

# KOMPOZITNE SMOLE MODIFIKOVANE POLIKISELINOM (KOMPOMERI) I GLAS-JONOMER CEMENTI MODIFIKOVANI SMOLOM

## POLYACID-MODIFIED RESIN COMPOSITES (COMPOMERS) AND RESIN-MODIFIED GLASS-IONOMER CEMENTS

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### **Kratak sadržaj**

Autori su postavili cilj da, na osnovu podataka iz literature, prikažu razlike između dve grupe materijala: kompozitnih smola modifikovanih polikiselinom, popularno nazivani "kompomeri" i, glas jonomer cementata modifikovani smolom. I jedni i drugi u svom sastavu sadrže smolnu komponentu i komponente glas jonomer cemenata. Međutim, početni materijal za jedan kompomer je kompozitna smola, koja se zatim modifikuje, dok su glas jonomer cementi modifikovani smolom, pravi glas jonomeri sa nekim dodatnim karakteristikama kompozitnih smola. Takođe, reakcija očvršćavanja kod ove dve grupe materijala se bitno razlikuje: ukoliko kompomer nije izložen polimerizacionoj svetlosti, izostaje reakcija vezivanja, dok je kiselinsko-bazna reakcija osnov za očvršćavanje glas-jonomer cemenata modifikovanih smolom. Razlike postoje i u pogledu oslobođanja fluorida: glas-jonomer cementi modifikovani smolom imaju mnogo viši nivo oslobođanja fluorida od kompomera. Mehaničke osobine i jedne i druge grupe materijala su inferiornije u odnosu na kompozite, a superiorne u odnosu na glas-jonomer cemente. Indikaciono područje je slično i kod jednih i kod drugih, i svedeno je na situacije koje nose mali pritisak, s tim što se glas-jonomer cementi modifikovani smolom mogu koristiti i kao lajneri.

**Ključne reči:** kompomeri, glas-jonomer cementi modifikovani smolom, sastav, osobine, primena.

### **Abstract**

Using literature as a base, the authors wanted to show the differences between the two groups of materials: polyacid-modified composite resins, called "compomers", and resin-modified glass-ionomer cements. Both of these materials contain a resin component and the components of glass-ionomer cements in their composition. However, the initial material for a compomer is a composite resin, which is then modified, whereas resin-modified glass-ionomer cements represent a genuine glass-ionomer with some additional features of composite resins<sup>1</sup>. Moreover, the setting reaction of these two groups of materials is distinctively different: if a compomer isn't exposed to polymerisation light, there will be no linking reaction, whereas the acid-base reaction represents a base for the curing process of resin-modified glass-ionomer cements. The differences are also evident in the release of fluoride: resin-modified glass-ionomer cements have a higher level of fluoride release than compomers. The mechanical properties of both groups of materials are inferior to compomers but superior to glass-ionomer cements<sup>1,3</sup>. Also, they have a similar indication area which is reduced to low stress bearing situation; the only difference is in the fact that resin-modified glass-ionomer cements can be used as liners as well.

**Key words:** compomers, resin-modified glass-ionomer cements, composition, properties, application

### **Uvod**

Jedna od glavnih osobina glas jonomer cementata je njihova sposobnost da oslobođaju fluoride i tako doprinose zaštiti od sekundarnog

### **Introduction**

One of the main characteristics of glass-ionomer cements is their ability to release fluoride and, in that way, to contribute to the protection

karijesa.<sup>1,2</sup> Restaurativni materijali od kompozitnih smola nemaju ovu sposobnost. Komponeri su kompozitni materijali na bazi smola, modifikovani polikiselinom, tako da su u stanju da oslobole znatne količine fluorida tokom dužeg vremenskog perioda. Iako predstavljaju hibrid kompozita i glas jonomer cementa, komponeri se jasno razlikuju od glas jonomer cemenata modifikovanih smolom.<sup>3,4</sup>

Početni materijal za jedan kompomer je kompozitna smola, koja se zatim modifikuje, dok su glas jonomer cementi modifikovani smolom, pravi glas jonomeri sa nekim dodatnim karakteristikama kompozitnih smola.<sup>1</sup>

Cij ovog informativnog rada je analiza sastava, osobina i moguća primena kompomera i glas-jonomer cemenata modifikovanih smolom, kako bi se izbeglo poistovećivanje ove dve grupe, očigledno različitih materijala.

