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# Klinička procjena fiksnih protetskih nadomjestaka

## *A Clinical Evaluation of Fixed Partial Dentures*

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### Sažetak

**Svrha:** procjena nosača i status fiksnih protetskih nadomjestaka kod pacijenata koji su zatražili njihovu zamjenu. **Materijali i metode:** U Zavod za protetiku Stomatološkog fakulteta Sveučilišta Ege poslano je 115 ljudi kako bi im se s razlogom skinuo FPN. Raspon godina bio je između 35 i 76 (53,98±8,55). Kategorije pregledanih fiksnih nadomjestaka bile su sljedeće: 15 (13%) potpunih metalnih krunica, 63 (54,8%) metalno-akrilatnih mostova i 37 (32,2%) metalno-keramičkih. Bio je zaobilježen i broj članova, položaj i vrsta restoracija u zubnom luku te starost. U postupku procjene okluzije koristili smo se kriterijima USPDH-a, a za procjenu kliničke kakvoće restoracija uprabljene su ocjene iz sustava CDA. **Rezultati:** Pregledano je ukupno 100 mostova sa 727 članova, 464 nosača i 263 međučlana. Prosječna im je iznosila je 6,53 (±7,04) godina za krunice, 8,16 (±9,28) za metalno-keramičke mostove i 10,00 (±6,21) godina za metalno-akrilatne mostove. Prosječna starost djelomičnih fiksnih proteza bila je znatno veća u metalno-akrilatnoj skupini negoli u metalno-keramičkoj ( $p=0,017$ ) i kod potpuno metalnih krunica ( $p=0,015$ ). Kliničkom procjenom otkriveno je da su parodontno zdravlje ( $p=0,011$ ), estetika ( $p=0,000$ ) i higijena ( $p=0,002$ ) bili na nižoj razini kod metalno-akrilatnih DFP-a negoli kod drugih vrsta djelomičnih fiksnih proteza. Najveći gubitak proksimalnih kontakata dogodio se u skupini metalno-akrilatnih FPN-a ( $p=0,003$ ). **Zaključak:** Prije skidanja djelomično fiksnih proteza ustanovljeno je pregledom i procjenom na temelju kriterija CDA-a da je ocjenu „neprihvatljivo“ za parodontno zdravlje, estetiku i higijenu dobilo više radova DFP-a iz skupine metalno-akrilatnih mostova negoli iz onih skupine metalno-keramičkih.

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### Ključne riječi

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### Uvod

Unatoč mogućnostima implantologije, konvencionalne metalno-keramičke proteze još se često izrađuju u slučaju indikacija za fiksne protetske nadomjestke (FPN) (1, 2). U nekim je radovima obrađena i dobna te spolna distribucija pacijenata koji su dobili djelomično fiksni nadomjestak. Opisano je i koliko su česte i gdje su smještene različite vrste FPN-a (3, 4). U većini istraživanja stopa traj-

### Introduction

In spite of the possibilities of implantology, conventional metal-ceramic prostheses are still commonly used for fixed partial dentures (FPDs) (1,2). Some reports have presented age and sex distribution of the patients who had received FPDs. The frequency and location of the various types of FPDs have also been reported (3,4). Most studies show that a survival rate of FPDs is nearly 95% after 5

nosti FPN-a iznosi od 95% nakon pet godina, 72% do 90% nakon 10 godina, 65% nakon 15 godina, 64% nakon 20 godina i oko 53% nakon 30 godina u funkciji (5-11). Teža je bila komparacija podataka o trajnosti djelomičnih fiksnih proteza starih od 18 do 23 godine (12-16). Čini se kako stope trajnosti radova oštrije padaju nakon 10 godina (2), što bi se, barem djelomice, moglo objasniti zamorom materijala – kovinskih slitina, keramike i cementa (6). Pretpostavlja se da slabljenje retencijskih elemenata i rekurentni karijes također pridonose padanju stope trajnosti nakon 10 godina (5).

Sustav procjene CDA (Udruga kalifornijskih stomatologa) definiran je godine 1977. kada je predložena i procjena kakvoće stomatološke skrbi, a temelji se na primjeni kliničkih parametara. U primjeni standardiziranih ispitivača, kao točan pokazao se način procjene dentalnih restoracija i dentalne skrbi (17). Osim kriterija CDA, primijenjeni su i kriteriji za kliničku procjenu Javne zdravstvene službe Sjedinjenih Američkih Država (USPHS-a) (18). Ryge i Snyder (19) su u svojoj studiji prilagodili te kriterije, a u recentnijem su ih radu još jasnije istaknuli. U procjeni kliničke kakvoće DFP-a neki su se autori služili kriterijima CDA (8, 9), a drugi USPHS-a (20, 21).

Svrha ovog ispitivanja bila je odrediti kliničku kakvoću i okluziju pacijenata s djelomičnim fiksnim protezama koji su zatražili pregled u Zavodu za protetiku Stomatološkog fakulteta Sveučilišta Ege kako bi im se iz različitih razloga skinuo DFP.

## Materijal i metode

Ovim je istraživanjem bila obuhvaćena 751 jedinica (nosač+međučlan+privjesak) FPN-a (103 mosta, 15 krunica) izvađena iz čeljusti 118 pacijenata u dobi između 35 i 76 godina ( $54,02 \pm 8,50$ ). Sudionici su bili pregledani u Zavodu za protetiku Stomatološkog fakulteta Sveučilišta Ege, a istraživanje je odobrilo Etičko povjerenstvo njegova Medicinskog fakulteta. (broj dopuštenja: #06-2/6).

