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ISPITIVANJE ČVRSTINE VEZE IZMEĐU PLOČASTIH ZUBNIH PROTEZA I MATERIJALA ZA IZRADU MEKOG PODLAGANJA

STRENGHT TESTING OF THE RELATION BETWEEN PLATE DENTURES AND MATERIALS FOR MAKING SOFT LINERS

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Sažetak

Uvod. *Gubitak adhezije između zubne proteze izrađene od toplopolimerizovanog poli (metil metakrilata) i materijala za meko podlaganje (rezilijentan materijal) može dovesti do apsorpcije vode, naseljavanja bakterija, pa čak i gubitka funkcije same proteze.*
Cilj *rada bio je određivanje čvrstine veze između poli (metil metakrilata) i materijala za podlaganje proteze i njene zavisnosti od potapanja u vodeno kupatilo na temperaturi od 37°C.*
Materijal i metode*. Četiri materijala za meko podlaganje (2 na bazi mekanih akrilata i 2 silikonska elastomera) vezana su za toplo polimerizovani akrilat prema uputstvima proizvođača. Za ispitivanje čvrstine veze korišćeno je četrdeset uzoraka (po 10 za svaki tip podlaganja). Polovina uzoraka testirana je neposredno nakon pripreme (kontrolna grupa; n=5). Preostali uzorci potopljeni su u vodu na temperaturi od 37°C (eksperimentalna grupa; n=5) u trajanju od nedelju dana, nakon čega su testirani .*
Rezultati. *Čvrstina veze na uzorcima neposredno nakon izrade značajno je veća kod podlaganja na bazi silikona, u odnosu na meke akrilate. Čvrstina veze između poli (metil metakrilata) baze i sloja materijala za meko podlaganje jača je nakon jednonedeljnog potapanja u vodu temperature 37 °C.*
Zaključak. *Veći priraštaj čvrstina veze uočen je kod silikonskih elastomera u odnosu na meke akrilate. Nije bilo promene tipa loma uzoraka pre i nakon stajanja u vodi, izuzev kod GC Reline Soft materijala za meko podlaganje, gde je ujedno izmeren i najmanji priraštaj čvrstoće.*

Ključne reči: *materijali za meko podlaganje, pločasta zubna proteza, zatezna čvrstina veze, potapanje u vodi*

Abstract

Introduction. *In clinical practice, the loss of adhesion between the denture base resin and reliner might cause the loss of material softness, water sorption, bacterial colonization and functional failure of the prosthesis.*
Aim. *This study evaluated the effect of immersion on tensile bond strengths of four soft relining materials to a denture base acrylic resin.*
Material and methods. *Four soft lining materials were bonded to heat-polymerized acrylic resin according to the manufacturers' directions. Forty specimens for bond strength test (10 for each liner type) were fabricated. Half of them (control group; n=5) were tested immediately after the fabrication. The other twenty specimens were stored in water at 37°C (test groups; n=5) for one week and then tested.*
Results. *Bond strength of samples right after the fabrication is significantly higher in cases of the samples with silicone elastomer base reliner compared to the samples with soft acrylic base.*
Bond strength of soft reliners to a denture base resin increases after storing the samples in a water bath for one week at 37°C.
Conslusion. *Higher increment of tensile bond strength appeared for silicone elastomers in comparison with soft acrylic resins. There were no changes of failure mode except for GC Reline Soft application with the lowest tensile bond strength increment.*

Key words: *soft relining material, denture, tensile bond strength, water immersion*

Uvod

Toplo polimerizovani metakrilati predstavljaju najčešće korišćeni materijal za izradu

Introduction

Heat-cured methacrylate resins represent the material of choice for making the base plate

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pločastih zubnih proteza. Vremenom se koštani oslonac zubnih proteza menja usled resorpcije ili starosne atrofije. Uobičajena procedura podlaganja zubnih proteza podrazumeva upotrebu materijala čija su fizička, hemijska i mehanička svojstva identična ili vrlo slična materijalu od koga se izrađuje njihova baza. Podlaganje zubnih proteza može se izvesti trvdim ili mekim materijalima.