### ***Sastav i način vezivanja kompomera i GJC modifikovanih smolom***

Kompomeri sadrže smole i punila koja su zajednička i za kompozitne smole i za glas jonomere. Smolna komponenta sadrži funkcionalne grupe polikarboksilne kiseline i metakrilate koje su kombinovane u jednom molekulu. Metakrilatne grupe obezbeđuju unakrsno povezivanje (kao u kompozitnim smolama) a karboksilne grupe učestvuju u kiselinsko-baznoj reakciji u prisustvu vode i metala (kao kod glas jonomera).<sup>1,4</sup>

Staklena komponenta koja sadrži fluorid, što je tipično za glas jonomere, čini osnovno punilo u koje se mogu dodati čestice stakla, slično onima iz kompozitnih smola. Takođe, mogu da postoje druga punila koja obezbeđuju dodatno oslobođanje fluorida i Rö nepropustljivost.

### ***Sastav kompomera***

Komponente	Funkcija
Dimetakrilatni monomer (UDMA).....	Formira smolni matriks
Specijalna smola.....	Obezbeđuje karboksilne grupe

of secondary caries.<sup>1,2</sup> Composite resin restorative materials do not have this ability. Compomers are polyacid-modified resin composite materials; thus, they are able to release a large amount of fluoride over an extended period of time. Although they can be treated as a hybrid of a resin composite and glass-ionomer cement, compomers are distinctively different from resin-modified glass-ionomer cements.<sup>3,4</sup>

The initial material for a compomer is a composite resin, which is then modified, while resin-modified glass-ionomer cements represent the genuine glass-ionomers with some additional features of resin composites.<sup>1</sup>

The aim of this informative article is the analysis of both the composition and the properties of compomers, as well as the possible application of compomers and resin-modified glass-ionomer cements, so that the identification of these two groups, obviously of different materials, can be avoided.

### ***Composition and linking of compomers and resin-modified GIC***

Compomers contain resins and fillers which are common to both composite resins and glass-ionomers. The resin component contains polycarboxylic acid and methacrylic functional groups which are combined in one molecule. Methacrylic groups provide cross linking (as in composite resins) while carboxyl groups take part in acid-base reaction in the presence of water and metal (as in glass-ionomer).<sup>1,4</sup>

The glass component containing fluoride, which is typical of glass-ionomers, represents the basic filler to which glass particles, similar to those in composite resins, can be added. Also, there are other fillers which provide additional release of fluoride and radiopacity.

### ***Composition of compomers***

Components	Function
Dimethacrylate monomer (UDMA).....	Forms the resin matrix
Special resin.....	Provides carboxyl groups

Fluoro-alumino-silikatno staklo..... Punilo i izvor fluorida

Hidrofilni monomeri..... Imaju za cilj transport vode i fluorida

Fotoaktivatori (inicijatori)..... Obezbeđuju očvršćavanje radikalnom polimerizacijom

Reakcija očvršćavanja u kompomerima odvija se u dve faze:

- reakcija u prvoj fazi je tipična za kompozitne smole aktivirane svetloću koje formiraju mrežu od smole koja okružuje čestice punila. Mehanizam svetlosnog očvršćavanja dovodi do stvrdnjavanja u kavitetu.

- reakcija u drugoj fazi se odvija sporo posle postavljanja u kavitet. Upijanje vode će se odvijati tokom 2-3 meseca i, u prisustvu karboksilnih grupa iz polikiseline i jona metala iz jonomernog stakla, postoji jedna relativno spora jonska kiselinsko-bazna reakcija. Unutar strukture smole, formiraće se hidrogelovi i doći će do sporog oslobađanja fluorida niskog nivoa.

Iako u procesu vezivanja kompomera postoji i radikalna polimerizacija i kiselinsko-bazna reakcija, ova prva, pobuđuje proces očvršćavanja ovih materijala. Doprinos reakcije kiselina-baza je da obezbedi oslobađanje fluoridnih jona tokom dužeg vremenskog perioda. Ukoliko kompomer nije izložen polimerizacionoj svetlosti, izostaje reakcija vezivanja, pošto kiselinsko-bazna reakcija nije u stanju da dovede do očvršćavanja materijala.<sup>1,5</sup>

Glas jonomer cementi modifikovani smolom sadrže fluoro-alumino-silikatno staklo i poli (alkenoičnu kiselinu), kao i inkorporisan monomer (obično 2-hidroksiethyl metakrilat -HEMA- ili Bis-GMA). Reakcija očvršćavanja kod ovih materijala može da se odvija na dva načina:

- Pomoću svetlosne polimerizacije i hemijske (kiselinsko-bazne) reakcije,
- Samo pomoću kiselinsko-bazne reakcije koja je tipična za konvencionalne glas-jonomer cemente.