Od 118 pacijenata njih 15 (12,7%) imalo je krunice, a 103 (87,3%) mostove. Mostove smo podijelili u skupine: zlatni fasetirani - 3 (2,5%), fasetirani mostovi od drugih slitina - 63 (53,4%) i metalno-keramički mostovi - 37 (31,4%). Kako je broj zlatnih mostova bio vrlo mali, ispitivanje je obavljeno na 115 pacijenata - 85 žena (prosječna dob  $53,38 \pm 9,24$ ) i 30 muškaraca (prosječna dob  $55,66 \pm 6,00$ ). Njih 15 (13%) imalo je krunice od neplemenitih kovinskih slitina, 63 (54,8%) nosilo je metalne fasetirane radove, a 37 (32,3%) metalno-keramičke fiksne protetske nadomjestke.

years, 72%-90% after 10 years, 65% after 15 years, 64% after 20 years and approximately 53% after 30 years of function (5-11). More difficult is the comparison of data on the survival of FPDs after 18 to 23 years (12-16). Survival rate seems to decrease more sharply after 10 years (2), which could be partly explained by fatigue of the materials used, such as metal alloys, porcelain and cement (6). Retainer loosening and recurrent caries probably also decrease the survival after 10 years (5).

Defined in 1977, the California Dental Association (CDA) evaluation system for the assessment of clinical quality of dental care is based on the application of clinical parameters. When applied by standardized examiners, it has frequently been demonstrated to be both precise and accurate in the evaluation of dental restorations and dental care (17). Besides the CDA criteria, clinical evaluation criteria have been defined by the United States Public Health Service (USPHS), as well (18). In the study of Ryge and Snyder (19), the criteria of clinical examination were refined and modified, and were clearly set out in a more recent study. Some authors have used the CDA criteria (8,9) and some authors have used USPHS criteria (20,21) to evaluate the clinical quality of FPDs.

The aim of this study was to determine the clinical quality and occlusion of various types of FPDs of patients who consulted Ege University, School of Dentistry, Department of Prosthodontics for the removal of their FPDs for various reasons.

## Material and Methods

This study comprised 751-units of (abutment+ pontic+cantilever) FPDs (103 bridges, 15 dental crowns), which were removed from 118 consecutive patients with an age range of 35-76 ( $54.02 \pm 8.50$ ) years. The patients with FPDs who consulted Ege University, School of Dentistry, Department of Prosthodontics for the removal of FPDs for various reasons, were recruited. This study was approved by the Ethics Committee of Ege University, School of Medicine (#06-2/6).

Out of 118 patients, 15 (12.7%) had crowns and 103 (87.3%) had bridges. The bridges were divided as follows: gold-acrylic (3, 2.5%) bridges, other alloy-acrylic bridges (63, 53.4%) and metal-ceramic (37, 31.4%) bridges. As the number of gold-acrylic bridges was low, the study was carried out on 115 people [85 women (mean age  $53.38 \pm 9.24$ ); 30 men (mean age  $55.66 \pm 6.00$ )]. Fifteen of them (13%) had crowns made of non-precious alloys, 63 (54.8%) had metal-acrylic and 37 (32.2%) had metal-ceramic FPDs.

**Klinički pregled**

Tijekom kliničkog pregleda bio je zabilježen broj jedinica, međučlanova i nosača, smještaj mosta u zubnom luku, trajnost restoracije i vrsta restorativnih materijala (potpuno metalni, metalni s akrilatnim fasetama ili metalno-keramički). Podaci su procijenjeni prema mostu, a ne prema njegovim pojedinačnim članovima. U procjeni okluzije restoracija koristili smo se prilagođenim kriterijima USPHS-a (Tablica 1.) (18, 19). Zabilježene su ocjene Alpha, Bravo i Charlie. Ocjenu Alpha dobili su radovi s najvećim stupnjem kliničke prihvatljivosti, a Bravo i Charlie su ocjene za progresivno manje stupnjeve kliničke prihvatljivosti. Ocjena Alpha dodijeljena je restoraciji koja ne zahtijeva modifikaciju i smatralo se da je klinički nepromijenjena. Ocjenu Bravo dali smo radu na kojemu je uočen manji defekt, a nije bila potrebna zamjena ili manji popravak. Ocjenu Charlie dobili su radovi s uočljivim nedostatkom.

Prema modificiranim kriterijima CDA, sve su restoracije ocijenjene kao zadovoljavajuće u (1) retenciji, (2) marginalnom integritetu, (3) parodontnom zdravlju, (4) estetici, (5) higijeni (6) i sekundarnom karijesu (Tablica 2.). Potkategorija ocjenjivanja bila je: Romeo (R)=zadovoljava, Sierra (S)=prihvatljivo i Tango (T)=neprihvatljivo. Procjenu CDA neovisno su obavila dvojica specijalista protetičara. U slučaju da su im mišljenja bila različita, pacijenta su zajednički pregledali i raspravljali o njegovu stanju.

**Statistička analiza**

Svi podaci analizirani su u programu Statistical Package for Social Sciences (SPSS-u), verzija 15,0 (SPSS Inc. Headquarters, Chicago, Illinois, SAD). U komparaciji dviju neovisnih skupina rabljen je Mann-Whitney U-test, a za usporedbu triju ili više neovisnih skupina H-test prema Kruskal-Wallis. Za neke je procjene odabran i hi-kvadrat test. Razina statističke znatnosti određena je kod 0,05.

