infiltration in unsatisfactory and requires subsequent invasive treatment with filling of cavities with esthetic material. A significant influence on the effect of treatment has also amount of time which passed from the appearance of white spots to the use of infiltration method. The studies prove that the best effects of white spots treatment are obtained when taking action as soon as possible from removal of orthodontic locks.

The prior use of local fluoride prevention may be the cause of unsatisfactory effect of infiltration method, by blocking an access of resin to lesion through a layer of generated $CaF_2$ on the enamel surface [14,15].

In the available articles from the 1980s reports appeared concerning too frequent decisions made by dentists about implementing invasive procedures in treatment of white spots on the teeth surfaces. Each restoration has limited durability and can require exchange. Thanks to new technologies a dentist has new possibility of esthetic treatment of white spots and discolorations. In 2009 non-invasive method was introduced, based on infiltration with resin of low viscosity, including Icon preparation [16].

Results of studies conducted *in vitro* show that the use of resin of low viscosity in order to close enamel porosity, cause increase of micro-hardness and resistance of tissues to demineralization processes, compared to lesions which remained untreated or undergone to only remineralization activities. What is more, it was proved that as a result of formation of diffusion barrier inside the structure of cavity, the weakened by pathological process tooth tissues become strengthened, what in effect decreases the risk of breaking enamel prism and appearing loss of tissues [12,13].

## CONCLUSION

1. Infiltration with resin of low viscosity is an effective method of treatment initial caries and white spots. Therefore, it is a method of therapeutic procedure, which should be widely spread and popularized among patients of dental offices.
2. The therapeutic and esthetic effect of the procedure is immediate and does not require big amount of work from dentist and time from the patient. At the same time it allows to keep tooth tissues without its mechanical preparation.
3. The method of infiltration in not effective in the cases of advanced carious process, then, an invasive treatment is necessary, i.e. preparation of cavity and filling with the appropriate esthetic material.

**REFERENCES**


1. Jańczuk Z, Kaczmarek U, Lipski M. Stomatologia zachowawcza z endodoncją. Zarys kliniczny. PZWL, Warszawa 2015.
2. Pels E. Początkowe zmiany demineralizacyjne: przyczyny powstawania, objawy, postępowanie terapeutyczne. Nowa Stomatol. 2016;1:74-8.
3. Boguszewska-Guternbaum H, Turska-Szybka A, Remiszewski A. Fluoroza zębów – opis przypadku. Nowa Stomatologia 2006;2:68-72.
4. Szymańska J, Wójtowicz A, Malm A. Assessment of Candida spp. frequency in the oral cavity ontocenosis of healthy individuals in different age groups. J Pre-Clin Clin Res. 2016;10,2:91-4.
5. Kraus A, Becker K, Świerk M. Demineralizacja szkliwa u pacjentów leczonych stałymi aparatami ortodontycznymi – wstępna ocena skuteczności leczenia metodą infliracji żywicą. Forum Ortod. 2014;10,4:246-54.
6. Kajka-Hawryluk K, Furmaniak K, Gromak-Zaremba J, Szopiński K. Zdjęcia zgryzowo-skrzydłowe we współczesnej stomatologii dziecięcej. Nowa Stomatol. 2015;20,2:73-80.
7. Paris S, Hopfenmuller W, Meyer-Lueckel H. Resin infiltration of caries lesions: An efficacy randomized trial. J Dent Res. 2010;89:823-6.
8. Paris S, Meyer-Lueckel H, Kielbassa AM. Resin infiltration of natural caries lesions. J Dent Res. 2007;86:662-6.
9. Frencken JE, Peters MC, Manton DJ, et al. Minimal intervention dentistry for managing dental caries – a review. Int Dent J. 2012;62:223-43.
10. Kielbassa AM, Müller J, Gernhardt CR. Closing the gap between oral hygiene and minimally invasive dentistry: A review on the resin infiltration technique of incipient (proximal) enamel lesions. Quintessence Int. 2009;40:663-81.
11. Meyer-Lueckel H, Bitter K, Paris S. Randomized controlled clinical trial on proximal caries infiltration: Three-year follow-up. Caries Res. 2012;46:544-8.
12. Paris S, Meyer-Lueckel H, Colfen H, Kielbassa AM. Resin infiltration of artificial enamel caries lesions with experimental light curing resins. Dent Mat J. 2007;26:582-8.
13. Paris S, Schwendicke F, Seddig S, et al. Micro-hardness and minimal loss of enamel lesions after infiltration with various resins: Influence of infiltrant composition and application frequency in vitro. J Dent. 2013;41:543-8.
14. Paris S, Meyer-Lueckel H. Masking of labial enamel white spot lesions by resin infiltration. Quintessence 2009;40:713-8.
15. Piesiak-Pańczyszyn D, Kaczmarek U, Woźniak J. Wpływ wytrawiania powierzchni wczesnej zmiany próchnicowej na proces jej leczenia z użyciem różnych preparatów remineralizacyjnych: badania in vitro. Czas Stomatol. 2005;58,9:620-7.
16. Bille J, Thylstrup A. Radiographic diagnosis and clinical tissue changes in relation to treatment of approximal caries lesions. Caries Res. 1982;16:1-6.



**Corresponding author**
Prof. dr hab. Jolanta Szymańska
Department of Integrated Paediatric Dentistry,
Medical University of Lublin, Poland
58 Lubartowska St., 20-094 Lublin
E-mail: jolanta.szymanska@umlub.pl