Za razliku od kompomera, ključna reakcija očvršćavanja kod glas-jonomer cemenata modifikovanih smolom je kiselinsko-bazna reakcija; ovi materijali, bez obzira da li se izlažu

Fluoro-alumino-silicate glass..... Filler and a source of fluoride

Hydrophilic monomers..... Aid the transport of water and fluoride

Photoactivators (Initiators)..... Provide cure by radical polymerisation

The setting reaction in compomers occurs in two phases:

- The reaction in the first phase is typical of composite resins activated by light, forming a resin network which surrounds the filler particles. The light-curing mechanism leads to hardening of the material in the cavity.

- The reaction in the second phase takes place slowly after placement in the cavity. The absorption of water will occur during 2-3 months and, in the presence of carboxyl groups from poly-acid and metal ions from the ionomer glass, there will be a relatively slow ionic acid-base reaction. Hydrogels will be formed within the resin structure and low-level fluoride will be slowly released.

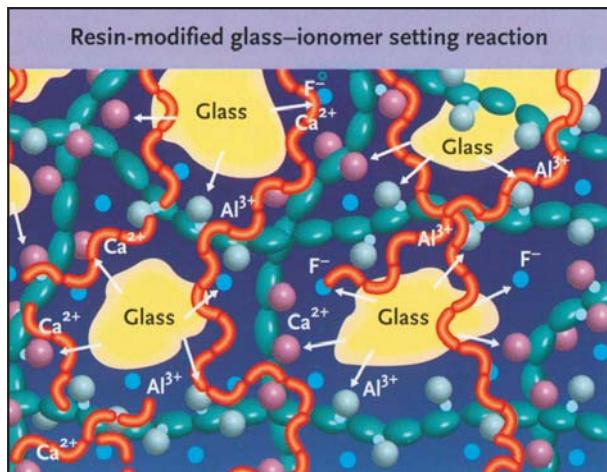
Although the process of linking the compomers has both a radical polymerisation and acid-base reaction, the former stimulates the setting process of these materials. The contribution of the acid-base reaction is to provide the release of fluoride ions over an extended period of time. Unless a compomer is exposed to polymerisation light, there will be no linking reaction, because the acid-base reaction cannot lead to material setting.<sup>1,5</sup>

Resin-modified glass-ionomer cements contain fluoro-alumino-silicate glass and polyacrylic acid as well as the incorporated monomer (usually 2-hydroxyethyl methacrylate HEMA- or Bis-GMA). The setting reaction of these materials can occur in two ways:

- Via light polymerisation and chemical (acid-base) reaction;
- Only via acid-base reaction which is typical of conventional glass-ionomer cements.

Unlike compomers, the crucial setting reaction of resin-modified glass-ionomer cements is the acid-base reaction; these materials cure, regardless of whether or not they are exposed to

polimerizacionoj svetlosti ili ne, očvršćavaju, s tim što polimeraciona svetlost može ubrzati proces vezivanja i zaštititi cement od upijanja vode u toku očvršćavanja<sup>2</sup> (slika 1).



## Osobine

### Oslobađanje fluorida

Iako kompomeri mogu da oslobađaju fluoride u toku dužeg vremenskog perioda, oni imaju niži profil oslobađanja fluorida nego glas jonomer cementi i glas-jonomer cementi modifikovani smolom (slika 2). Štaviše, glas-jonomer cementi modifikovani smolom imaju viši nivo oslobađanja fluorida od konvencionalnih glas-jonomer cemenata.<sup>5,6</sup>

Svi restaurativni materijali koji oslobađaju fluorid, pokazuju visok nivo oslobađanja u prvih nekoliko nedelja, ali se vremenom ono postepeno smanjuje. Još uvek nije poznato da li će smanjene količine fluorida, koje se oslobode posle nekoliko godina izlaganja oralnom okruženju, biti dovoljne da obezbede zaštitu od karijesa. Pokazano je da glas jonomer cementi imaju sposobnost da reapsorbuju fluorid iz oralnog okruženja i oslobode ga u nekoj kasnije

polymerisation light, which can only accelerate the linking process and protect the cement from water absorption during the curring process<sup>2</sup>. (Figure 1).