**Clinical Examination**

The numbers of units, pontics and abutments, the location of bridge in the arch, life span of restorations and type of restorative materials (full metal, metal-acrylic, or metal-ceramic) were recorded. The data were evaluated per bridge, not per individual bridge unit. Modified USPHS criteria were used to evaluate the occlusion of the restorations (Table 1) (18,19). Alpha, Bravo and Charlie rankings were recorded. Alfa was used to indicate the highest degree of clinical acceptability; Bravo and Charlie were used to indicate progressively lessening degrees of clinical acceptability. An alpha rating was given if the restoration did not require modification and was considered clinically unchanged. A bravo rating was assigned if there appeared some minor defect that did not need replacement or minor repairs. Charlie rating was assigned if the restoration showed a defect.

All restorations had to be rated as satisfactory according to the modified CDA quality evaluation system criteria for (1) retention, (2) marginal integrity, (3) periodontal health, (4) esthetics, (5) hygiene and (6) secondary caries (Table 2). The subrating was taken as Romeo (R)=satisfactory, Sierra (S)=acceptable, Tango (T)=unacceptable. The CDA evaluation was performed independently by two prosthodontists, and if the registrations differed, an agreement was reached after mutual reexamination of the patient and a discussion between the two examiners.

**Statistical Analysis**

All data were analyzed by means of Statistical Package for Social Sciences (SPSS), version 15.0 (SPSS Inc. Headquarters, Chicago, Illinois, USA). For the comparison of the two independent groups, Mann-Whitney U was used; for the comparison of the three or more independent groups, Kruskal-Wallis H was used. For some evaluations, Chi Square test was used as well. The Spearman correlation test was utilized. Level of significance was set at 0.05.

**Tablica 1.** Kriteriji USPHS-a modificirani za procjenu FPN-a  
**Table 1** USPHS criteria modified for the assessment of FPDs

Ocjene • Ratings	Alpha (α)	Bravo (β)	Charlie (γ)
Okluzalni kontakt • Occlusal Contact	Normalan okluzalni kontakt • Normal occlusal contact	Rani okluzalni kontakt • Premature occlusal contact	Nedostaje okluzalni kontakt • Missing occlusal contact
Balansni kontakt • Balancing Contact	Nema balansnog kontakta • No balancing contact	Balansni kontakt prisutan • Balancing contact present	Hiperbalansni kontakt prisutan • Hyperbalance contact present
Proksimalni kontakt • Proximal Contact	Fiziološki proksimalni kontakt(i) • Physiological proximal contact(s)	Jedva dostatan proksimalni kontakt(i) • Just adequate proximal contact(s)	Nedostaje • Missing proximal contact

**Tablica 2.** Modificirani kriteriji Kalifornijske stomatološke udruge za procjenu FPN-a  
**Table 2** Modified California Dental Association Criteria for Clinical Evaluation of FPDs

Kriterij • Criterion	Zadovoljava • Satisfactory (Romeo)	Prihvatljivo • Acceptable (Sierra)	Neprihvatljivo • Unacceptable (Tango)
Retencija FPN • Retention of FPDs	FPN stabilna, nepokretna • FPD is stable, without any movement	FPN stabilna, ali nije nepokretna • FPD is stable but shows a little movement	Jedna ili obe strane međučlana labave ili odlijepljene od nosača • One or both sides of pontic is loose or debonded from abutment
Marginalni integritet FPN • Marginal integrity of FPDs	Nema vidljivih znakova marginalne pukotine; Sonda ne zapinje niti propada • No visible evidence of crevice along margin; no catch or penetration of explorer	Vidljivi znakovi pukotine i/ili zapinjanja sonde; nema penetracije sondom • Visible evidence of crevice and/or catch of explorer; no penetration of explorer	Vidljivi znakovi pukotine i penetracija sondom • Visible evidence of crevice and penetration of explorer
Parodontno zdravlje FPN • Periodontal health of FPDs	Mukoza pod međučlanom i gingivalno oko nosača nema upale; noja i kontura klinički su zdravi • Mucosa under pontic and gingival around abutment show no inflammation; color and contour clinically healthy	Gingiva i mukoza pokazuju lagano crvenilo i oticanje • Gingiva and mucosa show slight red swelling	Gingiva i mukoza pokazuju očitu crvenu oteklinu • Gingiva and mucosa show obvious red swelling
Estetike međučlanova ili krunica • Esthetics of pontics or crowns	Poklapaju se boja, nijansa i/ili translucencija restoracije i susjednog zuba • No mismatch in color, shade, and/or translucence between restoration and adjacent tooth	Neslaganje između restoracije i zubne strukture unutar normalnog Raspona boje zuba, nijanse i/ili translucencije • Mismatch between restoration and tooth structure within normal range of tooth color, shade and/or translucence	Estetski nedostatna boja, nijansa i/ili translucencija • Esthetically displeasing color, shade, and/or translucence
Higijena krunica • Hygiene of crowns	Površine međučlanova su čisti i bez znakova kalkulusa • Pontic surfaces are clean and show no calculus	Manja količina kalkulusa na površinama međučlanova • Small quantity of calculus on surfaces of pontic	Očiti zubni kalkulus na površinama međučlanova • Obvious dental calculus on surface of pontic
Sekundarni karijes • Secondary caries	Nema karijes (nema diskoloracije; nema zapinjanja ni penetracije sonde na površini cakline oko proteze • No caries present (no discoloration; no catch or penetration of explorer on surface of enamel around prosthesis)	-	Karijes prisutan (diskoloracija i zapinjanje i/ili penetracija sonde na površine cakline oko proteze) • Caries present (discoloration and catch or penetration of explorer on surface of enamel around prosthesis)

## Rezultati

Procijenjene djelomično fiksne proteze bile su u devet slučajeva (7,8%) smještene u gornjem anteriornom segmentu, u gornjem posteriornom segmentu u 43 slučaja (37,4%), u gornjem anteriornom+posteriornom području kod 15 pacijenata (13%), u donjem anteriornom segmentu u 4 slučaja (3,5%), u donjem posteriornom u 40 slučajeva (34,8%) i u donjem anteriornom+posteriornom u 4 (3,5%) slučaja.

