Ispitivanje površinske hrapavosti amalgamskih ispuna mehaničkom elektroničkom napravom

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Sažetak

Svrha: *Svrha je ovog istraživanja bila utvrditi razlike u stupnju glatkoće poliranih površina amalgamskih ispuna nastalih kao rezultat uporabe različitih tipova instrumenata za poliranje.*

Materijali i metode: *Pri kliničkim su i laboratorijskim istraživanjima upotrebljene tri skupine uzoraka. Amalgamski su ispuni polirani različitim instrumentima. Postupak poliranja u dvjema skupinama uzoraka je sličan, a u trećoj skupini uzoraka dopunjen je poliranjem gumicom i pastom. Istraživani profil svakog uzorka snimljen je u obliku dijagrama, a polupresjek površina ispuna izometrijski je prikazan u dijelu površine veličine 2x2 mm.*

Rezultati: *Na temelju rezultata mjerenja provedena je raščlamba varijance za svaki parametar posebice. Vrijednosti utvrđene za četiri parametra hrapavosti na petnaest uzoraka u pet mjernih mjesta prikazuju da se površine amalgamskih ispuna znatno razlikuju ovisno o uporabi različitih instrumenata i o tehnikama poliranja. Najmanje srednje vrijednsoti (najfinije obrađene površine) dobivene su na uzorcima obrađenim postupkom C.*

Zaključak: *Rezultati istraživanja pokazuju znatne razlike površinske hrapavosti ovisno o izboru tehnike poliranja. Na temelju znatne razlike djelotvornosti postupka poliranja skupine uzoraka C i kliničkih opažanja, možemo zaključiti da optimalno završno poliranje amalgamskih ispuna poboljšava rubne odnose cakline i amalgama te povećava trajnost amalgamskog ispuna.*

Ključne riječi: *amalgamski ispun, površinska hrapavost, poliranje*

IZVORNI ZNANSTVENI RAD
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Uvod

Završna mehanička obrada amalgamskih ispuna vrlo je važna sa stajališta restorativne stomatologije. Glatka površina amalgamskih ispuna onemogućuje odlaganje plaka, osigurava trajnost ispuna, te povećava površinsku otpornost ispuna, posebice njegovih rubnih dijelova.

Smanjenjem površinske hrapavosti amalgamskog ispuna izostaju promjene dimenzija i obujma ispuna koje nastaju zbog aktivnosti sline i rezidualnog plaka. Zadržati zadane dimenzije ispuna je važno i kako bi se održala optimalna centrična relacija i osigurali se slobodni artikulacijski pokreti. Sve to u konačnici utječe na stanje potpornih struktura zuba i na sveukupno zdravlje usne šupljine.

Nužnost istraživanja površinske hrapavosti amalgamskih ispuna nametnula se je iz mnogobrojnih kliničkih opažanja da je prema ukupnome broju amalgamskih ispuna iznimno malo ispravno ispoliranih. Što više, i mnogi ispolirani ispuni ne zadovoljavaju suvremene zahtjeve restorativne stomatologije, jer se s vremenom opažaju promjene rubova ispuna s produbljivanjem rubnih pukotina (1,2,3). Te se promjene javljaju čak u 60% sveukupnih amalgamskih ispuna već nakon godine dana, ako ispun nije propisno poliran (4,5,6,7).

Djelotvornost amalgamskih ispuna ovisi o brojnim čimbenicima. Ponajprije o kakvoći amalgama i poštivanju uputa proizvođača za njegovu uporabu. Kakvoća amalgama podrazumijeva njegov sastav (broj i disperziju čestica, obujam), eletrokemijska i mehanička svojstva, te tehnologiju proizvodnje.

Način uporabe i umješnost liječnika, vrijeme potrebno za cjelovit zahvat, stanje zuba, te posljednja ali ne i manje važna pojedinost poliranje amalgamskog ispuna - imaju presudnu važnost za dobro načinjen amalgamski ispun (2,8).

Unatoč mnogim istraživanjima površinske hrapavosti amalgamskih ispuna važnost završne obrade još uvijek nije prihvaćena kao standardni postupak svakodnevne kliničke prakse.

