# Direct composite restoration in posterior dentition with extensive dental hard tissue defects

*Prof. Dr. Alexander Ivanovich Nikolayev, Prof. Dr. Leonid Makarovich Tsepov, Prof. Dr. Viktoria Rudolfovna Shashmurina, Alexey M. Romanov*

**Abstract**

The extent to which direct composite restoration in the posterior region is possible and appropriate when there are extensive dental hard tissue defects is discussed. Reasons for using the technique of selective restoration by the closed sandwich technique are explained: restoration of the dentine areas with a glass ionomer cement and restoration of the enamel areas with a universal microhybrid or nanohybrid composite. A clinical example of selective restoration of posterior teeth is cited in the context of caries treatment.

**Keywords**

*Caries, tooth restoration, glass ionomer cement, composite material, sandwich technique*

In practical therapeutic dentistry, the aesthetic restoration of teeth with light-curing composite materials is an important part of the treatment of caries and also dental hard tissue diseases of non-carious origin [2, 5]. Patients frequently choose composite restorations in preference to ceramic crowns or inlays.

When restoring anterior teeth, particularly in the aesthetically relevant region, the main objective is to imitate the colour and translucency of the dental hard tissue, restore the relief and microtexture of the enamel at the vestibular crown surface, create a better transition between the material and the tooth, and achieve a "dry shine" on the surface of the restoration [2, 5]. For the restorations themselves, the key requirements are to create a strong, durable restoration and to establish physiological contact points and interdental spaces, as well as avoiding postoperative sensitivities, ensuring good long-term marginal integrity of the restoration material, and preventing recurrent caries and inflammatory complications of the pulp [2, 3, 4].

In the following case, it appears useful to restore the enamel and dentine of a tooth with different restoration materials in order to achieve an integral, complex outcome of the direct tooth restoration. These materials should possess aesthetic, physical-mechanical and biological properties which best correspond to the properties of the dental hard tissues being restored, and which not only enable the desired aesthetic and functional outcome to be achieved, but also ensure a solid, stable bond with the dental hard tissue. Their biophysical properties should closely resemble those of the hard tissues being restored, and they should have a biological effect which is aimed at the reconstruction and remineralisation of the surrounding dentine. The closed sandwich technique, which entails selective filling, appears to be the most practical and most effective technique for the restoration of posterior teeth with extensive dental hard tissue defects in the enamel and dentine area. The technique: restoration of the dentine areas with a glass ionomer cement (GIC), adhesive preparation of the enamel surface and the liner, restoration of the enamel areas with a universal microhybrid or nanohybrid composite.

The use of light-curing glass ionomer cements is ideal in the situation considered here, with regard to handling properties, biocompatibility, biomechanical properties and price. GI cements can be used without prior conditioning of the dental hard tissue and – thanks to their consistency and physical-mechanical properties – they enable the application of thin liner layers (thinner consistency after mixing) or placement of a more substantial base (thicker consistency) [5, 6, 8, 12].

A glass ionomer cement which meets the above requirements is Ionolux (VOCO). The authors' experience in the clinical use of Ionolux demonstrates that it has good aesthetic properties and is easy to shape, both during mixing and during placement in the cavity. Ionolux is compatible with all composite materials, so the dentist does not need to change the composite he or she uses.

### A clinical example

During the thorough examination of a 46-year-old female patient, composite restorations were found in teeth 13, 14 and 15 (upper right canine and premolars), which had been placed about two years previously and no longer met the clinical requirements (Fig. 1). All three restorations represented a monolithic block and, in addition, there were marginal defects. According to the cold test, teeth 13, 14 and 15 were vital, the pain reaction was brief and immediately disappeared after removal of the temperature stimulus. Preliminary diagnosis: 13, 14, 15 – caries.

Following anaesthesia and removal of the fillings, the operating site was isolated and the soft tissue was retracted using a circular lip and cheek retractor and the protective wedge. Then retraction cords soaked in retraction liquid were placed. Before the final preparatory step, the rubber dam was placed and secured with wooden wedges in the interdental spaces.
During preparation of the carious lesions, it was found that the floor of the cavity in tooth 14 lay within the secondary dentine distally. In teeth 13 and 15, the floor was located within the middle dentine layers, at a sufficient distance from the dental pulp. There was no clinical evidence of a connection between the cavity and the pulp chamber. In the region of the cavity floor, a small amount of dense dentine, discoloured by pigments, was left in situ (Fig. 2). Final diagnosis: 14 – deep caries (initial onset of pulpitis / hyperaemia of the pulp), 13, 15 – moderate caries (dentinal caries).