*Slika 1. Reakcija očvršćavanja GJC modifikovanih smolom je zasnovana na kiselinsko-baznoj reakciji (kao kod glas-jonomer cemenata), ali će se uneta smola (uglavnom HEMA) stvarnjavati posle svetlosne inicijacije i zaštititi samootvrdnjavajući sistem od upijanja vode. Hidroksil metakrilat (HEMA) je predstavljen narandžastim lancima (Mount GJ, Hume WR, 1998).*

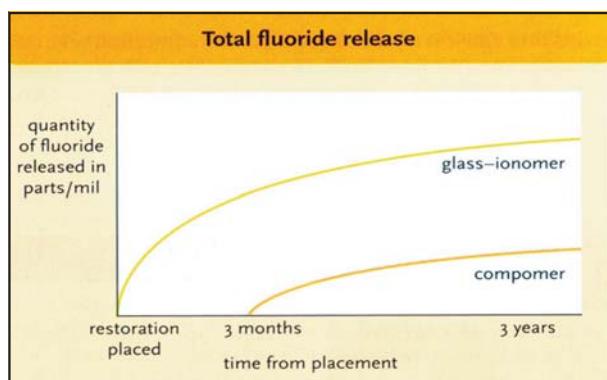
*Figure 1. The setting reaction of resin-modified glass-ionomer cements is based on acid-base reaction (as in glass-ionomer cements) but the resin (mostly HEMA) will cure after the light initiation and will protect the self-curing system from water absorption. Hydroxyethyl methacrylate (HEMA) is presented by orange chains (Mount GJ, Hume WR, 1998).*

## Properties

### Fluoride release

Even though compomers are able to release fluoride over an extended period of time, they have a lower fluoride release profile than glass-ionomer cements and resin-modified glass-ionomer cements (Figure 2). Moreover, resin-modified glass-ionomer cements have a higher fluoride release than conventional glass-ionomer cements.<sup>5,6</sup>

All the restorative materials which release fluoride show a high amount of release in the first few weeks, but gradually this decreases. It's still unknown whether the reduced amounts of fluoride which are being released after several years of exposure to the oral environment will be adequate to provide protection from caries. It has been shown that glass-ionomer cements have the ability to reabsorb fluoride from the oral environment and release it at a later



*Slika 2. Ukupno oslobađanje fluorida tokom vremena za prosečan glas-jonomer u poređenju sa kompomerom koji ne počinje da oslobada fluorid u toku prva tri meseca po postavljanju. Količina fluorida koja se kasnije oslobodi iz kompomera je značajno manja u odnosu na glas-jonomer cement. (Mount GJ, Hume WR, 1998)*

*Figure 2. Total fluoride release over a period of time for an ordinary glass-ionomer compared to a compomer which doesn't release fluoride during the first three months after placement. The amount of fluoride which is later released from a compomer is considerably reduced in relation to glass-ionomer cement. (Mount GJ, Hume WR, 1998)*

fazi. Zbog toga restauracija može da deluje kao rezervoar fluorida koji se redovno obnavlja kada je izložen lokalnim fluoridima. Ovo je veoma važna osobina u smislu dugoročne antikarioznosti glas-jonomer cemenata, kao i onih modifikovanih smolom, što se nije pokazalo kao moguće kod kompomera.<sup>7</sup> Takođe, kod restauracija od GJC i GJC modifikovanih smolom, koje su postavljene u blizini marginalne gingive, dentalni plak nije u stanju da se razvije na površini ispuna zbog prisustva fluorida.<sup>8</sup>

### **Adhezija**

Za razliku od glas-jonomera i glas-jonomer cemenata koji su modifikovani smolom, kompomeri nemaju prirodni afinitet prema gleđi i dentinu i moraju da se koriste zajedno sa dentin adhezivima. Neki proizvođači preporučuju da se izostavi nagrizanje gleđi i dentina kiselinom. Ovo će za rezultat imati manju jačinu veze zbog čega se kompomeri preporučuju u aplikacijama koji trpe manji pritisak. Neki kompomeri se isporučuju sa sopstvenim adhezivom i imaju karakteristike samonagrizajućih prajmera.<sup>1,4</sup>