Zato smo s pomoću elektroničko-mehaničkog uređaja s ticalom nastojali objektivno procijeniti razlike u stupnju glatkoće poliranih površina amalgamskih ispuna nastalih kao rezultat uporabe različitih instrumenata za poliranje i ponoviti važnost poliranja za trajnost i kakvoću amalgamskog ispuna.

Uzorak i postupak istraživanja

Na ekstrahiranim humanim zubima standardnim su kliničkim postupkom preparirani kaviteti prvoga razreda, te ispunjeni amalgamom Amalcap Plus Non Gamma Two, Ivoclar Vivadent. Amalgamski ispuni polirani su različitim instrumentima i postupkom 48 sati nakon kondenzacije.

Uzorci skupine A obrađeni su okruglim svrdlom tungsten carbid sa šest oštrica FG ISO No 021. Obrada je nastavljena s okruglim finirerom, tungsten carbide s dvanaest oštrica FG ISO No 023, reduciranim brojem okretaja i kontinuiranim vlaženjem polirane površine.

Uzorci skupine B obrađeni su malim brojem okrataja okruglim svrdlom, tungsten carbide sa šest oštrica, FG ISO No 021 i FG ISO No 023. Tijekom obrade amalgamske površine osigurano je kontinuirano vlaženje, te smjer obrade od sredine ispuna prema rubovima kaviteta.

Uzorci skupine C također su obrađeni instrumentima i postupkom A i B skupine uzoraka. Zatim su obrađeni montiranim kamenim arkansas polirerima i gumicom uz reducirani broj okretaja i kontinuirano vlaženje. Konačna obrada provedena je polir gumicama i pastom.

Laboratorijska su ispitivanja počela pripravom uzorka površine amalgamskog ispuna u svrhu objektivizacije i kvantifikacije promjene stupnja hrapavosti površine ispuna. Učinak završnog poliranja analgamskih ispuna istraživan je temeljem parametara hrapavosti. Ispitivanje hrapavosti površine uzoraka amalgamskog ispuna provedeno je elektroničko-mehaničkim uređajem s ticalom metodom dodira. Kod takvih tipova uređaja igla ticala se kreće konstantnom brzinom duž referentnog pravca po ispitivanoj površini. Igla slijedi neravnine na ispitivanoj površini i s pomoću mehaničko-električnog pretvornika pomake pretvara u električni signal koji kroz pojačalo ulazi u mjernu jedinicu. Slika profila dobiva se na osnovi grafičkoga zapisa pojačanog signala, a obradom signala u računalu vrijednosti parametara hrapavosti na pokaznom instrumentu.

Na petnaest uzoraka amalgamskog ispuna hrapavost površine ispitivala se elektroničko-mehaničkim uređajem Perthometer S8P uz iste uvijete:

1. duljina puta ticala LT=5,6 mm
2. mjerenje četiri parametra hrapavosti:

- najveća visina profila (Rmax)
- visina neravnina prifila u 10 točaka (Rz)
- srednje aritmetičko odstupanje profila (Ra)
- najveća visina vrha profila (Rp).

Na svakoj površini uzorka amalgamskog ispuna mjerenje parametara hrapavosti provedeno je na pet mjernih mjesta (pravaca). Srednje vrijednosti rezultata mjerenja, razvrstane prema završnim postupcima obrade za navedene parametre i sve uzorke, prikazane su u Tablici 1.

Tablica 1. *Rezultati mjerenja parametara hrapavosti površina amalgamskih ispuna*
Table 1. *Measurement results of roughness parameters of amalgam restoration surfaces*

