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The impact of irrigation procedures on the bond strength of fiber posts cemented with two different adhesive techniques

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SUMMARY

Introduction Endodontically treated teeth are usually weaker due to the loss of tooth structure. As most of the crown of the tooth is destroyed, the most common retention for restoration is application of a fiber-reinforced composite posts in the root canal. In endodontically treated teeth, there are two main problems in the restorative procedure: reduced resistance of the remaining tooth structure and choosing the necessary adequate retention for restoration. The aim of this work was to evaluate the impact of irrigation protocol on the bond strength of two types of fiber posts luted with two different adhesive cements.

Materials and method In this *in vitro* study, 48 single-rooted teeth (incisors, single-rooted second premolars) extracted for orthodontic and periodontal reasons were used. The teeth were divided into the four groups of 12 teeth depending on the type of fiber post used as well as the irrigation agent. Each group was further divided into the two subgroups of six teeth depending on the material and cementation technique.

Results In all cross-sectional statistics the difference appeared only when different types of irrigants were used and they changed bond strength between dentin and bonding material.

Conclusions Irrigation protocol has a significant influence on the bond strength of composite post, independent of the type of post and cementation material used.

Keywords: irrigants; dual-polymerizing cements; composite post

INTRODUCTION

Prognosis of endodontically treated teeth depends not only on the success of endodontic treatment, but also on the type of restoration as these teeth suffer a lot tooth structure loss. Often a post is required as the part of restorative process. Surface treatment of dentin with different irrigants can change chemical and structural composition of dentin, changing its characteristics of permeability and solubility that affect adhesion of materials on the dentin surface [1, 2, 3].

The use of irrigats before starting the bonding procedure can affect adhesion because it changes the properties of the hydrophilic resins. Sodium hypoclorite (NaOCl) and ethylenediamine tetraacetic acid (EDTA) are irrigants commonly used during endodontic treatment. NaOCl is used due to its antibacterial properties, as well as its ability to dissolve the organic part of the smear layer [4, 5, 6]. While EDTA is a chelating agent that binds calcium ions from dentin and enables its easier instrumenting. Adhesion of radicular dentin can be influenced by many factors such as the presence and thickness of smear layer, more difficult light curing, moisture control, the application of adhesive and viscosity of cements [7, 8].

Composite posts reinforced with glass fibers are commonly used for post-endodontic restorations, mainly due to their favorable physical properties, ie. the modulus of elasticity which is similar to dentin. Adhesion of fiber posts to radicular dentin can be influenced by various factors, such as the presence and thickness of residual smear layer after root canal instrumentation, the type of irrigants used, intracanal medications and lubricants, the use of eugenol-based agents, (local analgesics), as well as geometric factors [9, 10]. Materials used for cementing fiber posts and their bonding to the dentin can be influenced by the irrigants used during chemo-mechanical instrumentation of the root canal.

The aim of this work was to evaluate the impact of irrigation protocol on the bond strength of two types of fiber posts luted with two different adhesive cements.

MATERIAL AND METHOD

The tests were carried out at the Clinic for Dental Diseases and Endodontics at the Faculty of Dentistry in Skopje, UKIM and the Faculty of Mechanical Engineering, UKIM, Skopje. For this *in vitro* study, 48 single-rooted teeth (incisors, single-rooted second premolars) extracted for orthodontic and periodontal reasons were used.

During endodontic treatment, root canals were prepared manually using the step-back technique to an apical

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Table 1. Types of fiber posts, irrigants and adhesive systems used in the study
Tabela 1. Vrste kompozitnih kočića, iriganasa, adhezivnih sistema koji su korišćeni u studiji