Ukupno je bilo pregledano 100 mostova sa 727 članova na 464 nosača (prosjeak 4,64 ( $\pm 2,02$ ), raspon 2 do 14) i 263 međučlana (prosjeak 2,63 ( $\pm 1,23$ ), raspon 1 do 9). Na 63 metalno-akrilatna mosta bilo je 290 nosača (prosjeak 2,66 ( $\pm 1,16$ ), raspon 2 do 9) zajedno sa 168 međučlanova (prosjeak 1,92 ( $\pm 1,29$ ), raspon 1 do 9). Na 37 metalno-keramičkih mostova, 174 nosača (prosjeak 2,56 ( $\pm 1,36$ ), raspon 1 do 7) i 95 međučlanova (prosjeak 2,08 ( $\pm 1,21$ ) jedinica, raspon 1 do 7) ukupni je omjer međučlano-

## Results

The evaluated FPDs were located as upper anterior in 9 (7.8%), upper posterior in 43 (37.4%), upper anterior+posterior in 15 (13%), lower anterior in 4 (3.5%), lower posterior in 40 (34.8%), and lower anterior+posterior in 4 (3.5%) of all the cases.

Altogether, 100 bridges with 727 units, containing 464 abutments (mean 4.64 ( $\pm 2.02$ ), range 2-14) and 263 pontics (mean 2.63 ( $\pm 1.23$ ), range 1-9) were examined. In 63 metal-acrylic bridges, 290 abutments were recorded (mean 2.66 ( $\pm 1.16$ ), range 2-9) together with 168 pontics (mean 1.92 ( $\pm 1.29$ ), range 1-9). In 37 metal-ceramic bridges, 174 abutments (mean 2.56 ( $\pm 1.36$ ), range 1-7) and 95 pontics (mean 2.08 ( $\pm 1.21$ )) units, range 1-7) were recorded. The overall pontic/abutment ratio was 0.79 ( $\pm 0.41$ ). Pontic/abutment ratio was 0.74 ( $\pm 0.39$ ) for the metal-acrylic bridges, and 0.88 ( $\pm 0.43$ ) for the metal-ceramic bridges. Twelve (12%) of examined bridges was with cantilever.

**Tablica 3.** Prosječan životni vijek FPN-a prema odabranim varijablama (NZ, nije znatno)

**Table 3** Mean life span of FPDs according to selected variables (NS, not-significant)

Parametar • Parameter	Prosječni životni vijek • Mean life span	
	prosjeak • mean ( $\pm$ sd)	p
<b>Spol • Gender</b>		
Muški • Male	9.23 (6.06)	NZ • NS
Ženski • Female	8.85(7.94)	
<b>Dob • Age</b>		
35-45	5.05(4.45)	0.011
46-55	8.44(6.41)	
56-65	10.41(6.47)	
66 +	14.83(18.75)	
<b>Broj jedinica u DFP • Number of units in FPD</b>		
1-3	8.92(8.28)	NZ
4-6	8.98(7.30)	
7 +	8.90(5.66)	
<b>Gornja/donja čeljust • Upper/lower jaw</b>		
Gornja • Upper	10.23(8.29)	0.032
Donja • Lower	7.16(5.75)	
<b>Restorativni materijal • Restorative material</b>		
Metal-akrilat • Metal-acrylic	10(6.21)	0.011
Metal-keramika • Metal-porcelain	8(16.22)	
Metalna krunica • Metal crown	6.53(7.04)	
<b>Vrsta međučlana • Type of Pontic</b>		
Sedlast • Saddle	6.11 (3.98)	NS
Grebensko krilo • Ridge Lap	8.48 (4.57)	
Modificirano grebensko krilo • Modifiye ridge lap	10.59 (8.98)	
Higijenski • Hygienic	-	

va/nosača iznosio 0,79 ( $\pm$ 0,41). Za metalno-akrilatne mostove omjer međučlanova/nosača iznosio je 0,74 ( $\pm$ 0,39) te 0,88 ( $\pm$ 0,43) za metalno-keramičke mostove. Dvanaest (12%) pregledanih mostova bilo je s privjeskom.

Prosječna starost restoracija bila je 8,95 godina ( $\pm$ 7,47) u rasponu od 1 do 39 godina. Prosječna starost krunica iznosila je 6,53 godina ( $\pm$ 7,04) u rasponu od 1 do 30 godina, za metalno-keramičke mostove 8,16 godina ( $\pm$ 9,28) u rasponu od 1 do 39 godina, a za metalno-akrilatne prosječna je starost iznosila 10,00 godina ( $\pm$ 6,21) u rasponu od 1 do 25 godina.

U Tablici 3. je odnos između trajnosti FPN-a s različitim varijablama. Zabilježili smo veliku korelaciju između «životnoga vijeka» fiksnih protetskih nadomjestaka i dobnih skupina nositelja tih radova ( $p=0,010$ ). Znatna je korelacija ustanovljena između skupine s pacijentima od 35 do 45 godina i onih od 46 do 55 ( $U=283,50$ ;  $p=0,020$ ) te s dobnom skupinom od 56 do 65 godina ( $U=200,00$ ;  $p=0,001$ ). Trajnost radova FPN-a, koje je imala dobnja skupina od 35 do 45, bio je kraći od svih ostalih skupina. Djelomično fiksne proteze izrađene za gornju čeljust bile su trajnije negoli radovi za donju čeljust ( $p=0,032$ ). Zabilježena je statistički velika korelacija između trajno-

The mean age of restorations was 8.95 ( $\pm$ 7.47) years (range 1 to 39 years). For the crowns, it was 6.53 ( $\pm$ 7.04) years (range 1 to 30 years), for the metal-ceramic bridges 8.16 ( $\pm$ 9.28) years (range 1 to 39 years), and for the metal-acrylic bridges 10.00 ( $\pm$ 6.21) years (range 1 to 25 years).