Glas-jonomer cementi modifikovani smolom su veoma otporni na isušivanje. Veza za gleđ i dentin je podjednako dobra, ako ne i bolja od veze kod konvencionalnih glas-jonomera, pošto smolna komponenta daje dodatnu jačinu očvrsnutom cementu pri istezanju.<sup>2,9</sup>

Restauracija od glas-jonomer cementa modifikovanog smolom, može odmah da se polira, za razliku od kompomerne restauracije.<sup>1</sup>

### **Polimerizaciono skupljanje**

Polimerizaciono skupljanje kod kompomera slično je kao i za kompozitne smole (~2-2,5 vol.%) kao i apsorpcija vode, što je oko 40 mg. mm<sup>-3</sup>. Kompomeri se razlikuju od kompozita po brzini upijanja vode. Brza apsorpcija vode kod kompomera obezbeđuje nadoknadu za polimerizaciono skupljanje matriksa od smole za nekoliko dana i pomaže da se smanji marginalni prostor koji se eventualno stvara prilikom postavljanja.<sup>4</sup>

Smolom modifikovani glas-jonomer cementi sadrže manje od 5% dodatne smole i pokazuju veoma malo početno skupljanje smolne komponente u vreme aktiviranja svetlošću. Naknadno skupljanje usled produžene reakcije kiselina-baza, razvija se prilično sporo i kontroliše se adhezijom do izvesnog stepena.<sup>2,5</sup>

phase. Because of this, the restoration can function as a fluoride reservoir which is regularly refilled when exposed to a local fluoride. This is a very important characteristic of the long-term anticariogenicity of glass-ionomer cements, which has shown to be impossible with the compomers.<sup>7</sup> Also, in the restoration of glass-ionomer cements and resin-modified glass-ionomer cements, which are near the marginal gums, a bacterial plaque cannot accumulate on the surface of the filling because of the presence of fluoride.<sup>8</sup>

### **Adhesion**

Unlike the glass-ionomer and the resin-modified glass-ionomer cements, compomers don't have a natural affinity for enamel and dentine and have to be used together with a dentine adhesive. Some manufacturers recommend the omission of the acid etching of the enamel and dentine. This will result in lower bond strength, which is why the compomers are recommended for low stress bearing applications. Some compomers are delivered with a proprietary adhesive and have features of the self-etching primers.<sup>1,4</sup>

Resin-modified glass-ionomer cements are very resistant to desiccation. The bond to enamel and dentine is as good as that of conventional glass-ionomers, if not better, because the resin component gives an extra strength to the set cement during the stretching.<sup>2,9</sup>

The restoration of resin-modified glass-ionomer cement can be polished immediately, unlike the restoration of compomers.<sup>1</sup>

### **Polymerisation Shrinkage**

Both the polymerisation shrinkage of compomers (~2-2.5 vol.%) and water absorption (about 40 µg.mm<sup>-3</sup>) are similar to that of the composite resins. The compomers differ from the composites in their rate of water uptake. The rapid water absorption by compomers provides compensation for the polymerisation shrinkage of the resin matrix in a few days and helps to reduce a marginal gap that may have been formed during the placement.<sup>4</sup>

Resin-modified glass-ionomer cements contain less than 5% of the used resin and show some initial shrinkage of the resin component during light activation. The subsequent shrinkage, which is a result of a prolonged acid-base reaction, will occur very slowly and will be controlled by adhesion to a certain degree.<sup>2,5</sup>

### Mehaničke osobine

Mehaničke osobine kompomera su uglavnom manjeg kvaliteta nego kod kompozitnih smola, sa smanjenom tvrdoćom i otpornošću na mehanički pritisak. Ovo isključuje njihovu upotrebu u situacijama koje nose velike pritiske, kao što je karijes/oštećenje IV klase. Nihova otpornost na trošenje je veća nego kod glas-jonomera i glas-jonomera modifikovanih smolom. Ipak, u poređenju sa kompozitnim smolama, otpornost na habanje je smanjena. Pretpostavlja se da se ova osobina javlja zbog prisustva nešto većih čestica punila nego što sadrže kompozitne smole i usled reakcije kiselina-baza koja se stalno odvija na granici između staklenog punila i smole.<sup>3</sup>