Prema hemijskom sastavu, rezilijentni materijali za podlaganje zubnih proteza mogu se podeliti na meke akrilate i silikonske elastomere. Osnovni polimer (prah) dvokomponentnog sistema mekih akrilata obično je poli - metil metakrilat (PMMA) ili poli - etil metakrilat. Tečnost predstavlja mešavinu 30-60% estarskih plastifikatora (dibutil ftalat, butil glikonat) i etanola kao rastvarača (4-60%)[1]. Plastifikatori koji se dodaju metakrilatima čine ih rezilijentnim na temperaturi tela[2]. Najčešća baza silikonskih elastomera jeste poli - dimetil siloksan ili poli - vinil siloksan. Silikonski elastomeri sadrže i do 40% silikonskog punjenja, što povećava njihovu otpornost na dejstvo različitih sila[3]. Rezilijentni materijali za podlaganje zubnih proteza pripremaju se na sobnoj temperaturi (hladno polimerizovani), kao i na višim temperaturama (toplo polimerizovani)[4,5].

Uloga mekih materijala za podlaganje (oralno tkivnih kondicionera), koji se dodaju na unutrašnju površinu zubnih proteza, jeste podjednaka distribucija mastikatornih sila, smanjenje preopterećenja sluzokože proteznog oslonca i poboljšanje retencije zubnih proteza[6]. Rezilijentni materijali formiraju viskoelastičan omotač na delovima proteze koji naležu na sluzokožu usne duplje. Kako su plastifikatori rastvorljivi u pljuvački, njihov postepeni gubitak i posledična apsorpcija vode dovode do očvršćavanja materijala u ustima pacijenta[6,7]. Željena svojstva mekih materijala za podlaganje zubnih proteza jesu biokompatibilnost prema oralnim tkivima, stabilnost oblika i boje, otpornost prema abraziji, kao i postojanost veze između sloja materijala i same proteze[4]. Gubitak adhezije između baze zubne proteze i materijala za podlaganje u kliničkoj praksi za posledicu ima očvšćavanje oralno tkivnih kondicionera, apsorpciju vode, bakterijsku kolonizaciju i lošu funkcionalnost zubnih proteza.

Podlaganje zubnih proteza mekim materijalima relativno je čest postupak u svakodnevnoj stomatoprotetskoj praksi. Iz tih razloga, koristan je svaki aspekt ispitivanja fizičkih, mehaničkih i hemijskih svojstava ovih materijala.

of mobile dentures. Denture support tissues change over time because of bone resorption or atrophy due to disease or aging. The usual procedure of denture relining involves the use of materials, whose physical and chemical properties are identical or very similar to the material of their base. Denture relining can be made with hard or soft resilient materials.

According to their chemical composition, soft relining materials can be divided into soft acrylics and silicone elastomers. The basic polymer (powder) of soft acrylic two-component system is usually poly(methyl methacrylate) or poly(ethyl methacrylate). The liquid is a mixture of ester plasticizers (dibutyl phthalate, butyl glycolate) consisting of 30-60% and ethanol as solvent, whose content is 4-60%[1]. Plasticizers, which are added to methacrylic resin make these materials resilient at body temperature[2]. The most common bases of silicons are poly(dimethyl siloxane) and poly(vinyl siloxane). Silicone elastomers contain up to 40% silica filler, which increases their resistance to the effects of different forces[3]. Soft relining materials are prepared at room temperature (cold-curing), or polymerized at a higher temperature (heat-curing)[4,5].

Denture soft relining materials (tissue conditioners) are applied to inner surface of dentures to achieve a more equal distribution of masticator forces, to reduce localized pressures and to improve denture retention[6]. Their role is the formation of a viscoelastic layer on the parts of the dentures which are in contact with oral mucous membranes. Plasticizers are soluble in oral fluids, and their gradual loss and water absorption consequently lead to material hardening in the patient's mouth[6,7]. Denture soft relining materials should be characterized by: biocompatibility toward the oral tissues, shape and color stability, resistance to abrasion, and durability of the junction between the lining and the denture[4]. In clinical practice, the loss of adhesion between the denture base resin and reliner may cause the loss of material softness, water sorption, bacterial colonization and functional failure of the prosthesis.

The application of soft denture reliners to denture base resin is often present in prosthodontic practice. Thus, every detail related to their physical, mechanical and chemical properties is useful for the dentists.

Cilj istraživanja bio je određivanje čvrstine veze (mehaničko svojstvo) između četiri materijala za meko podlaganje i toplopolimerizovanog PMMA pre i nakon jednonedeljnog stajanja u vodi konstantne temperature od 37 °C.