	Type of fiber post Vrsta kompozitnih kočića	Irrigants Irigansi	Adhesives Adhezivi
1	FRC Postec Plus Ivoclar Vivadent Inc., Schaan, Liechtenstein	NaOCl	SpeedCEM™ Self-Etch
			Variolink + Excite Total Etch
2	FRC Postec Plus Ivoclar Vivadent Inc., Schaan, Liechtenstein	NaOCl + EDTA	SpeedCEM™ Self-Etch 2.1
			Variolink + Exite Total Etch 2.2
3	Ever Stick GC America	NaOCl	SpeedCEM™ Self-Etch 4.1
			Variolink + Exite Total Etch 4.2
4	Ever Stick GC America	NaOCl + EDTA	SpeedCEM™ Self Etch 5.1
			Variolink + Excite Total Etch 5.2

size of ISO 40. After changing each instrument, root canals were rinsed with 5 ml of 2.5% NaOCl solution. The root canals were dried with paper points (Dentsply Maillefer, Tulsa, Okla., USA) and filled with gutta-percha and AH Plus sealer (Dentsply Caulk, Milford, Del., USA) using cold lateral-compaction technique.

Then the teeth were divided into the four groups of 12 teeth depending on the type of fiber post (FRC Postec Plus /Ivoclar and Ever Stick /GC) as well as the irrigation agent used (NaOCl and NaOCl + EDTA). Each group was divided into the two subgroups of six teeth depending on the material and cementation technique (Table 1).

After obturation, the samples were properly prepared and appropriate composite posts were cemented, depending on the group and subgroup, according to the previously determined work protocol (Table 1). In the subgroup **a**, the posts were cemented with SpeedCEM™(Ivoclar Vivadent Inc., Schaan, Liechtenstein) using the self-etch technique, while in the samples from subgroup **b** the posts were cemented with Variolink (Ivoclar Vivadent Inc., Schaan, Liechtenstein) and Exite as adhesive, using total etch technique.

After endodontic treatment and cementing the composite posts, all samples were firstly invested in plastic molds (FIXI FORM, STRUCTURES), with an internal diameter of 25 mm and a height of 25 mm and are made of PVC (polyvinyl chloride) ISO 3698.

All teeth during casting were secured with bonding wax to the substrate in the center of the mold. Two-component transparent acrylate ORTO POLI (POLIDENT DOO, Slovenija) was used for embedding the samples. We left the embedded samples for 3 hours at room temperature to harden. After removing embedded samples from plastic molds, we proceeded to cutting, i.e., extraction of cross-sections which were further used to examine the bond strength between dentin and post using the Push Out Method. For cutting the sample we used the ISOMET 1000 machine. Examination of the bond strength between the composite post and hard dental tissues, was made with a Push-out test at the Faculty of Mechanical Engineering – Skopje. Obtained results were statistically processed with the statistical package Excel ANOVA 2016 and SPSS.

RESULTS

The results obtained from this study are shown in Table 2. The highest values of the bond strength with the push out test were obtained in the group of teeth where we applied a GC Ever stick posts in combination with Variolink / Excite with Total Etch technique, and NaOCl / EDTA as irrigant (3.12 MPa), while the lowest values were obtained in the

Table 2. The effect of irrigation agents and cementation materials on the bond strength of fiber posts with dentin
Tabela 2. Uticaj sredstava za irigaciju i materijala za cementiranje na čvrstoću veze kompozitnih kočića sa dentinom

	Type of fiber post Vrsta kompozitnih kočića	Irrigants Irigansi	Adhesives Adhezivi	Average value Srednja vrednost μTBS (MPa)	Minimum value Minimalna vrednost (MPa)	Maximum value Maksimalna vrednost (MPa)
1	FRC Postec Plus Ivoclar	NaOCl	SpeedCEM™ Self-Etch	0.76	0.45	1.23
			Variolink + Excite Total Etch	1.118	0.78	1.55
2	FRC Postec Plus Ivoclar	NaOCl + EDTA	SpeedCEM™ Self-Etch	1.36	0.88	1.97
			Variolink +Exite Total Etch	1.59	1.06	2.45
3	GC Ever stick	NaOCl	SpeedCEM™ Self-Etch	1.11	0.55	1.54
			Variolink +Exite Total Etch	1.383	0.86	2.19
4	GC Ever stick	NaOCl + EDTA	SpeedCEM™ Self Etch	1.536	0.96	2.27
			Variolink + Excite Total Etch	2.185	1.09	3.12