The relationship between the life span of FPDs with different variables has been given in Table 3. A significant relationship was found between the life span of FPDs and the age groups ( $p=0.010$ ). FPDs life span of the 35-45 age group was found to be significantly shorter than those of the other groups. The life span of FPDs was significantly higher in the upper jaw as compared with the lower jaw ( $p=0.032$ ). A significant difference for the life span of FPDs was found between different types of restorative materials ( $p=0.011$ ). The life span was found to be statistically significantly higher in the group of metal-acrylic than in the metal-ceramic ( $U=831.00$ ;  $p=0.017$ ) and metal crown ( $U=281.50$ ;  $p=0.015$ ) groups. The life span for the metal-acrylic restorations was longer than those for the full metal crowns and metal-ceramic restorations.

Modified USPHS criteria values of the FPDs can be seen in Table 4. In the assessment of occlusal

**Tablica 4.** Odnos između modificiranih kriterija USPHS-a i restorativnih materijala (n,%), (NZ, nije znatno)  
**Table 4** Relationship between modified USPHS criteria and restorative materials (n,%), (NS, not-significant)

Grupa • Group	Okluzalni kontakt • Occlusal Contact				Balancing kontakt • Balancing Contact				Proksimalni kontakt • Proximal Contact			
	$\alpha$	$\beta$	$\gamma$	p	$\alpha$	$\beta$	$\gamma$	p	$\alpha$	$\beta$	$\gamma$	p
Krunica • Crown (n=15)	12 (80)	2(13.3)	1(6.7)	NZ • NS	9(60)	5(33.3)	1(6.7)	NZ • NS	6(40)	9 (60)	-	0.003
Metal-keramički • Metal-ceramic (n=37)	33(89.2)	2(5.4)	2(5.4)		30(81.1)	4(10.8)	3(8.1)		25(67.6)	11(29.7)	1(2.7)	
Metalno-akrilatni • Metal-acrylic (n= 63)	48(76.2)	1(1.6)	14(22.2)		45(71.4)	11(17.5)	7(11.1)		20(31.7)	33(52.4)	10(15.9)	
Ukupno • Total (n=115)	93(80.9)	5(4.3)	17(14.8)		84(73)	20(17.2)	11(9.6)		51(44.3)	53(46.1)	11(9.6)	

sti DFP-a i vrste restorativnih materijala ( $p=0,011$ ). Trajnost metalno-akrilatne skupine bila je statistički znatno dulja od onih iz metalno-keramičke skupine ( $U=831,00$ ;  $p=0,017$ ) te skupine potpunih kovinskih krunica ( $U=281,50$ ;  $p=0,015$ ). Statistički se znatnim pokazao i odnos između trajnosti radova te vrste restorativnih materijala. Trajnost metalno-akrilatnih restoracija dulja je od one za potpune kovinske krunice i metalno-keramičke restoracije.

U Tablici 4. vrijednosti su modificiranih kriterija USPHS-a. U procjeni okluzalnog kontakta ( $\chi^2(4)=9,70$ ,  $p=0,458$ ) i balansnog kontakta ( $\chi^2(4)=4,18$ ,  $p=0,382$ ) nisu bile zabilježene statističke velike razlike između skupina različitih DFP-a, no znatno veći gubitak područja proksimalnog kontakta zabilježen je kod metalno-akrilatnih mostova ( $\chi^2(4)=16,01$ ,  $p=0,003$ ).

U Tablici 5. su modificirane ocjene CDA za djelomično fiksne proteze. Među različitim FPN-ima nije

contact ( $\chi^2(4)=9.70$ ,  $p=0.458$ ) and balancing contact ( $\chi^2(4)=4.18$ ,  $p=0.382$ ) no significant differences were observed between the groups of different FPDs, whereas the loss of the proximal contact areas was found to be significantly greater ( $\chi^2(4)=16.01$ ,  $p=0.003$ ) for the metal-acrylic bridges.

The modified CDA ratings for FPDs are shown in Table 5. There was no significant difference between different FPDs for the retention ( $\chi^2(4)=2.07$ ,  $p=0.722$ ), marginal integrity ( $\chi^2(4)=4.07$ ,  $p=0.396$ ) and secondary caries ( $\chi^2(6)=3.82$ ,  $p=0.700$ ). Periodontal health ( $\chi^2(4)=13.04$ ,  $p=0.011$ ), esthetics ( $\chi^2(4)=45.74$ ,  $p=0.000$ ) and hygiene ( $\chi^2(4)=16.81$ ,  $p=0.002$ ) were significantly different between different FPDs.

The relationship between the pontic/abutment ratio and life span of restoration was found not to be significant according to Spermans' rho test ( $\rho=0.072$ ;  $p=0.472$ ;  $N=100$ ).