The aim of this study was to determine the bond strength (mechanical property) among four kinds of soft relining materials and warm polimerizing PMMA before and after being immersed for one week in the water, at constant temperature of 37^0C.

Materijal i metode

Kao predstavnik materijala za izradu pločastih zubnih proteza korišćen je toplopolimerovani akrilat Triplex Hot (Ivoclar Vivadent, Lihtenštajn). Meki materijali korišćeni u istraživanju prikazani su u tabeli 1.

Material and methods

Denture base resin material in this case was heat-cured acrylic (Triplex Hot, Ivoclar Vivadent, Liechtenstein). The resilient relining materials for denture base resin used in this study are listed in Table 1.

Tabela 1 / Table 1. Ispitivani materijali za meko podlaganje/ Tested soft relining materials

Denture soft relining material / Meki materijal za podlaganje proteze	Chemical type / Hemijski tip	Manufacturer / Izrada	Material type / Tip materijala
Bosworth Trusoft	poly (ethyl methacrylate)	Bosworth Company, USA	Cold-curing
Vertex Soft	poly (methyl methacrylate)	Vertex-Dental B.V., Netherlands	Heat-curing
Ufigel P	silicone elastomer	VOCO GmbH, Germany	Cold-curing
GC Reline Soft	silicone elastomer	GC Corporation, Japan	Cold-curing

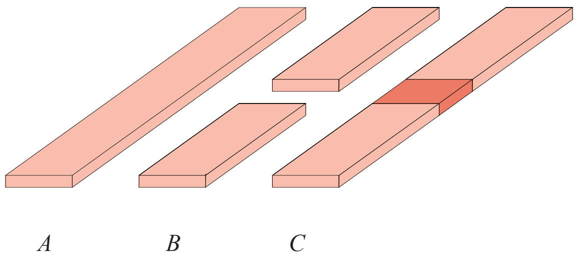
Po dva tipa mekih akrilata i silikonskih elastomera nanošena su u tankom sloju na uzorke od toplopolimerizovanog PMMA, nakon čega je merena zatezna čvrstina njihove veze i analiziran tip loma. Za izradu uzoraka korišćen je specijalan aluminijumski kalup sa poklopcem i poliranim unutrašnjim površinama, da bi se obezbedila glatkost uzoraka. Dimenzije gnezda kalupa iznosile su: dužina 50 mm, širina 15 mm i dubina 2 mm (slika 1).

Uzorci PMMA su pripremljeni prema uputstvu proizvođača toplom polimerizacijom unutar aluminijumskog kalupa. Nakon polimerizacije, višak materijala je odstranjen. Testerom sa vodenim hlađenjem isečen je središnji deo svakog uzorka širine 3 mm, nakon čega su nastala dva dela vraćena u gnezdo kalupa. Nastali prostor popunjen je mekim materijalom za podlaganje, što je šematski prikazano na slikama 1 i 2.

Polimerizacija materijala za meko podlaganje vršena je po uputstvu proizvođača. U slučaju silikonskih elastomera, nanošen je najpre odgovarajući adheziv na površinama spoja PMMA, a onda i sam materijal. Za svaki od

Two acrylic and two silicone-based, resilient denture reliners were applied to a heat-cured polymerized acrylic denture resin to assess the tensile bond strength at the liner denture base resin interface, as well as the failure mode after debonding. These materials were chosen because they appear to be among the more successful in common clinical use.