Smolom modifikovani glas-jonomer cements poseduju veću otpornost na mehanički pritisak (frakturu) u odnosu na samovezujuće glas-jonomer cemente. Otpornost na frakturu se kod nekih verzija ovih materijala upoređuje sa otpornošću kompozita koji sadrže mikropunilo. Ipak, glas-jonomer cementi modifikovani smolom se međusobno mogu razlikovati po pitanju mehaničkih osobina, jer će one zavisiti od količine i tipa ugrađene smole, kao i od mehanizma očvršćavanja. Generalno, i GJ modifikovani smolom i kompomeri, imaju inferiornije mehaničke osobine u odnosu na kompozite, a superiornije u odnosu na glas-jonomer cemente.<sup>1,3</sup>

### Primena

Na račun postizanja korisnog efekta fluorida, kompromitovane su (do izvesnog stepena) mehaničke osobine kompozita u kompomerima. Stoga, kompomeri nemaju isto indikaciono područje kao kompozitne smole; raspon aplikacija je sličan onom koji imaju glas-jonomer cementi i glas-jonomer cementi modifikovani smolom.<sup>3,4</sup>

Pošto su mehaničke osobine i otpornost na habanje kompomera i GJ modifikovanih smolom obično inferiornije u odnosu na kompozitne smole (ali bolje od onih koje imaju glas-jonomer cementi) njihova upotreba je ograničena na situacije koje nose mali pritisak (slike 3 i 4):

- klinaste erozije,
- kaviteti V klase.
- kaviteti III klase,

### Mechanical Properties

The mechanical properties of compomers mostly aren't of the same quality as that of the composite resins; they are with a reduced hardness and with resistance to mechanical pressure. This excludes their use in high stress bearing situation, such as caries/ a class IV lesion. Their wear resistance is better than that of glass-ionomers and resin-modified glass-ionomers. Yet, in comparison with composite resins, the wear resistance is reduced. It is supposed that this feature occurs because of the presence of somewhat larger filler particles than those contained in composite resins, and as a consequence of the acid-base reaction that is constantly going on at the border between the glass filler and the resin.<sup>3</sup>

Resin-modified glass-ionomer cements possess a higher resistance to mechanical pressure (fracture) in relation to self-linking glass-ionomer cements. The resistance to fracture, in some versions of these materials, is compared to the resistance of composites which contain microfiller. Yet, as far as their mechanical properties are considered, resin modified glass-ionomer cements may be dissimilar, because they depend on the amount and the type of the used resin, and on the curing mechanism. Generally, both the resin-modified glass-ionomers and the compomers have mechanical properties which are inferior to composites but superior to glass-ionomer cements.<sup>1,3</sup>

### Application

In order to achieve a useful fluoride effect, the mechanical properties of composites in compomers are compromised (to a certain degree). As a result, the compomers don't have the same indicated area as composite resins; the range of application is similar to that of glass-ionomer cements and resin-modified glass-ionomer cements.<sup>3,4</sup>

Since the mechanical properties and wear resistance of compomers and resin-modified glass-ionomers are inferior in relation to composite resin (but better than those of glass-ionomer cements), their use is limited to low stress bearing situations (Figures 3 and 4):

- erosion lesions
- a class V cavity
- a class III cavity



Slika 3. Klinaste erozije restaurisane kompomernim materijalom (Mount GJ, Hume WR, 1998)  
Figure 3. Erosion lesions restored by a compomer material (Mount GJ, Hume WR, 1998).