**Tablica 5.** Odnos između modificiranih kriterija CDA i restorativnih materijala (n,%), (NZ, nije znatno)  
**Table 5** Relationship between modified CDA criteria and restorative materials (n,%), (NS, not-significant)

Modificirani Kriteriji Stomatološke udruge Kalifornija • Modified California Dental Association Criteria												
Grupa • Group	Retencija • Retention				Marginalni integritet • Marginal Integrity				Parodontno zdravlje • Periodontal Health			
	R	S	T	p	R	S	T	p	R	S	T	p
Krunica • Crown (n=15)	8 (53.3)	5 (33.3)	2 (13.3)	NZ • NS	5(33.3)	6(40)	4(26.7)	NZ • NS	5(33.3)	10(66.7)	-	0.011
Metal-keramički • Metal-ceramic (n=63)	16(43.2)	10(27)	11(29.7)		9(24.3)	20(54.1)	8(21.6)		15(40.5)	9(24.3)	13(35.1)	
Metalno-akrilatni • Metal-acrylic (n= 37)	3(52.4)	15(23.8)	15(23.8)		12(19)	27(42.9)	24(38.1)		14(22.2)	27(42.9)	22(34.9)	
Ukupno • Total (n=115)	57(49.6)	30(26.1)	28(24.3)		26(22.6)	53(46.1)	36(33.1)		34(29.6)	46(40)	35(30.4)	

Modificirani sustav ocijenjivanja CDA • Modified California Dental Association												
Grupa • Group	Estetski • Esthetic				Higijenski • Hygiene				Sekundarni karijes • Secondary caries			
	R	S	T	p	R	S	T	p	R	T	p	
Krunica • Crown (n=15)	5(33.3)	9(60)	1(6.7)	0.000	7(46.7)	8(53.3)	-	0.002	9(60)	6(40)	NZ • NS	
Metal-keramički • Metal-ceramic (n=63)	23(62.2)	11(29.7)	3(8.1)		20(54.1)	13(25.1)	4(10.8)		24(64.8)	13(35.2)		
Metalno-akrilatni • Metal-acrylic (n= 37)	2(3.2)	39(61.9)	22(34.9)		12(19)	36(57.1)	15(23.8)		36(57.2)	27(42.9)		
Ukupno • Total (n=115)	30(26.1)	59(51.3)	26(22.6)		39(33.9)	57(49.6)	19(16.5)		69(60)	46(40)		

bilo statistički veće razlike u retenciji ( $\chi^2(4)=2,07$ ,  $p=0,722$ ), marginalnom integritetu ( $\chi^2(4)=4,07$ ,  $p=0,396$ ) i sekundarnom karijesu ( $\chi^2(6)=3,82$ ,  $p=0,700$ ), parodontnom zdravlju ( $\chi^2(4)=13,04$ ,  $p=0,011$ ), estetici ( $\chi^2(4)=45,74$ ,  $p=0,000$ ) i higijeni ( $\chi^2(4)=16,81$ ,  $p=0,002$ ).

Prema Spermanovu ro-testu, korelacija između omjera međučlanova/nosača i trajnosti restoracije nije bila statistički znatna ( $ro=0,072$ ;  $p=0,472$ ;  $N=100$ ).

## Rasprava

Analiza raspada dentalnih restoracija važna je kako bismo spoznali elemente koji bi mogli poboljšati kliničke postupke i odabir materijala. Iz dostupnih podataka o dugotrajnosti djelomično fiksnih proteza jasno je da postoje varijacije i u načinu skupljanja podataka i u rezultatima (9). Fayyad i Al-Rafee (22) te Walton i njegovi kolege (23) priopćili su da su metalno-keramički FPN-i najčešće korišteni oblici radova, a da se u Turskoj rutinski izrađuju najčešće potpuno kovinski mostovi (uglavnom od neplemenitih kovina), zatim rjeđe metalno-akrilatni te metalno-keramičke restoracije. Uporaba potpuno keramičkih mostova prevladala je u posljednjih pet godina, ali njihova je primjena u rutinskim postupcima još dosta ograničena. U ovom su ispitivanju 63 mosta bila metalno-akrilatna, 37 je bilo metalno-keramičkih, a 15 krunica bilo je izrađeno od plemenitih kovina.

Prosječna starost pregledanih FPN-a iznosila je 8,95 godina - 6,53 godina za potpune metalne krunice, 8,16 godina za metalno-keramičke mostove i 10,00 godina za metalno-akrilatne mostove. Prosječna trajnost radova bila 8,5 godina, što je više od trajnosti radova od 6,1 godinu koju su objavili Fayyad i al-Rafee (24), 6,2 godine iznosi kod Fostera (25) i 8,3 godine kod Waltona i suradnika (23). Fayyad i Al-Rafee (22) ističu da su svi potpuno kovinski radovi pacijentima služili 6,2 godine, a metalno-keramički 4 godine. U istraživanju Waltona i suradnika (23) trajnost tih istih radova bila je 7,1 te 6,3 godine. U ovom je ispitivanju prosječna trajnost metalno-keramičkih djelomično fiksnih proteza bila 8,16 godina, što je više od iznosa koji su u svojem radu istaknuli Fayyad i Al-Rafee (22) te Walton i njegovi kolege (23). Prosječna starost potpunih kovinskih krunica određena je na 6,53 godine, što je više od radova o kojima govore Fayyad i Al-Rafee (22), a manje od onih koje opisuju Walton i suradnici (23). Valderhaug (9) u svojem radu objavljuje prosječnu trajnost mostova tipa 3 od lijevanoga zlata i toplinski polimeriziranog akrilata od 10,5 godi-

## Discussion

Analyses of failures and deterioration of dental restorations are important as to ascertain what might improve clinical procedures and the selection of materials as well. From the available data on the longevity of FPDs, there is variation both in the manner in which the data are collected and in the results (9). Fayyad & Al-Rafee (22) and Walton et al. (23) reported that metal-ceramic FPDs were the most commonly used type of retainers. In state institutions in Turkey, in routine procedures, full metal (mostly made of non-precious alloys), metal-acrylic (though with decreased use) and metal ceramic restorations have been used for FPDs. The use of full ceramics dates back to less than 5 years ago and its use in routine procedures is still very limited. In this study 63 bridges were metal-acrylic, 37 were metal-ceramic, and there were 15 crowns made of non-precious metals.