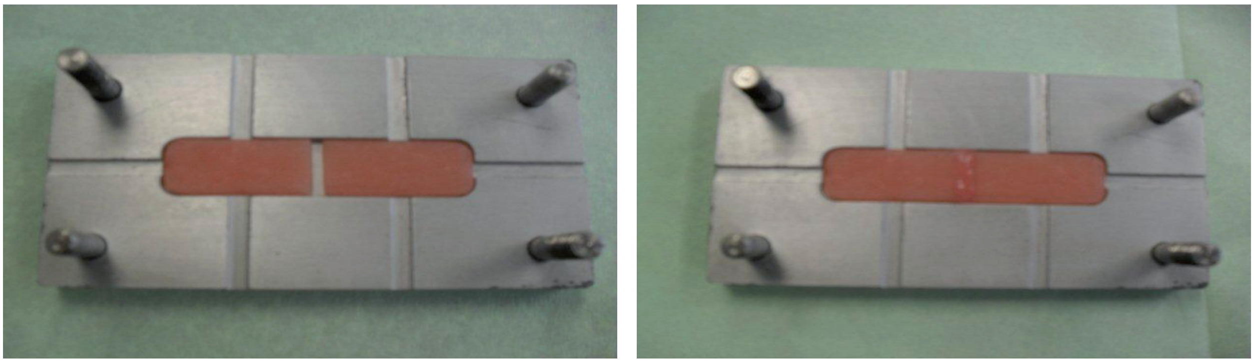
For tensile bond strength test of specimens, five identical molds made of aluminum were prepared. The molds were machined and polished so as to make the surface of the specimens smooth enough. The dimensions of the mold were: 50 mm in length, 15 mm in width and 2 mm in thickness (Figure 1). The heat-polymerized acrylic resin was processed according to the manufacturer's instructions. After polymerization, the samples were removed from the mold and any flash was trimmed with a sharp blade. Then, using a water-cooled edged saw, 3 mm of the material was cut from the thin midsection (Figure 1). The appearance of the mold is shown in Figure 2.



Slika 1/ Figure 1. Šematski prikaz pripreme uzoraka / Review of specimen preparation:
A: uzorak PMMA / PMMA acrylic resin block; B: prostor u središnjem delu / material removed from mid-section; C: popunjavanje prostora mekim materijalom za podlaganje / after application of soft denture reliner

Ten specimens with a cross-sectional area of 15 x 2 mm^2 were prepared for each tested soft reliner. Denture relining soft materials were strictly prepared according to the manufacturer's instructions. Silicone elastomer preparation required the use of an appropriate adhesive. Dimensions of the samples are shown in Figure 3.

The samples of each material were divided into two groups. Half of them (control group n=5) were tested immediately after polymerization. The other specimens were tested after one week storage in a water bath at 37°C (GFL, Germany) (test group n=5).



Slika 2. Priprema uzoraka u kalupu
Figure 2. Preparation of specimen in mold

(a) Uzorak sa isečenim središnjim delom; (b) Uzorak nakon polimerizacije podlagača
(a) Specimen with material removed from the mid-section; (b) Specimen after the application of the soft denture reliner

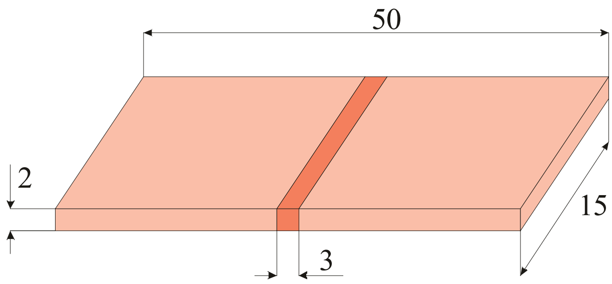
ispitivanih mekih materijala za podlaganje napravljeno je po deset uzoraka.

Dimenzije ispitivanih uzoraka prikazane su na slici 3.

Ispitivanje jedne polovine uzoraka izvršeno je neposredno nakon polimerizacije mekih materijala za podlaganje (kontrolna grupa, n=5), dok je druga polovina testirana nakon nedelju dana stajanja u vodenom kupatilu (GFL, Germany) temperature 37°C (eksperimentalna grupa; n=5).

Testiranje je izvedeno na univerzalnoj mašini za ispitivanje zatezanjem, pritiskom i savijanjem, pri konstantnoj brzini deformacije od 20 mm/min (slika 4). Uzorci su postavljani u stezni alat, a zatim opterećivani silom zatezanja sve do kidanja. Sila zatezanja merena je pomoću mernog pretvarača za silu (HBM Q11 10 kg, 16 mV/V) i snimana pomoću višekanalnog uređaja (Spider 8 HBM).

Kao parametar za upoređivanje i analizu rezultata korišćen je maksimalni napon koji se javlja na poprečnom preseku uzorka prilikom njegovog zatezanja. Pošto se pri tom naponu zatezanja kontinuitet uzorka najčešće preki-



Slika 3. Dimenzije uzorka za ispitivanje (mm)
Figure 3. Dimensions of the specimen for tensile bond test (mm)

The samples were placed under tension, until failure, in the universal testing machine using a crosshead speed of 20 mm/min (Figure 4). The tensile force was measured using a load cell (HBM Q11 10 kg, 16 mV/V) and recorded by multi-channel electronic PC measurement unit (Spider 8 HBM).