Postupak obrade Polishing Proces type	Uzorak broj Specimen Number	Parametri hrapavosti Roughness parameters			
		Rmax µm	*Rz* µm	*Ra* µm	*Rp* µm
A	A1	19,3	15,3	3,2	7,7
	A2	25,5	17,6	3,5	10,3
	A3	18,5	15,5	3,2	9,3
	A4	15,9	13,0	2,3	6,5
	A5	15,7	13,8	3,1	8,7
	$\overline{A}$	18,98	15,04	3,06	8,50
B	B1	28,0	22,3	4,4	14,8
	B2	27,2	20,7	4,3	13,8
	B3	29,6	23,1	5,0	12,3
	B4	28,2	21,9	4,0	16,5
	B5	32,1	22,1	4,8	14,7
	$\overline{B}$	29,02	22,02	4,50	14,42
C	C1	9,7	5,5	1,0	2,6
	C2	6,3	3,7	1,8	1,4
	C3	4,3	2,6	1,7	2,1
	C4	3,8	2,5	2,5	1,2
	C5	2,4	1,7	0,7	1,6
	$\overline{C}$	5,30	3,20	1,54	1,78

Osim toga, na svim uzorcima snimljen je po jedan dijagramski zapis ispitivanog profila te izometrijski prikaz središnjega dijela površine veličine 2 x 2 mm.

Rezultati mjerenja

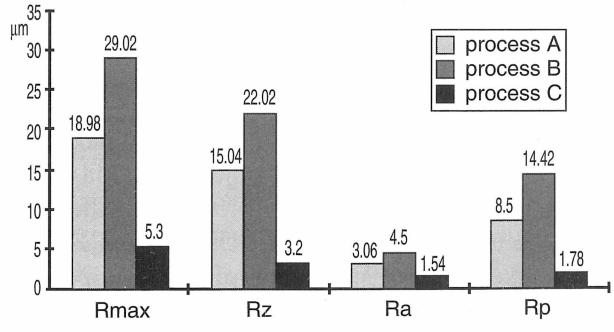
Na osnovi rezultata mjerenja danih u Tablici 1 provedena je raščlamba varijance, za svaki parametar posebeno, s ciljem da se ustanovi razlikuje li se znatno hrapavost površine amalgamskih ispuna između triju skupina uzoraka obrađenih različitim završnim postupcima obrade.

Za sve parametre hrapavosti (Tablica 2) dobivene vrijednosti F>F0,05 potvrdile su hipotezu da postoji znatna razlika u hrapavosti površina između uzoraka amalgamskih ispuna obrađenih različitim završnim postupcima obrade.

Tablica 2. *Rezultati raščlambe varijance*
Table 2. *One-way analysis of variance*

Parametar hrapavosti Roughness parameters	Procjena varijanci Sum of squares		F-test	
	Unutar stupaca Within groups s^2_{us}	Između stupaca Between groups s^2_{is}	Računska vrijednost F-ratio F	Teorijska vrijednost Sig. lev. $F_{0,05}$
Rmax	9,16300	708,81867	77,357	3,88
Rz	2,01500	452,58200	224,606	3,88
Ra	0,28866	10,95466	37,949	3,88
Rp	1,60633	199,97867	124,494	3,88

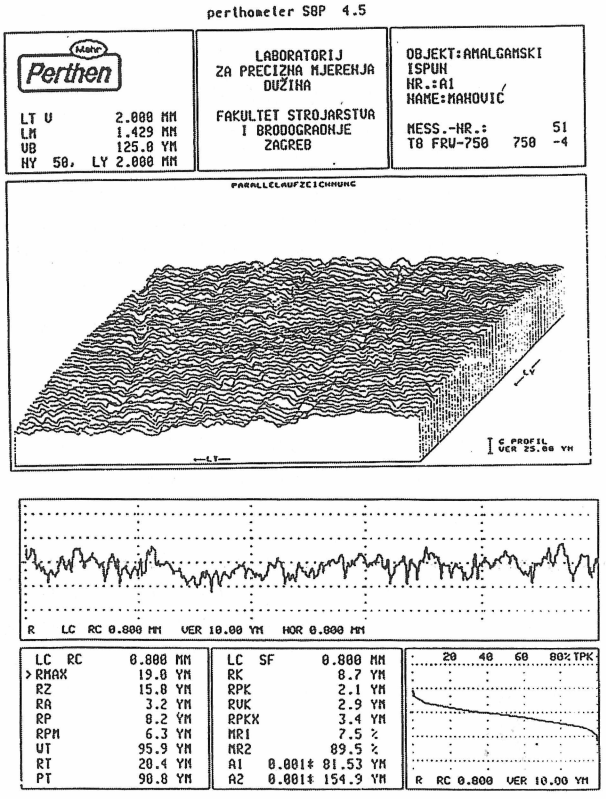
Na Slici 1 dan je uposredni grafički prikaz srednjih vrijednosti parametara hrapavosti uzoraka obrađenih s trima različitim postupcima obrade za svaki mjerni parametar odvojeno. Iz grafičkoga prikaza vidljivo je sljedeće:



Slika 1. *Srednje vrijednosti rezultata mjerenja parametara hrapavosti*
Figure 1. *Mean values of roughness parameters*

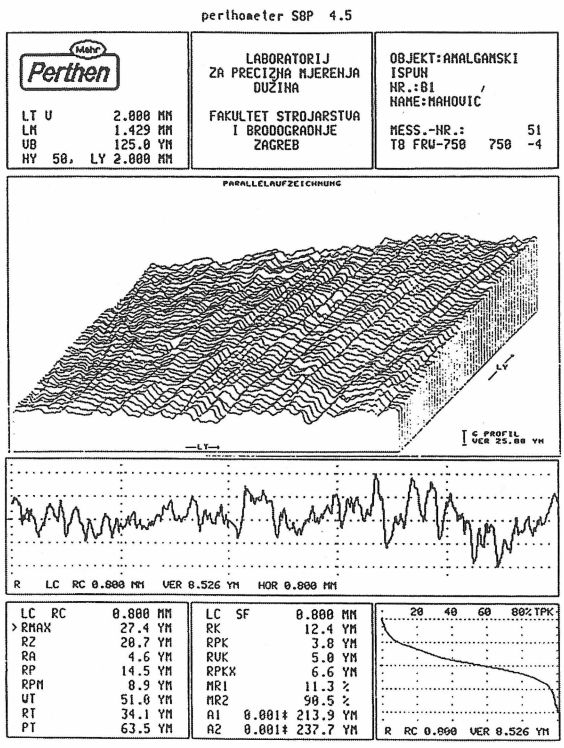
- najveće srednje vrijednosti za sve mjerene parametre dobivene su na uzorcima obrađenih završnim postupkom B,
- najmanje srednje vrijednosti za sve mjerene parametre (najfinije obrađene površine) dobivene su na uzorcima obrađenih završnim postupkom C,
- završnim postupkom A dobivena je nešto manja hrapavost nego postupkom B.

To je potvrđeno usporednim prikazom dijagramskih zapisa ispitivanih profila i izometrijskih prikaza površina uzoraka A1, B1, C1, snimljenih uz ista okomita i vodoravna povećanja (Slike 2,3,4).

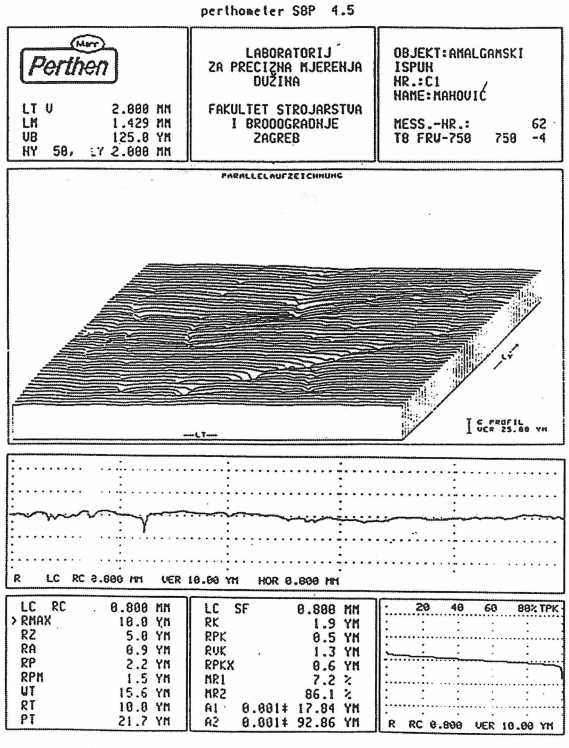


Slika 2. *Izometrijski prikaz površine uzorka s dijagramskim zapisom profila površine uzorka A1*
Figure 2. *Profile graphs and isometric surface specimen A1*

Površina amalgama i učinak završne obrade površine amalgamskog ispuna procjenjuje se na temelju parametara hrapavosti. Interpretacija rezultata definira se u području nanometrijskih mjerenja te dijagramskog zapisa ispitivanog profila ili topografskom slikom amalgamske površine. Ova se istraživanja mogu uspoređivati sa sličnim istraživanjima drugih autora, a sam postupak istraživanja je jednostavan i ponovljiv.