Table 3. Assessment of bond strength between the groups according to different irrigation protocol
Tabela 3. Jačina veze između grupa prema različitim protokolima irigacije

Values Vrednosti	N	Mean Srednja vrednost	Std. Deviation Standardna devijacija	Std. Error Standardna greška	95% Confidence Interval for Mean 95% Interval pouzdanosti za srednju vrednost		Minimum Minimum	Maximum Maksimum
					Lower Bound Donja granica	Upper Bound Gornja granica		
NaOCL	24	1.0933	0.43456	0.08870	0.9098	1.2768	0.45	2.19
NaOCL+ EDTA	24	1.6721	0.67013	0.13679	1.3891	1.9551	0.88	3.12
Total Ukupno	48	1.3827	0.63063	0.09102	1.1996	1.5658	0.45	3.12

Table 4. Bond strength between the groups according to the cementing materials and adhesive techniques
Tabela 4. Jačina veze između grupa prema materijalima za cementiranje i adhezivne tehnike

Values Vrednosti	N	Mean Srednja vrednost	Std. Deviation Standardna devijacija	Std. Error Standardna greška	95% Confidence Interval for Mean 95 % Interval pouzdanosti za srednju vrednost		Minimum Minimum	Maximum Maksimum
					Lower Bound Donja granica	Upper Bound Gornja granica		Lower Bound Donja granica
SpeedCEM Self-Etch	36	0.9900	0.51717	0.08619	0.8150	1.1650	0.35	2.27
Variolink Exicte Total-Etch	36	1.2478	0.73574	0.12262	0.9988	1.4967	0.37	3.12
Total Ukupno	72	1.1189	0.64463	0.07597	0.9674	1.2704	0.35	3.12

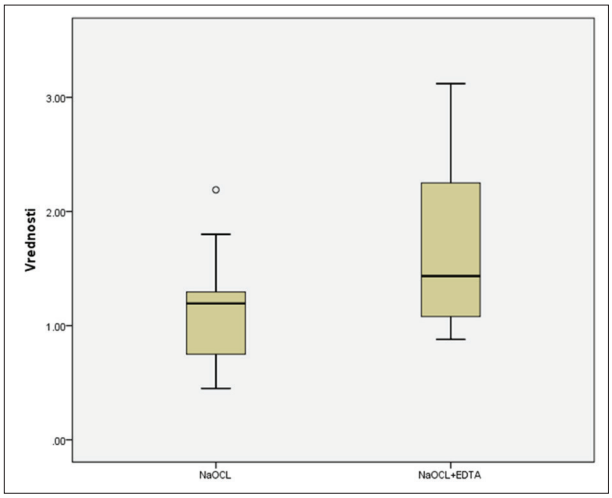

Figure 1. Cross-statistics for bond strength between the groups according to different irrigation protocols
Slika 1. Unakrsna statistika za jačinu veze između grupa prema različitim protokolima irigacije

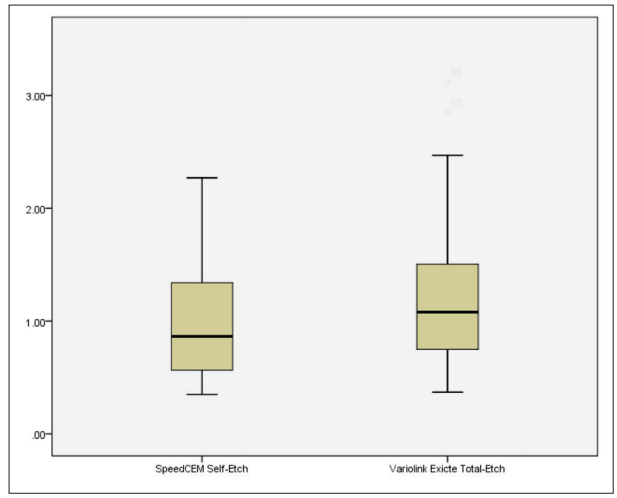

Figure 2. Cross-statistics for bond strength between the groups according to the cementing materials and adhesive techniques
Slika 2. Unakrsna statistika za jačinu veze između grupa prema materijalima za cementiranje i adhezivnim tehnikama