An ultimate tensile stress was elected as a parameter for comparing. The stress was calculated as the maximum tensile force divided by the cross-sectional area of the sample (15 x 2 mm^2). Since the stress was maximal da na površini spoja materijala za podlaganje i PMMA, to se on može označiti kao zatezna čvrstina veze. Čvrstoća veze predstavljena je količnikom maksimalne sile zatezanja i površine poprečnog preseka uzorka (15 x 2 mm^2). Izračunate su srednje vrednosti zatezne čvrstine veze i standardne devijacije za grupe od po pet uzoraka. Tip loma uzorka određen je na osnovu pregleda površine loma na optičkom mikroskopu i definisan kao adhezivni, kohezivni ili kombinovni lom, sve u zavisnosti od toga da li je i u kojoj meri došlo do „odlepljivanja“ materijala za podlaganje od PMMA.

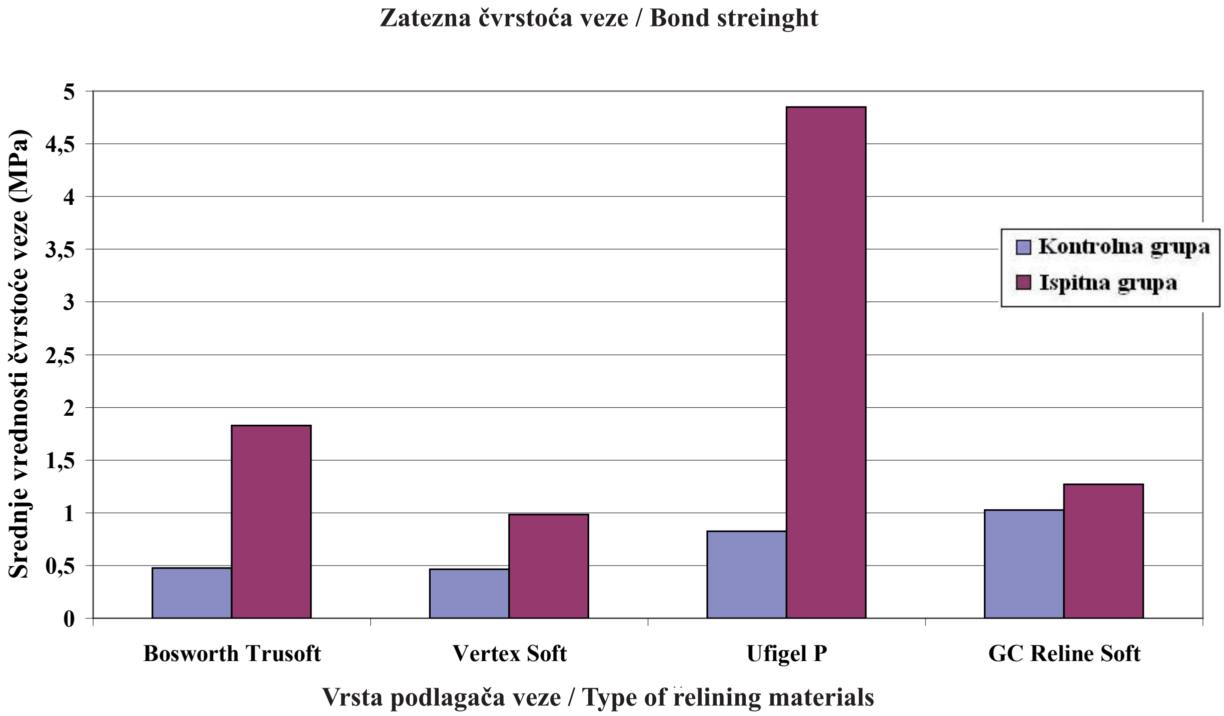
Slika 4. Ispitivanje zatezanjem na univerzalnoj mašini
Figure 4. Tensile test performing

Rezultati

U okviru ovog ispitivanja, četrdeset uzoraka materijala zatezano je do kidanja. Srednje vrednosti čvrstina veza i standardnih devijacija za četiri kontrolne i četiri ispitivane grupe, kao i tipovi loma, prikazani su u tabeli 2.