Slika 3. *Izometrijski prikaz površine uzorka s dijagramskim zapisom profila površine uzorka B1*
Figure 3. *Profile graphs and isometric surface specimen B1*



Slika 4. *Izometrijski prikaz površine uzorka s dijagramskim zapisom profila površine uzorka C1*
Figure 4. *Profile graphs and isometric surface specimen C1*

Rasprava

Razmatrajući svrsishodnost poliranja amalgamskog ispuna potrebno je napomenuti i mišljenje nekih istraživača koji ističu da je hrapavost površine nekih non-gamma 2-amalgama ponajprije uzrokovana njihovim fizikalnim osobitostima, poput veličine, broja i rasporeda čestica, te zato smatraju da završno poliranje nije prijeko potrebno, jer se već pri pažljivom ručnom oblikovanju ispuna postiže zadovoljavajuća glatkoća (4,9,10).

Ipak, mnogi se istraživači ne slažu s tim postavkama, a rezultati njihovih istraživanja pokazuju da nastaju promjene dimenzija ispuna i rubnih pukotina u svim slučajevima kada nije izvedeno završno poliranje amalgamskih ispuna.

Poput Collinsa i sur. (4) te još mnogih istraživača držimo da kakvoća amalgama ponajprje ovisi o njegovim fizikalnim, kemijskim, električnim i mehaničkim svojstvima. No ta se svojstva mogu znatno poboljšati završnim poliranjem ispuna primjenom najprikladnijih tehnika (2,11,12,13).

Brojni istraživači poput Bauera (14), Lovadina (15), Bryanta (16), Johstada (17) te Woodsa (18) pokazali su da ručno oblikovanje amalgamskih ispuna zadovoljava samo ako ga slijede odgovarajući procesi završnoga poliranja.

Naša su pak istraživanja pokazala da samo ispravno završno poliranje amalgamskog ispuna osigurava njegovu cjelovitost i postojanost. U našem se je ispitivanju skupina C uzoraka (najfinije obrađena površina) obrađivala malim brojem okretaja okruglim tungsten karbidnim svrdlom oblikovanim sa šest oštrica FG ISO No 021 i FG No 023. Postupak je tada nastavljen okruglim tungsten karbidnim svrdlom s 12 oštrica FG ISO No 023 pri malom broj okretaja. Završno je poliranje sprovedeno arkansas kamenom za poliranje uz neprekidno vlaženje pri malom broju okretaja. Na kraju je upotrebljena gumica i pasta.

Za raščlambu stupnja hrapavosti polirane površine amalgamskog ispuna najprikladnijom se pokazala metoda dodira ticalom elektroničko-mehaničkog uređaja. Razvojem ticala s velikim mjernim opsegom i dostatnom osjetljivošću uređaja rezultati istraživanja površinske hrapavosti amalgamskog ispuna postaju pouzdani, dijagramski zapis i topografska slika lako usporedivi s rezultatima sličnih istraživanja, a cjelokupni proces jednostavan i ponovljiv.

Naše je istraživanje pokazalo da samo optimalno završno poliranje daje površinu ispuna najfinije glatkoće. Kao dio ukupnoga kliničkog postupka mehaničke obrade amalgamskog ispuna visoki stupanj ispoliranosti osigurava trajnost i povećanu otpornost površine i rubova ispuna. Smanjujući rubnu pukotinu završnim poliranjem, poboljšavamo rubne odnose cakline i amalgama, te sprječavamo nastanak sekundarnog karijesa. Zaglađena površina amalgamskog ispuna pokazuje povećanu homogenost površine, smanjenu koroziju i nakupljanje plaka. Smanjenom hrapavosti površine amalgamskog ispuna izostaju dimenzijske promjene ispuna. Sve to potvrđuje da je potrebno standardizirati klinički postupak finalne obrade površine restorativnog ispuna.