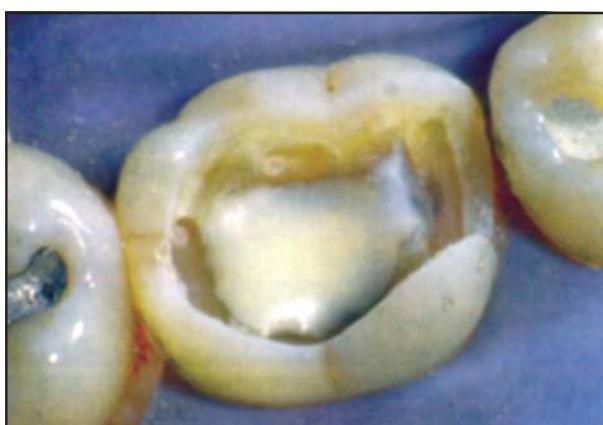


Slika 4 (a i b). Karijes treće klase i klinasti defekt ispunjeni glas-jonomer cementom modifikovanim smolom  
(Mount GJ, Hume WR, 1998)

Figure 4 (a and b). A class III caries and proximal erosion filled with resin-modified glass-ionomer cement  
(Mount GJ, Hume WR, 1998).

- definitivne restauracije kod mlečnih zuba,
- dugotrajne privremene restauracije kod stanih zuba.

Indikaciono područje se kod GJC modifikovanih smolom proširuje na izuzetno prihvatljivu zaštitu dentina u vidu lajnera, ispod kompozitnih i drugih restauracija (slika 5).



- permanent restorations in the primary dentition,
- long-term temporaries in the permanent dentition

The indication area of resin-modified glass-ionomer cement is extended to a highly acceptable protection of dentine in the form of liners, under the composite and other restorations (Figure 5).

Slika 5. GJC modifikovan smolom postavljen kao lajner debljine oko 0,5 mm u cilju zaštite pulpe od temperaturnih promena (Mount GJ, Hume WR, 1998)

Figure 5. Resin-modified glass-ionomer cement in form of a 0,5 mm thick liner which is placed to protect a pulp from changes in temperature (Mount GJ, Hume WR, 1998).

Kompomeri pokazuju preterano higroskopno širenje, verovatno zbog visokog sadržaja hidrofilne smole. Slično se ponašaju i GJC modifikovani smolom, iako je količina smole mnogo manja. Dok ova osobina može biti korisna za smanjenje marginalnog prostora oko restauracija, ovo širenje može dovesti do frakture keramičkih krunica koje se cementiraju smolom za lepljenje ili sličnim verzijama glas-jonomer cemenata modifikovanih smolom. Zbog toga se ni jedni ni drugi ne preporučuju za cementiranje keramičkih restauracija.<sup>1</sup>

## Zaključak

- Kompozitne smole modifikovane polikiselinom (kompomeri) i glas-jonomer cementi modifikovani smolom predstavljaju dve posebne grupe materijala koje se razlikuju u pogledu:
  - sastava i načina vezivanja,
  - nivoa oslobađanja fluorida,
  - adhezije za tvrda zubna tkiva,
  - polimerizacionog skupljanja.
- Kompomeri i glas-jonomer cementi modifikovani smolom pokazuju sličnost u pogledu:
  - mehaničkih osobina,
  - indikacionog područja.
- Motivacija da se proizvedu kompomeri je dodavanje polikiseline koja će obezrediti oslobađanje fluorida, a motivacija za proizvodnjom glas-jonomer cemenata modifikovanih smolom je poboljšanje mehaničkih osobina konvencionalnih glas-jonomer cemenata. I u jednom i u drugom slučaju dobijeni su materijali koji zauzimaju značajno mesto u restorativnoj stomatologiji i opravdanje za primenu kojoj su namenjeni.

Compomers show an excessive hygroscopic expansion, probably because of the high content of hydrophilic resin. Resin-modified glass-ionomer cements behave in a similar way, even though the amount of resin component is greatly reduced. While this feature can be useful for the reduction of marginal gap around restorations, this expansion may lead to fracture of all-ceramic crowns which are cemented by a luting resin or similar versions of resin-modified glass-ionomer cements. Because of this, neither of them is recommended for all-ceramic restorations.<sup>1</sup>

## Conclusion

- Polyacid-modified composite resins (compomers) and resin-modified glass-ionomer cements present two different groups of materials which differ in:
  - composition and the way of linking
  - the level of fluoride release
  - adhesion for hard tooth tissue
  - polymerisation shrinkage
- Compomers and resin-modified glass-ionomer cements show similarity in
  - mechanical properties
  - indication area
- The motivation for producing compomers is the addition of polyacid which will provide the fluoride release, and the motivation for producing resin-modified glass-ionomer cements is the improvement of mechanical properties of conventional glass-ionomer cements. In both cases, we get the materials with an important position in the restorative dentistry, as well as justification for their application.

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