samples where we applied the FRC Postec Plus Ivoclar posts in combination with SpeedCEM™, Self-Etch technique and NaOCl as irrigant (1.23 Mpa).

Table 3 and Figure 1 show the results of cross-statistics between the groups where we used the same fiber posts, the same cements and the same adhesive technique (self-etching and complete etching) but different irrigants (NaOCl with NaOCL and EDTA). We obtained values of p=0.001. As p was < 0.05, that indicates that there is a significant difference between these groups where we used different irrigants.

Table 4 and Figure 2 show the results of cross-statistics of the groups where we used the same composite post FRC Postec Plus Ivoclar and GC Ever Stick, the same irrigants (NaOCl, NaOCl with EDTA), and different cements and adhesive techniques (SpeedCEM with the technique of self-etching, and Variolink cement with total etching technique), where we obtained p=0.090, i.e. p>0.05. This indicates that there was no statistically significant difference in the bond strength between the composite post and dentin, depending on the type of cement used.

DISCUSSION

Several studies have been performed to evaluate the bond strength of fiber posts to root dentin. In intraradicular dentin, a smear layer is attached to the surface after instrumentation with endodontic files [11, 12, 13].

Radicular smear layer acts as a barrier, partially obstructing and sealing dentinal tubules (smear plugs), reducing dentin permeability by up to 86%, making it difficult for substances used as intracanal medication to diffuse, preventing the penetration of the endodontic sealers into the dentinal tubules, as wells hindering the diffusion of monomers into dentinal tubules during adhesive procedure. Thus, its removal is commonly recommended in the literature [14–18].

Irrigation solutions used during endodontic therapy, which have the main objective of cleaning the root canal, can facilitate the reduction and removal of the smear-layer due to their antimicrobial, solvent and chelating actions [12, 19, 20].

Although irrigants used in endodontic therapy are known to affect adhesion, less is known about how they affect the relationship between the tooth and the fiber post.

In our study, a comparison was made between the bond strength of two types of fiber posts cemented with different types of cements, different adhesive techniques, while the root canal was irrigated with different types of irrigants.

The results showed that the use of sodium hypochlorite in combination with EDTA as an irrigant gave the highest bond strength regardless of the cementation technique used and the type of post.

For the groups where sodium hypochlorite and EDTA were used as irrigation agents, we obtained a higher bond strength in the total etching adhesive system than in the self-etching adhesive system, which is still in correlation with the study of Zorba et al., who concluded that the application of 17% EDTA with 5.25% sodium hypochlorite after spatial preparation for composite post increased the strength of self-adhesive cement more than the strength of self-etching cement. The explanation for the reasons was the removal of the secondary residual layer before the cementation of the post and chemical bond of self-adhesive cement [19].

In contrast, Demiryürek et al. concluded that sodium hypochlorite reduces the bond strength of self-etching cement [20]. Similarly, Goracci et al. showed that extracting bond strength of self-adhesive cement can be compared to that of self-etching cement [21].

In all cross-sectional statistics in the groups where we used two types of composite posts and different adhesive techniques, the difference appeared only when different types of irrigants were used and they changed bond strength between dentin and bonding material, thus the first objective where the influence of the effects of irrigation on the bond strength of the two composite posts with the dentin were evident only in the cases of the cross-sectional statistics.

Cementing materials reacted differently only with the application of the different irrigants that we used on the strength of the two types of composite posts.