Rezultati istraživanja daju potporu uporabi amalgama u kliničkoj restorativnoj stomatologiji i opovrgavaju danas sve češće mišljenje da uporabu amalgama treba izbjegavati te za ispune uporabljivati samo kompozitne materijale. Samo ispravnom procjenom za svaki ispun zasebno i mogućnošću slobodnog izbora različitih materijala u restorativnoj stomatologiji možemo potpuno udovoljiti zahtjevima struke.

Zaključci

Temeljem iznesenih rezultata slijedi:

1. Izmjerene vrijednosti svih promatranih parametara hrapavosti potvrdile su F>F 0,05. Budući da je naš F (računska vrijednost) veći od F0,05 (teoretska vrijednost) zaključujemo da se postupci završne obrade znatno razlikuju po djelotvornosti.
2. Ove vrijednosti pokazuju uočljive razlike površinske hrapavosti ovisno o izboru tehnika poliranja.
3. Završno poliranje amalgamskih ispuna poboljšava rubne odnose cakline i amalgama te ukupnu kakvoću amalgama.
4. Optimalno završno poliranje amalgamskih ispuna sprječava dimenzijske promjene ispuna te može uspješno kompenzirati niz strukturnih manjkavosti amalgamskog ispuna.
5. Potreba i obveza standardizacije kliničkoga postupka završne obrade površine restorativnog ispuna.

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Assessment of Amalgam Restoration Surface Roughness by Mechanical Electronic Instrument

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Summary

Objective: *The purpose of the study was to determine the differences in smoothness degree of polished surfaces in amalgam restorations, resulting from the use of different types of polishing instruments.*

Materials and Methods: *Clinical and laboratory examinations were performed on three sample groups. Two sample groups were treated by a similar polishing procedure, whereas the third group was additionally treated with rubbers and paste. The examination profile of each sample was recorded in the form of a diagram, while the midsection of the restoration surface was isometrically presented in the 2x2 mm size.*

Results: *On the basis of the obtained measurement results analysis of the variance was made for each parameter. The values obtained of four roughness parameters on 15 samples from 5 measuring locations show that amalgam restoration surfaces vary significantly with regard to the use of different polishing techniques and instruments. Minimum mean values (the most delicately polished surfaces) were obtained on the sample group treated with "C" procedure.*

Conclusion: *The examination results show that there are important differences in surface roughness with regard to different polishing techniques. On the basis of the considerable effective difference of the polishing procedure applied on the sample group "C" and clinical observations, it can be concluded that the optimum final polishing of the amalgam restorations improves borderline relations between the enamel and the amalgam and increases amalgam restoration resistance.*

Key words: *amalgam restorations, surface roughness*

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Introduction

Mechanical finish of amalgam restoration is essential from the viewpoint of restoration dentistry. A smooth surface prevents depositing of plaques, ensures durability and increases resistance of restoration surface, its edges and the material as a whole. Polishing improves the borderline relations between enamel and amalgam and prevents the formation of secondary caries. A decrease in surface roughness of amalgam restoration reduces dimensional changes that result from metabolic activity of saliva and residual plaque. Restoration dimensions are also responsible for centric relations and they ensure free articular movements; all of these affect the condition of supportive dental tissues, articulations of the jaw and entire health of the oral cavity.

The need to assess surface roughness of amalgam restorations results from numerous clinical observations indicating that there is an exceptionally small number of polished surfaces in relation to the overall number of amalgam restoration. Furthermore, a great number of the polished restorations do not comply with modern requirements of restoration dentistry (7, 13, 17). Therefore changes in restoration edges and borderline fissures that get deeper with time may be noticed already after one year in about 60% of amalgam restoration that have not been submitted to regular polishing procedure (4, 9, 12, 15).