In this study, the overall mean age of FPDs was 8.95 years; 6.53 years for full metal crowns, 8.16 years for metal-ceramic bridges, and 10.00 years for metal-acrylic bridges. The average lifespan of 8.95 years was higher than the average lifespan of 6.1 years reported by Fayyad and al-Rafee (24), 6.2 years reported by Foster (25), and 8.3 years reported by Walton et al. (23). Fayyad & Al-Rafee (22) report that all-metal retainers had an average length of service for 6.2 years, and metal-ceramic retainers for 4 years. In the study of Walton et al. (23), the former was reported as 7.1 years, and the latter as 6.3 years. In this study, the mean age of metal-ceramic FPDs was observed as 8.16 years, which was higher than those reported by Fayyad & Al-Rafee (22) and Walton et al. (23). The mean age of full metal crowns determined as 6.53 years was higher than that of Fayyad & Al-Rafee (22) and lower than that of Walton et al. (23). Valderhaug (9) reported that the mean time of service for type-3 casting gold and heat-cured acrylic veneering bridges were 10.5 years. In this study, metal-acrylic restora-

na. U ovom su ispitivanju metalno-akrilatne restoracije bile izrađene od neplemenitih kovina te im je određena prosječna trajnost od 10 godina, što je u skladu s nalazima Valderhauga.

Hochman i suradnici (26) priopćili su da je prosječna trajnost FPN-a u dobnoj skupini pacijenata od 61 godine naviše, dulja nego u svim ostalim skupinama. U našem istraživanju nije zabilježena statistički znatna razlika u prosječnoj trajnosti djelomično fiksnih proteza među različitim dobnim skupinama, iako je ipak najdulja (vrijednost SD također je bila veća) u dobnoj skupini onih iznad 66 godina. Prosječna trajnost FPN-a kod pacijenata od 35 do 45 godina kraća je od one procijenjene za skupine od 46 do 55 te od 56 do 65 godina. Znanstvenici smatraju da je razlog za taj nalaz u tendenciji pripadnika najmlađe dobne skupine da ranije potraže pomoć liječnika u kontroli svojih FPN-a. Problemi se obično rješavaju obnavljanjem djelomično fiksnih proteza prema pacijentovim željama, što smanjuje stopu trajnosti u toj skupini.

U literaturi nismo pronašli statistički znatnije odnose između stope trajnosti radova i broja jedinica (međučlanovi + nosači + privjesci) u FPN-u (23,27). Trajnost djelomično fiksnih proteza korelirala je s brojem retencijskih elemenata, ali ne i jedinica (25). Slično rezultatima drugih stručnjaka, ni u ovom istraživanju nije zabilježen statistički znatan odnos između broja jedinica i prosječne trajnosti FPN-a (Tablica 3.).

U ovom smo radu isto tako uočili da se više mostova nalazilo u gornjoj, negoli u donjoj čeljusti, što je u skladu s ranijim istraživanjima (28,29). Većina je bila posteriorna (gornji i donji), a to se može rastumačiti činjenicom da je manjkalo više stražnjih zuba od prednjih, što u svojim podacima potvrđuju i Foster (25), te Fayyad i Al-Rafee (22). Hochman i suradnici (26) ističu, pak, dulju trajnost FPN-a u donjoj čeljusti negoli u gornjoj, no mi smo u našem radu dobili suprotne rezultate. Naime, prosječna trajnost restoracija u gornjoj čeljusti bila je dulja od one za radove u donjoj čeljusti.

Stručnjaci su kritizirali polimerni restorativni materijal za boju zuba koji se uporabljao za fasetiranje krunica. Prigovarali su nedovoljnoj stabilnosti boje i slabom otporu prema trošenju. Mi smo također zapazili gubitak proksimalnih kontakata zbog trošenja, kao što je zabilježeno kod metalno-akrilatnih restoracija kod kojih su područja proksimalnog kontakta izrađena od akrilata.

Od nekih se stručnjaka tražilo da ocijene svojstva površine i boju, anatomske oblike i marginalni integri-

tions were prepared from non-precious metals and the mean age observed as 10 years was in compliance with Valderhaug.

Hochman et al.(26) reported that the mean life span of FPDs for the 61 and above age group was higher than the other age groups. In this study, the 66 and above age group had the highest value for the mean life span of FPDs (SD value was higher as well), but no statistical significance was observed. The mean life span of FPDs for the 35-45 age group was found to be significantly shorter than those of 46-55 and 56-65 age groups. It has been thought by the researchers that the reason for this might be that people of younger age refer to health institutions at an earlier stage for the control of their FPDs. Problems are usually solved by renewing the FPDs according to patient's choice that decreases the survival rate of FPDs.

In literature no relationship was found between the survival rate of FPDs and the number of units (pontics + abutments + cantilevers) (23,27). The lifespan of FPDs was correlated with the number of retainers, not with the number of units (25). Similar to the results of other researchers, no significant relationship was observed between the number of units and the mean life span of FPDs in this study as well (Table 3).

In this study, it has also been noted that most of the bridges were constructed in the upper jaw, which is in compliance with earlier studies (28,29). The majority of the bridges in this study were posterior bridges (upper and lower), and this could be explained by the fact that there were more posterior teeth missing than the anterior, which also confirmed the data of Foster (25), and Fayyad and Al-Rafee (22). While Hochman et al. (26) reported the mean life span of FPDs in the lower jaw to be higher than that in the upper jaw, in this study, contrary to the results of other researchers, the mean life span for the restorations in the upper jaw was observed to be higher than that in the lower jaw.