Solutions such as sodium hypochlorite (NaOCl), ethylenediamine tetra acetic acid (EDTA), chlorhexidine gluconate (CHX) and peracetic acid (PAA) help in removing organic and inorganic elements from smear-layer. They are used during and after endodontic instrumentation, improving the cutting efficiency of the instruments.

According to J.F.C. Lima various irrigation techniques did not exert any influence on the bond strength of intra radicular posts luted with self-adhesive luting agent 24 hours after endodontic treatment when dentin affected by the auxiliary chemical substance was removed before cementation [22].

In cross-sectional statistical analysis in our study, adhesive techniques did not show significant differences in the bond strength of dentin and posts that were used.

The treatment of dentin surface initially implies efficient removal of the root smear layer, followed by the infiltration of adhesive monomers. To this end, etch-rinse (ER)and self-etch (SE) strategies can be used. However, as SE systems are composed of weak acids, they are not as effective as ER systems in removing root smear layer. ER systems are most commonly used adhesive systems for the treatment of root dentin, because in addition to more effective removal of the smear layer, a more uniform demineralization pattern is obtained [23, 24, 25].

CONCLUSIONS

Based on our research we can conclude that irrigation protocol has a significant influence on the bond strength of composite post, independent of the type of post and cementation material used.

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Uticaj irigacije na jačinu veze kompozitnog kočića pričvršćenog dvema različitim adhezivnim tehnikama

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KRATAK SADRŽAJ

Uvod Endodontski lečeni zubi su obično oslabljeni zbog gubitka strukture zuba. Često je veći deo krune zuba uništen, pa je najčešća retencija za restauraciju primena kompozitnih kočiča ojačanih vlaknima u kanalu korena. Kod endodontski lečenih zuba postoje dva glavna problema u postupku restauracije, a to su: smanjena otpornost preostale zubne strukture i problem izbora neophodne adekvatne retencije za restauraciju.

Cilj ovog rada je da se proceni uticaj protokola za irigaciju na jačinu veze dve vrste kompozitnih kočića cementiranih sa dva različita adhezivna cementa.

Materijal i metode Za ovu *in vitro* studiju korišćeno je 48 jednokorenih zuba (sekutića, jednokorenih drugih pretkutnjaka) ekstrahovanih iz ortodontskih i parodontalnih razloga. Zatim su zubi podeljeni u četiri grupe od po 12 zuba u zavisnosti od vrste kompozitnog kočića i korišćenog sredstva za irigaciju. Svaka grupa je podeljena u dve podgrupe od po šest zuba u zavisnosti od materijala i tehnike cementiranja.

Rezultati U svim statistikama preseka u grupama gde smo koristili dve vrste kompozitnih kočića i različite adhezivne tehnike, razlika se pojavila samo kada su korišćeni različiti tipovi iriganata koji su menjali jačinu veze između dentina i vezivnog materijala.

Zaključak Na osnovu našeg istraživanja možemo zaključiti da protokol irigacije ima značajan uticaj na jačinu veze kompozitnog kočića, nezavisno od vrste kočića i materijala za cementiranje koji se koristi.

Ključne reči: irigansi; dvojno polimerizirajući cement; kompozitni kočići

UVOD

Prognoza endodontskog tretmana zuba ne zavisi samo od uspeha endodontskog lečenja već i od vrste nadoknade samih zuba. Ti zubi su oslabljeni samim tretmanima i gubitkom strukture zuba. Često je potrebna intervencija sa kočićem u korenu zuba kao deo procesa restauracije.

Površinski tretman dentina različitim irigansama može da promeni hemijski i strukturni sastav dentina, menjajući njegove karakteristike trajnosti i rastvorljivosti koje utiču na adheziju materijala na dentinskoj površini [1, 2, 3].

Upotreba sredstava za irigaciju pre početka postupka vezivanja može uticati na adheziju jer menja svojstva hidrofilnih smola.