Tabela 2 / Table 2. Srednje vrednosti čvrstina veza i standardnih devijacija i tipovi loma uzoraka / Mean values, standard deviations and mode of failure of samples

Soft reliner material / Meki materijal za podlaganje	Chemical base / Hemijska osnova	Mean values of bond strength (MPa) / Srednja vrednost čvrstoće veze	Standard deviation (%) / Standardna devijacija (SD)	Failure mode / Tip loma
Non-treated samples (control groups) / Netretirani uzorci (kontrolna grupa)				
Bosworth Trusoft	soft acrylic / meki akrilat	0.42	2.6	combined / kombinovani 80 % cohesive / kohezivni 20 %
Vertex Soft		0.46	3.9	adhesive / athezivni 100 %
Ufigel P	silicone elastomer / silikonski elastomer	0.85	4.5	adhesive / athezivni 100 %
GC Reline Soft		1.17	5.6	adhesive / athezivni 100 %
Immersed samples (test groups) / Potapani uzorci (testirane grupe)				
Bosworth Trusoft	soft acrylic / meki akrilat	1.85	5.5	adhesive / athezivni 100 %
Vertex Soft		0.98	4.3	cohesive / kohezivni 60 % combined / kombinovani 40%
Ufigel P	silicone elastomer / silikonski elastomer	4.69	2.5	cohesive / kohezivni 60 % adhesive / athezivni 40 %
GC Reline Soft		1.25	4.1	adhesive / athezivni 100 %

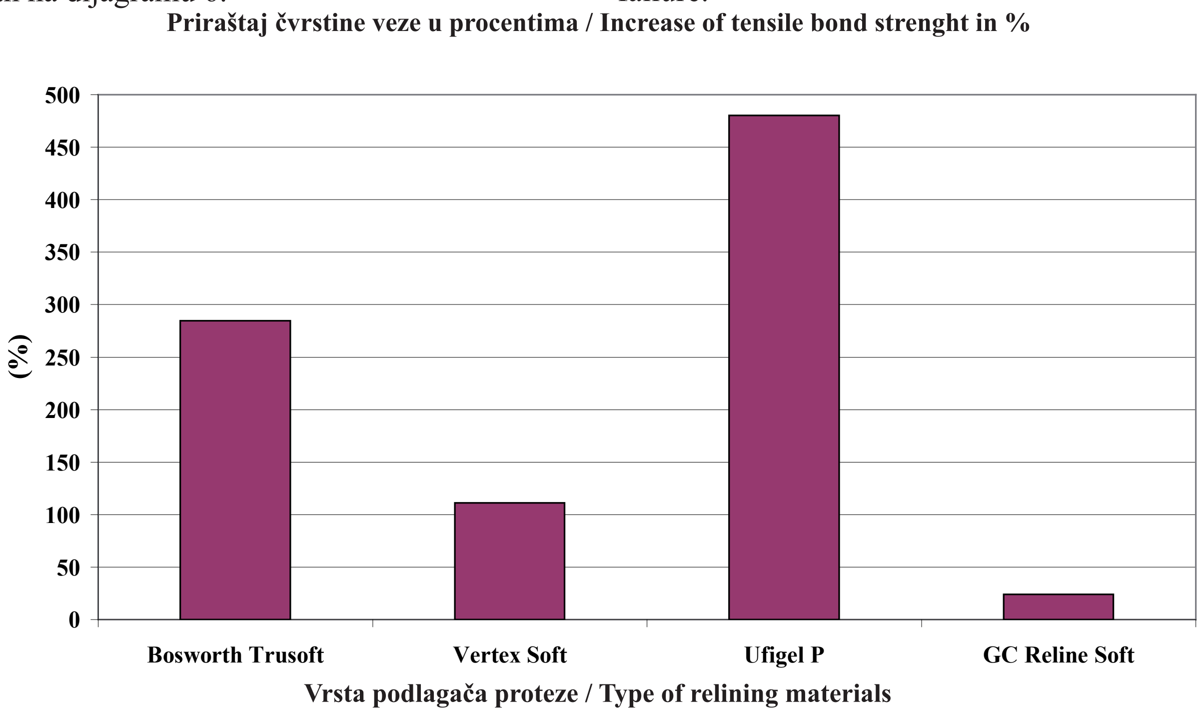


Dijagram 5. Srednje vrednosti zateznih čvrstoća veza u Mpa
Figure 5. Means of tensile bond strength for tested materials in Mpa

Na dijagramu 5 nalazi se grafički prikaz srednjih vrednosti čvrstina veza između materijala za podlaganje i akrilatne baze.