The efficacy of amalgam restorations is known to depend upon a number of factors, primarily upon the amalgam quality and compliance with the regulations about its standardisation. These imply its content, physical (size, number and dispersion of particles), electrochemical and mechanical characteristics, and also technological processing of the alloy. Treatment procedure and skill of the dentist, time to make restoration, extent of preparation, category of teeth and, last but not least, final polishing of amalgam restoration are of special importance (1, 13).

Despite numerous studies on surface roughness of amalgam restorations the importance of final treatment is still not accepted as standard procedure in every day clinical practice. Therefore, by using a contact stylus instrument, we have tried to objectively assess differences in the roughness of polished surfaces of amalgam restorations caused by the use of different polishing instruments and to repeat the importance of polishing and in this connection the durability and quality of amalgam restoration.

Materials and Methods

In extracted human teeth first degree cavities were prepared and filled with amalgam in a standard procedure (Amalcap Plus Non Gamma Two, Ivoclar Vivadent). Amalgam restorations were polished by different instruments and procedures 48 hours following condensation (restoration).

Group A samples were treated by round bore tungsten carbide with 6 blades, FG ISO N. 021. The treatment was then continued by twelve blade tungsten carbide round finisher, FG ISO No. 023, with reduced number of rotations and continuous moistening of the polished surface.

Group B samples were treated by six blade tungsten carbide round bore, FG ISO No. 021 and FG ISO No. 023. In the course of polishing the surfaces were kept moist; polishing started from the middle toward the edges of the restoration.

Group C samples were first treated by the same instruments and procedures as the group A samples. They were then additionally treated by mounted stone Arkansas polishers and rubber at reduced number of rotations and continuous moistening. Final polishing was made by rubbers and paste.

Measurements of surface roughness in amalgam restorations were made by using stylus contact instruments. The method consists of passing the stylus across the surface at constant velocity. The stylus follows surface and intercession irregularities, while transducers convert vertical movements into proportional variation of an electrical signal. The profile graph is realised by amplified electrical signal on the recorder. The roughness parameters are determined on the basis of computer processing of the signal.

Surface roughness was measured under equal conditions by Perthometer S8P stylus instruments in 15 samples of amalgam restorations:

- traversed length LT = 5.6 mm
- measurement of four roughness parameters:
  Rmax = maximum roughness depth
  Rz = mean peak-to-valley height

Ra = roughness arithmetic mean
Rp = levelling depth.

Measurement of roughness parameters for each amalgam restoration surface specimen was made in five sites, or profiles. The mean values of measurement results and classification of polishing treatment for each individual sample and for the four roughness parameters are given in Table 1. Also, a profile graph and isometric picture of 2x2 mm size central area are provided for each individual study sample.

Results and Discussion

As presented in Table 1, on the basis of the obtained results a one-way analysis of variance was made for each parameter in order to determine whether there was significant difference in surface roughness of amalgam restorations between the three study groups treated by different polishing procedures.

As can be seen in Table 2, the obtained values for all roughness parameters are F > F0.05, which verify the hypothesis of significant difference in surface roughness of amalgam restorations between the three study groups with, regard to different polishing methods.

A histogram in Figure 1 shows mean values of all roughness parameters in study samples treated by the same polishing technique. The following can be concluded :

- maximum values for all parameters were obtained in the group of study samples treated by type B polishing method
- minimum values for all parameters were obtained in the group of study samples treated by type C polishing method
- study samples treated by type A polishing method had less surface roughness than type B samples.

Profile graphs and isometric pictures of all surfaces for study samples of groups A1, B1 and C1 (Figure 2) were made in equal vertical and horizontal amplifications.

The effects of final polishing of amalgam restoration surfaces were assessed on the basis of roughness parameters. Interpretation of study results concerning the polished surfaces refers to nanometric measurements, diagrams of the studied profiles, and topographic scans of amalgam restoration surfaces. On the basis of our experience the contact stylus instrument method proved to be the most objective method. Stylus instruments with large measurement capacity and sufficient sensitivity yield reliable results. Profile graphs and topographic scans can readily be compared with the results of other similar studies, while the entire research procedure is simple and reproducible.