Natrijum-hipohlorid (NaOCl) i etilendiamin-tetrasirćetna kiselina (EDTA) supstance su koje se obično koriste tokom endodontskog lečenja. NaOCl se koristi zbog svojih antibakterijskih svojstava, kao i zbog sposobnosti da rastvara organski deo razmaznog sloja [4, 5, 6], dok je EDTA helatni agens koji vezuje jone kalcijuma iz dentina i omogućava njegovu lakšu obradu.

Na adheziju radikularnog dentina mogu uticati mnogi faktori kao što su prisustvo i debljina endodontskog razmaznog sloja, teža svetlosna polimerizacija, kontrola vlage, nanošenje adheziva i viskoznost cementa [7, 8].

Kompozitni kočići ojačani staklenim vlaknima najčešće se koriste za postendodontske nadoknade, uglavnom zbog svojih povoljnih fizičkih svojstava (modul elastičnosti koji je sličan dentinu). Na adheziju vlakana na radikularni dentin mogu uticati različiti faktori, kao što su prisustvo i debljina rezidualnog razmaznog sloja nakon preparacije kanala korena zuba, vrsta korišćenih iriganasa, intrakanalni medikamenti i lubrikanti, upotreba sredstava na bazi eugenola (lokalni analgetici), kao i geometrijski faktori [9, 10].

Na materijale koji se koriste za cementiranje kompozitnih kočića i njihovo vezivanje za dentin mogu uticati irigansi koji se koriste tokom hemomehaničke preparacije kanala korena tokom endodontskog lečenja, a koji su predmet ovog istraživanja.

Cilj ovog rada je da se proceni uticaj protokola za irigaciju na jačinu veze dva tipa kompozitnih kočića cementiranih sa dva različita adhezivna cementa.

MATERIJAL I METODE

Za realizaciju postavljenih ciljeva ispitivanja su obavljena na Klinici za bolesti zuba i endodonciju pri Stomatološkom fakultetu u Skoplju, UKIM i Mašinskom fakultetu UKIM, Skoplje. Za ovu *in vitro* studiju korišćeno je 48 jednokorenih zuba (sekutića, jednokorenih drugih pretkutnjaka) ekstrahovanih iz ortodontskih i parodontalnih razloga.

Tokom endodontskog tretmana, kanali korena su ručno pripremljeni tehnikom *step-back* do apikalne veličine ISO 40. Nakon promene svakog instrumenta, kanali korena su isprani sa 5 ml 2,5% rastvora NaOCl. Kanali korena su osušeni papirnim štiftovima (Dentsply Maillefer, Tulsa, Okla, USA) i punjeni gutaperkom i materijalom za punjenje AH Plus (Dentsply Caulk, Milford, Del., USA) tehnikom hladne lateralne kondenzacije. Zatim su zubi podeljeni u četiri grupe od po 12 zuba u zavisnosti od vrste korišćenog kompozitnog kočića (FRC Postec Plus / Ivoclar i Ever Stick / GC) kao i sredstva za irigaciju (NaOCl i NaOCl + EDTA).

Svaka grupa je podeljena u dve podgrupe od po šest zuba u zavisnosti od materijala i tehnike cementiranja (Tabela 1).

Posle opturacije uzorci su propisno pripremljeni i na njih su cementirani odgovarajući kompozitni kočići, u zavisnosti od grupe i podgrupe, prema prethodno utvrđenom protokolu rada (Table 1). U podgrupi a, kompozitni kočići su cementirani tehnikom samonagrizanja SpeedCEM™ (Ivoclar Vivadent Inc., Schaan, Liechtenstein), dok su u uzorcima iz podgrupe b kompozitni kočići cementirani Variolinkom (Ivoclar Vivadent Inc.,

Schaan, Liechtenstein) i adhezivom Exite, tehnikom totalnog jetkanja.

Nakon endodontskog tretmana i cementiranja kompozitnih kočića, svi uzorci su prvo uloženi u plastične kalupe (Fixi form, konstrukcije) koji su unutrašnjeg prečnika 25 mm i visine 25 mm i izrađeni od PVC (polivinil-hlorida) ISO 3698.