Priraštaj srednjih vrednosti zateznih čvrstina veza između ispitivanih materijala i toplopolimerizovanog PMMA dat je u tabeli 3 i prikazan na dijagramu 6.

(the samples were broken), it could be noted as tensile bond strength. Mean values of tensile bond strengths and standard deviations were determined for all materials. The type of failure was observed using an optical microscope and was marked as cohesive, adhesive or combined failure.



Dijagram 6. Priraštaji čvrstine veza nakon stajanja u vodi, izraženi u %
Figure 6. Increase of tensile bond strength after immersion in %

Tabela 3 / Table 3. Priraštaj čvrstine veze nakon stajanja u vodi / Increase of tensile bond strength after immersion

Soft reliner material / Materijal za meko podlaganje	Chemical base / Hemijska osnova	(MPa)	(%)
Bosworth Trusoft	soft acrylic / meki akrilat	1.35	285
Vertex Soft		0.52	111
Ufigel P	silicone elastomer / Silikonski elastomer	4.00	480
GC Reline Soft		0.25	24

Diskusija

Pacijenti često pokazuju preosetljivost na tvrdu bazu zubne proteze kako zbog tanke i relativno nerezilijentne oralne sluzokože, tako i usled uznapredovale alveolarne resorpcije. Efikasnost mekih materijala za podlaganje zavisi od trajanja njihove viskoelastičnosti. Prema podacima iz literature, klinički su postojaniji materijali na bazi silikona[8]. Jedan od najozbiljnijih problema u vezi sa materijalima za meko podlaganje je njihovo odvajanje od toplo polimerizovane baze pločaste zubne proteze. Mesto prekida spoja predstavlja potencijalnu površinu za rast bakterija, Candide albicans, stvaranje plaka i kamenca[6].

Komponente male molekularne mase (plastifikatori) se vremenom iz materijala oslobađaju u usnu duplju. U isto vreme, polimer apsorbuje tečnost iz usne duplje tako da postaje čvršći[9,10]. Veza između baze zubne proteze i materijala za podlaganje tako postaje jača[11,12]. Ovo istraživanje je, dakle, imalo za cilj simulaciju uslova koji realno postoje u usnoj duplji pacijenta.

Hipoteza da se čvrstina veze povećava nakon potapanja uzoraka u vodeno kupatilo na 37°C je potvrđena, što se može uočiti na dijagramu 5. Na istom dijagramu se lako zapaža da je čvrstina veze neposredno nakon pripreme značajno veća kod silikonskih materijala za podlaganje u odnosu na akrilatne. Činjenica je da se između materijala za podlaganje na bazi akrilata i PMMA, zbog sličnog hemijskog sastava formira hemijska veza. Iz tih razloga, očekivana je veća čvrstina veza između materijala za podlaganje na bazi akrilata i toplo polimerizovanog PMMA.

Results

In total, forty specimens were tested. The mean values of tensile bond strength, standard deviations and modes of failure for both four control groups and four test groups are shown in Table 2. Graphic representation of the mean values of tensile bond strength is shown in Figure 5. The increase of means tensile bond strengths is given in Table 3, and graphically presented in Figure 6 and Table 3.

Discussion

Some edentulous patients cannot tolerate a hard denture base due to the thin and relatively non-resilient oral mucosa or severe alveolar resorption. The efficiency of soft relining materials depends on both viscoelasticity and durability. In terms of durability, the silicones are preferred[8]. One of the most serious problems with soft relining materials is bond failure between the denture relining and the heat-curing denture base. Bond failure creates a potential surface for bacterial and Candida albicans growth, plaque and calculus formation[6].

Over time, the low molecular weight components (plasticizers) are leached out. At the same time, water from oral cavity is absorbed into the polymer which becomes harder[9,10]. The bond between the denture base and relining material becomes stronger, too[11,12]. This experiment simulated the conditions which exist in reality in the oral cavity of the patient.