The cavities were treated with 2 % chlorhexidine solution. Calcimol (VOCO Cuxhaven), a self-curing liner made of calcium salicylate for pulp capping, was applied to the cavity floor of tooth 14 distally. As a GIC liner, Ionolux (VOCO) was applied to teeth 13, 14 and 15, replacing the missing dentine. The material was light-cured. The surfaces of the liners and the walls of the cavities were prepared using diamond burs to give them the necessary contours and remove excess GIC. The contours of the liner were formed so as to restore the shape of the missing dentine. A 1.5 to 2 mm wide space was left on the occlusal surface for the composite material. The final reconstruction of the teeth was performed in a single stage, in two steps: firstly teeth 13 and 15, then tooth 14. For this, sectional matrices and ring matrices with tension rings and interdental wedges made of wood were used (Fig. 3).

The adhesive restoration placement was performed by means of the total etch technique, using phosphoric acid and an adhesive. Following reconstruction of teeth 13 and 15, the matrices were removed and macro texturing of the restoration was performed. Tooth 14 was reconstructed using the active multivector method for reconstruction of the approximal surfaces in the posterior region and for positioning the contact point (Fig. 4).

On completion of shaping and curing the restorations, the matrices and interdental wedges were removed. Then macro texturing of the restoration, removal of the rubber dam, occlusal adjustment, and finishing/polishing of the surface of the composite were performed. Finally, a surface sealant was applied (Fig. 5).

During a follow-up examination after 14 months (Fig. 6), the following findings were noted: no problems; the fillings meet the clinical requirements. Marginal integrity: good, no porosities in the material, sensitivity test (cold): normal, no signs of inflammation at the marginal periodontium in the region of teeth 13, 14 and 15, no signs of recurrent caries. In the long term, the patient is planning on a definitive treatment with ceramic crowns.

### Conclusion

In the authors' opinion, this restoration technique allows the dentist to make direct restorations more durable, more physiological and more effective from a medical/biological standpoint with the aid of composite materials. The options for caries treatment in the posterior region are expanded, and the efficacy of the therapeutic-preventive measures, particularly in regard to extensive defects of the dental hard tissue, is increased. Furthermore, the method is to be preferred in situations in which the dentist is forced to leave "suspicious" dentine in the area of the floor of a lesion which, for example, has amalgam discolouration (Fig. 7).

## Clinical Case

Fig. 1: The preoperative situation of teeth 13, 14 and 15

Fig. 2: Stepwise isolation of the operating site, preparation of the carious lesions

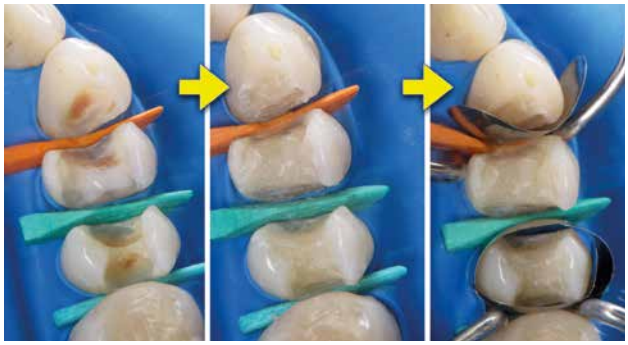

Fig. 3: Application of the liner for pulp capping and placement of the linings; application of the matrices, wedges and tension rings

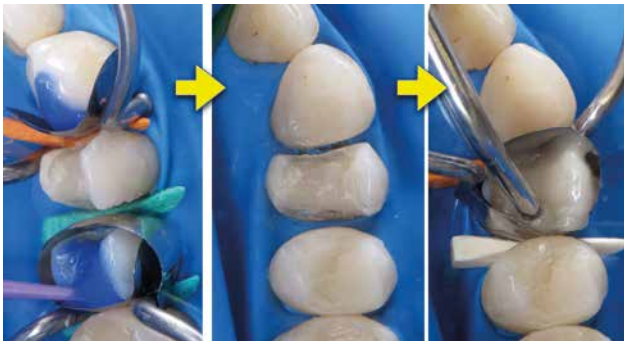

Fig. 4: Restoration of the teeth with a light-curing composite

Fig. 5: Finishing and polishing the restorations, application of a surface sealer

Fig. 6: Teeth 13, 14 and 15 fourteen months after the treatment

Fig. 7: Tooth 16 with dentine discolouration, which can be attributed to an amalgam filling remaining in the tooth for a long period of time. Base material: Ionolux.