Tokom livenja svi zubi su pričvršćeni voskom za vezivanje za podlogu u centru kalupa. Za ugradnju uzoraka korišćen je dvokomponentni providni akrilat Ortopoli (Polident DOO, Slovenija). Ugrađeni uzorci su ostavljeni tri sata na sobnoj temperaturi da se stvrdnu. Nakon što su ugrađeni uzorci izvađeni iz plastičnih kalupa, prešlo se na sečenje, tj. ekstrakciju poprečnih preseka, koji su dalje korišćeni za ispitivanje jačine veze između dentina i kočića metodom *push out*. Za sečenje uzorka korišćena je mašina ISOMET 1000. Ispitivanje jačine veze između kompozitnog kočića i tvrdih zubnih tkiva urađeno je testom *push out* na Mašinskom fakultetu u Skoplju.

Dobijeni rezultati su statistički obrađeni statističkim paketom Excel ANOVA 2016 i SPSS.

REZULTATI

Rezultati dobijeni iz ove studije prikazani su u Tabeli 2. Najveće vrednosti čvrstoće veze sa testom *push out* dobijene su u grupi zuba gde smo primenili kočiće GC Ever stick u kombinaciji sa Variolink / Excite sa tehnikom totalnog jetkanja i NaOCl / EDTA kao sredstvo za irigaciju (3,12 MPa), dok su najniže vrednosti dobijene u uzorcima gde smo primenili kočiće FRC Postec Plus Ivoclar u kombinaciji sa SpeedCEM™, tehnikom samojetkanja i NaOCl kao irigantom (1,23 Mpa).

Tabela 3 i Grafikon 1 prikazuju rezultate unakrsne statistike između grupa u kojima smo koristili iste kompozitne kočiće, iste cemente i istu tehniku adhezije (samojetkanja i totalnog jetkanja), ali različite iriganse (NaOCl sa NaOCl i EDTA). Dobili smo vrednosti za $p = 0,001$. Kako je $p < 0,05$, to ukazuje da postoji značajna razlika između grupa kod kojih smo koristili različitu irigaciju.

Tabela 4 i Grafikon 2 prikazuju rezultate unakrsne statistike grupa u kojima smo koristili isti kompozitni kočić FRC Postec Plus Ivoclar i GC Ever Stick, iste iriganse (NaOCl, NaOCl sa EDTA) i različite cemente i adhezivne tehnike (SpeedCEM sa tehikom samojetkanja i Variolink cement sa tehnikom totalnog jetkanja), pri čemu smo dobili $p = 0,090$, odnosno $p > 0,05$. Ovo ukazuje na to da ne postoji statistički značajna razlika u jačini veze između kompozitnog kočića i dentina, u zavisnosti od vrste cementa koji se koristi.

DISKUSIJA

Urađeno je nekoliko studija kako bi se procenila jačina veze kompozitnih kočića sa dentinom korena. U intraradikularnom dentinu razmazani sloj se pričvršćuje na površinu nakon instrumentacije endodontskim turpijama [11, 12, 13].

Radikularni razmazni sloj deluje kao barijera, delimično ometa i zaptiva dentinske tubule (razmazne čepove), smanjujući permeabilnost dentina do 86%, što otežava difuziju supstanci koje se koriste kao intrakanalni medikamenti, sprečavajući prodiranje endodontskih materijala u dentinske tubule, kao i ometanje difuzije monomera u dentinske tubule tokom adhezivne procedure. Stoga se njegovo uklanjanje obično preporučuje u literaturi [14–18].

Rastvori za irigaciju koji se koriste u endodontskoj terapiji, a čiji je glavni cilj čišćenje kanala korena, mogu olakšati smanjenje i uklanjanje razmaznog sloja zbog svog antimikrobnog rastvarača i helatnog delovanja [12, 19, 20].

Iako je poznato da irigansi koji se koriste u endodontskoj terapiji utiču na adheziju, manje se zna o tome kako utiču na odnos između zuba i kompozitnog kočića.