The hypothesis that mean bond strength increases after storing the samples in a water bath for one week at 37°C is confirmed. That fact can be noted easily from Figure 5. Also, the same diagram clearly shows that the bond strength of samples right after fabrication with silicone elastomer base reliner is significantly higher than in others with soft acrylic base. On the other hand, a chemical bond is formed between the acrylic-based denture relining materials and PMMA denture base polymer, due to similar chemical compositions. For these reasons, a stronger bond between acrylic based reliner and heat curing PMMA was expected.

Since silicone reliners have little or no chemical bond to PMMA, an adhesive (primer) was supplied to improve the join between the reliner and polymerized denture base. Therefore, the highest bond strength on the non-

Kako je hemijska veza između silikonskih elastomera i PMMA slaba ili uopšte ne postoji, u toku pripreme se koristi adheziv (prajmer) u cilju poboljšanja veze polimerizovane baze zubne proteze i materijala za podlaganje. Najverovatnije je zbog toga najveća čvrstina veze na kontrolnim uzorcima izmerena kod primene GC Reline Soft materijala na bazi silikona i iznosi 1,17 MPa. Najmanja čvrstina javila se prilikom primene mekog materijala na bazi akrilata Bosworth Trusoft i to 0,42 MPa. Vrednosti čvrstine veze neposredno nakon izrade uzoraka sa mekim podlaganjem na bazi akrilata bile su približne za oba ispitivana materijala (oko 0,45 MPa).

U slučaju eksperimentalnih uzoraka materijala, najveća čvrstina nađena je kod Ufigel P (4,69 MPa), a najmanja kod Vertex Soft (0,98 MPa).

Na dijagramu 6 i u tabeli 3 mogu se videti priraštaji čvrstina nakon jednonedeljnog stajanja uzoraka u vodi temperature 37°C. Očigledno je da je najveći priraštaj čvrstine zabeležen kod podlaganja materijalom Ufigel P (480 %), a najmanji kod GC Reline Soft (24 %), oba iz grupe silikonskih elastomera.

Što se tiče tipa loma epruveta pre i nakon stajanja u vodi, promena nije zabeležena jedino kod GC Reline Soft, gde je ujedno i najmanji priraštaj čvrstine. Kod preostala tri meka materijala za podlaganje tip loma se menjao (tabela 2).

Zaključak

Uzimajući u obzir ograničenja prilikom eksperimentalnog dela istraživanja, a na osnovu merenja može se zaključiti:

- Čvrstina veze je značajno veća kod podlaganja na bazi silikona, u odnosu na pločaste proteze podlagane mekim akrilatima.
- Čvrstina veze između PMMA baze i sloja materijala za podlaganje jača je nakon stajanja nedelju dana u vodi temperature 37 °C.
- Najveći priraštaj čvrstine nakon potapanja javlja se kod Ufigel P.
- Najmanji priraštaj čvrstoće nakon potapanja javlja se kod GC Reline Soft.
- Nije bilo promene tipa loma uzoraka pre i nakon stajanja u vodi, izuzev kod GC Reline Soft, gde je ujedno i najmanji priraštaj čvrstine veze.

treated samples is measured with application of GC Reline Soft (1.17 MPa). The smallest one appears with Bosworth Trusoft application (0.42 MPa). Both materials with soft acrylic base have approximately equal values of mean strengths before immersion.

In the case with water immersed samples, the highest bond strength appears with the application of Ufigel P (4.69 MPa), and the lowest one with Vertex Soft application (0.98 MPa).

Table 3 and Figure 6 show that the highest increment of tensile bond strength is for Ufigel P reliner application (480 %). The opposite situation occurs for GC Reline Soft use (24 % tensile bond strength increment).

There are no changes of failure mode only for GC Reline Soft application with the lowest tensile bond strength increment. In other three cases, the type of failure is changed (Table 2) after water immersion of samples.

Conclusion

Within the limits of this experimental research, the following conclusions can be drawn:

- Bond strength of samples right after fabrication is significantly higher in cases of the samples with silicone elastomer base reliner compared to the samples with soft acrylic base.
- The highest increment of bond strength of soft reliners to a denture base resin increases after storing the samples in a water bath for one week at 37°C.
- Tensile bond strength appears for Ufigel P reliner application.
- The lowest increment of tensile bond strength occurs for GC Reline Soft use.
- There are no changes of failure mode only for GC Reline Soft application with the smallest tensile bond strength increment.

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