## Literature


1. L.A. Lobovkina, A.M. Romanov Sposoby zameshcheniya dentina v restavratsiyakh bokovykh zubov // Sovremennaya stomatologiya. 2014. No. 1 (70 ). p. 11-12.
2. I.M. Makeyeva, A.I. Nikolayev Vosstanovleniye zubov svetootverzhdayemymi kompozitnymi materialami: prakticheskoye rukovodstvo dlya vrachey stomatologov-terapevtov. – Moskau: MEDpress-inform, 2011. – 368 p.
3. I.M. Makeyeva, A.I. Nikolayev, N.N. Vlasova Obshchiye printsipy restavratsii defektov tverdykh tkaney zuba / Im Buch: I.M. Makeyeva, V.A. Zagorskiy Biomekhanika zubov i plombirovochnykh materialov. - Moscow: BINOM press, 2013. – p. 111-129.
4. A.I. Nikolayev Sistemnyy podkhod k diagnostike i kompleksnomu lecheniyu karioznykh i prisheyechnykh nekarioznykh porazheniy tverdykh tkaney zubov (kliniko-laboratornoye issledovaniye): Diss. … for the degree of doctor of medicine: 14/01/2014 - Smolensk, 2012. – 193 p.
5. A.I. Nikolayev, L.M. Tsepov Prakticheskaya terapevticheskaya stomatologiya: uchebnoye posobiye dlya sistemy poslevuzovskogo professional'nogo obrazovaniya vrachey stomatologov. – 6th ed., revised and supplemented – Moscow: MEDpress-inform, 2007. – 928 p.
6. G.I. Skripkina, T.S. Mityayeva, Y.G. Romanova Sravnitel'naya kharakteristika effektivnosti ispol'zovaniya stekloionomernykh tsementov v klinike stomatologii detskogo vozrasta // Cathedra – kafedra. Stomatologičeskoe obrazovanie. 2014. No. 47. p. 48-51.
7. S.K. Surzhanskiy, E.K. Trofimets, A.V. Azarov Analiz mikroflory na poverkhnosti plomb iz razlichnykh materialov // Nauchnyye trudy SWorld. 2010. ed. 22. no. 4. p. 8-11.
8. S.I. Tokmakova, Y.V. Lunitsyna, N.Y. Luk'yanov, S.S. Senchenko Kliniko-laboratornaya otsenka plomb iz kompozita v sochetanii s prokladochnymi materialami pri lechenii kariyesa zubov // Problemy stomatologii. 2014. No. 2. p. 34-36.
9. F.M. Burke, N.J. Ray, R.J. McConnell Fluoride-containing restorative materials // International Dental Journal. Feb 2006; 56(1): 33-43.
10. S.B. Fúcio, A.B. Paula, J.C. Sardi, C. Duque, L. Correr-Sobrinho, R.M. Puppin-Rontani Streptococcus Mutans Biofilm Influences on the Antimicrobial Properties of Glass Ionomer Cements // Brazilian Dental Journal. 2016 Nov-Dec; 27(6): 681-687.
11. E.R. Hewlett, G.J. Mount Glass ionomers in contemporary restorative dentistry – a clinical update // Journal of the California Dental Association. Jun 2003; 31(6): 483-492.
12. G.J. Mount, C. Patel, O.F. Makinson Resin modified glass-ionomers: strength, cure depth and translucency // Australian Dental Journal. Dec 2002; 47(4): 339-343.


## Authors

Prof. Dr. Alexander Ivanovich Nikolayev, Head of the Department of Therapeutic Dentistry at the University of Smolensk, chairman of the specialist group "Aesthetic Dentistry" of the Russian Dental Association (StAR), Smolensk.

Prof. Dr. Leonid Makarovich Tsepov, Professor at the Department of Therapeutic Dentistry, University of Smolensk.

Prof. Dr. Viktoria Rudolfovna Shashmurina, Head of the Department of Dentistry in the School of Continuing Education, University of Smolensk.

Alexey M. Romanov, Medical Director of the Implamed Dental Clinic, Moscow.