U našoj studiji upoređena je jačina veze dve vrste kompozitnih kočića cementiranih različitim vrstama cementa, različitim adhezivnim tehnikama, dok je kanal korena pripremljen različitim vrstama iriganasa.

Dobijeni rezultati su pokazali da je primena natrijum-hipohlorida u kombinaciji sa EDTA kao sredstva za irigaciju dala najveću jačinu veze bez obzira na primenjenu tehniku cementiranja i vrstu kompozitnog kočića.

U grupama u kojima su natrijum-hipohlorit i EDTA korišćeni kao agensi za irigaciju dobili smo veću jačinu veze sa adhezivnom tehnikom sa totalnim jetkanjem nego u adhezivnoj tehnici za samojetkanja, što je još uvek u korelaciji sa studijom Zorbe i sar., koji su zaključili da primena 17% EDTA sa 5,25% natrijum-hipohlorita nakon prostorne pripreme za naknadnu nadogradnju kompozita povećava čvrstoću samolepljivog cementa više od čvrstoće samojetkajućeg cementa. Objašnjenje razloga je uklanjanje sekundarnog zaostalog sloja pre cementiranja kočića i hemijska veza samolepljivog cementa [19].

Nasuprot tome, Demiryürek i sar. zaključili su da natrijum-hipohlorit smanjuje jačinu veze samojetkajućeg cementa [20]. Slično, Goracci i sar. pokazali su da se jačina veze pri ekstrakciji samo cementa može uporediti sa onom samojetkajućeg cementa [21].

U svim statistikama poprečnog preseka u grupama gde smo koristili dve vrste kompozitnih kočića i različite adhezivne tehnike, razlika se pojavila samo kada su korišćeni različiti tipovi iriganasa koji su menjali jačinu veze između dentina i vezivnog materijala, što je bio prvi cilj po kome je uticaj efekata irigacije na jačinu veze dva kompozitna kočića sa dentinom bio evidentan samo u slučajevima statistike poprečnog preseka.

Materijali za cementiranje su različito reagovali samo pri primeni različitih irigansa koje smo koristili na jačini dve vrste kompozitnih kočića.

Rastvori kao što su natrijum-hipohlorit (NaOCl), etilendiamin-tetrasirćetna kiselina (EDTA), hlorheksidin-glukonat (CHX) i persirćetna kiselina (PAA) pomažu u uklanjanju organskih i neorganskih elemenata iz razmaznog sloja. Koriste se tokom i posle endodontske instrumentacije, poboljšavajući efikasnost sečenja instrumenata.

Prema J. F. C. Limi, različite tehnike irigacije nisu imale nikakav uticaj na jačinu veze intraradikularnih kočića fiksiranih samolepljivim sredstvom za cementiranje 24 sata posle endodontskog tretmana kada je dentin pogođen pomoćnom hemijskom supstancom uklonjen pre cementacije [22].

U statističkoj analizi poprečnog preseka u našoj studiji, adhezivne tehnike nisu pokazale značajne razlike u jačini veze dentina i kočića koji su korišćeni.

Tretman površine dentina u početku podrazumeva efikasno uklanjanje razmaznog sloja korena, nakon čega sledi infiltracija

adhezivnih monomera. U tu svrhu mogu se koristiti strategije jetkanja i ispiranja (ER) i samojetkanja (SE). Međutim, kako se SE sistemi sastoje od slabih kiselina, oni nisu tako efikasni kao ER sistemi u uklanjanju razmazanog sloja korena. ER sistemi su najčešće korišćeni adhezivni sistemi za tretman dentina korena, jer se pored efikasnijeg uklanjanja razmaznog sloja dobija i uniformniji obrazac demineralizacije [23, 24, 25].

ZAKLJUČAK

Na osnovu našeg istraživanja možemo zaključiti da protokol irigacije ima značajan uticaj na jačinu veze kompozitnog kočića, nezavisno od vrste kočića i materijala za cementiranje koji se koristi.