When discussing the purpose of amalgam restoration polishing a number of authors categorically state that the roughness of certain non-gamma 2--amalgams is first of all influenced by their physical characteristics, suchas the size, number and distribution of particles. Thus, they are of opinion that final polishing is not necessary since satisfactory smoothness of the restoration surface is achieved by manual manipulation and shaping (4, 6, 16). However, there are authors who disagree with this assumption and their study results indicate early development of dimension changes in restorations and borderline grooves in cases where there is no final polishing of the restoration surfaces.

Our attitude is in accordance with that of Collins et al. (4) and other experts who are of opinion that the quality of amalgam depends on its physical, chemical, electrical and mechanical characteristics. However, the quality may be significantly improved by final polishing of the restoration, which implies the use of most appropriate techniques and methods in restoration finishing (5, 8, 13, 14).

The studies carried out by Bauer et al. (2), Lovadino et al (11), Bryant et al. (3), Jokstad et al. (10) and Woods et al. (18), and by other authors and dental experts have shown that manual shaping of amalgam provides a professionally based technique of amalgam restorations only when combined with proper finishing and polishing procedures.

Our studies have shown that only the optimal final polishing, as part of the entire procedure of mechanical treatment involving amalgam restorations, ensures their permanent and enhanced resistance. In our study group C samples were treated by a small number of rotations of a rounded six-blade tungsten carbide bore, FG ISO No. 021 and FG ISO No. 023. The treatment was then continued by a rounded twelve-blade tungsten carbide finisher, FG ISO No. 023, at a reduced number of rotations. Final poli-

shing was achieved by mounted stone Arkansas polishers and rubber at a reduced number of rotations and continuous moistening. Finally, rubber and paste were used.

Final polishing improves borderline relations between the enamel and amalgam, and prevents formation of borderline grooves and secondary caries. Decreased roughness of the amalgam restoration surface prevents changes in dimension of the restoration, which leads to correct vertical dimension as a prerequisite for proper relations within the jaw.

The omnipresent doubt regarding the use of amalgam in modern restoration dentistry motivated us to study certain factors that are relevant to high quality amalgam restorations.

By observing set standards in amalgam production manufacturers reduce or even completely neutralise the possible adverse effects of physical, chemical, electrical and mechanical amalgam components. Sufficient time and a skilled dentist will provide for appropriate restoration. However, the best results may be expected only when correctly and properly selected techniques and methods of final polishing of amalgam restoration are employed. Hence our attitude is that although there are no fixed standards, greater smoothness of the amalgam restoration surface will undoubtedly contribute to reduction of all external and internal negative effects upon the restoration itself.

With regard to the fact that roughness of the amalgam restoration surface depends on the size, number and distribution of particles, some authors readily accept the assumption that manual treatment of amalgam surface is sufficient since the additional final polishing will not significantly improve these characteristics. However, our study has shown that final polishing of the amalgam restoration is needed, as it may compensate for a series of structural defects in the restoration. Naturally, the selection of procedures and methods for final treatment are of paramount importance since erroneous selection and unskilled manipulation with polishing means may damage the restoration by causing mechanical modifications to its surface, which may be revealed by microdensity test.

Our study results and also the indication area and positive amalgam features strongly contradict the opinion that the use of amalgam should be avoided and composites used instead, as such attitudes are obviously harmful to the profession.

Only the selection of all types of materials used in restoration stomatology can satisfy the demands of the profession and time, and therefore similar studies should be continued in the future.

Conclusions

From the presented results it follows that:

1. The obtained variances of all the roughness parameters observed during the research confirmed that F>F 0.05. The experimental F (experimental value), being greater than F=0.05 (theoretical value), it can be concluded that the efficacy of the final treatment procedure differed significantly.
2. These values show significant differences in surface roughness with regard to different polishing techniques.
3. Final polishing of amalgam improved borderline relations between the enamel and amalgam, as well as the quality of the amalgam.
4. Optimal final polishing prevented changes in dimension of the restoration and may compensate a series of structural defects in the restoration.
5. The study demonstrated that standardization of the final treatment procedure on amalgam restoration surface is necessary.