Tooth-coloured polymeric restorative material for veneering of crowns has been criticized for its lack of colour stability and resistance against wear. In this study as well, loss in the proximal contacts caused by wear was noted in the metal-acrylic restorations of which the proximal contact areas were prepared of acrylic.

Some examiners were asked to rate the characteristics of surface and colour, anatomic form, and margin integrity for FPDs according to CDA criteria (30,31). Glantz et al. (8) examined the quality of FP-



tet djelomično fiksni proteza prema sustavu ocjenjivanja CDA (30,31). Prema istim su kriterijima Glantz i suradnici (8) procijenili kakvoću radova DFP-a nakon 5 godina, a Valderbaug (9) nakon 15 godina. Glantz i suradnici (8) istaknuli su da 90% restoracija zadovoljava, a Valderbaug (9) je ocijenio „neprihvatljivima» između 5% i 14% različitih svojstava pregledanih jedinica. Suprotno tim rezultatima, od 22,1 do 49,6% restoracija obuhvaćenih našim ispitivanjem zadovoljilo je, a od 16,5 do 33,1% od svih pregledanih ocijenjeno je neprihvatljivima. U našem radu vrijednosti u kategoriji „neprihvatljivih“ odnose se na higijenu, estetiku i parodontno zdravlje metalno-akrilatnih restoracija i veće su od onih za metalno-keramičke radove. To tumačimo činjenicom da je akrilatnim materijalima površina porozna te stvaraju područja akumulacije plaka, posebice ispod međučlanova, a imaju i slabiji otpor prema diskoloraciji, što im umanjuje estetsku kakvoću (32). Walton i suradnici (23) te Libby i njegovi kolege (33) smatraju da je zubni karijes kriv za neuspjeh, što obuhvaća od 22,20% do 38,00% neuspjelih restoracija. U ovom je ispitivanju sekundarni karijes zabilježen kod 40% restoracija. Kod metalno-keramičkih taj iznos je 35,2%, a 40% kod krunica, dok 42,9% dosiže kod metalno-akrilatnih radova. Smatra se da je uzrok veća prosječna trajnost djelomičnih fiksnih proteza izrađenih od metala i akrilata.

De Backer i suradnici (34) ističu nizak prosječan broj jedinica prema FPN-u (4,1), ali velik razmjer međučlanova prema nosačima (0,86). To objašnjava malo zuba nosača koji zamjenjuju isti broj zuba koji manjkaju. U našem radu, kao i u njihovu istraživanju, prosječan broj jedinica prema FPN-u iznosi 4,64, a razmjer međučlanova prema nosačima 0,79. Kod metalno-akrilatnih FPN-a razmjer međučlanova prema nosačima je 0,74, a za metalno-keramičke ta vrijednost iznosi 0,88.

## Zaključak

Procjena pregledanih fiksnih protetskih nadomjestaka indiciranih za skidanje, pokazala je njihovu veću prosječnu trajnost u gornjoj čeljusti negoli u donjoj.

Odnos između razmjera međučlanova prema nosačima i prosječne trajnosti restoracije nije se pokazao statistički znatnim.

Kliničkom procjenom otkrivene su mnogo niže vrijednosti parodontnog zdravlja, estetike i higijene kod metalno-akrilatnih mostova u usporedbi s FPN-ima izrađenima od drugih materijala.

Kod proksimalnih kontakata bilo je više gubitaka, negoli kod metalno-akrilatnih FPN-a.

Ds after 5 years, and Valderbaug (9) after 15 years, using the CDA quality-evaluating system. Glantz et al. (8) rated 90% of the restorations as satisfactory, and Valderbaug (9) rated between 5% and 14% of the units as 'not acceptable' for the different characteristics evaluated. In contrary with the results of researchers mentioned above, 22.1- 49.6% of restorations examined in this study, were rated as satisfactory whereas 16.5- 33.1% of all were unacceptable. In this study, the 'unacceptable' values regarding the characteristics of hygiene, esthetics and periodontal health of metal-acrylic restorations were observed to be higher than those of metal-ceramic ones. This could be explained by the fact that acrylic materials have porous surface characteristics and create plaque accumulation areas particularly under pontics, and also by acrylic material lower resistance for discoloration which diminishes the aesthetic quality (32). Walton et al. (23) and Libby et al. (33) reported dental caries was the primary cause of failure accounting for 22.0% and 38.0% of failed restorations. In this study, secondary caries were noted in 40% of the restorations. This rate was observed as 35.2% in metal-ceramic restorations and 40% in the crowns, while it reached 42.9% in the metal-acrylic ones. The reason for this has been thought to be the higher mean age of metal-acrylic FPDs and/or porous surface which favour the plaque accumulation.

De Backer et al. (34) reported that the mean number of units per FPD was low (4.1), however, the pontic/abutment ratio was high (0.86). This accounts for a low number of abutment teeth replacing an equal number of missing teeth. Similar to the result of their study, in this study as well, the mean number of units per FPD was observed as 4.64, and the pontic/abutment ratio as 0.79. While the pontic/abutment rate was 0.74 for the metal-acrylic FPDs, it reached 0.88 for the metal-ceramic FPDs.

## Conclusion

Evaluation of the FPDs which had to be removed showed that the mean age of FPDs was higher in the upper jaw than in the lower jaw.

The relationship between the pontic/abutment ratio and the mean life span of restoration was not significant.

The clinical assessment showed that periodontal health, esthetics and hygiene were significantly lower in the metal-acrylic bridges compared to other FPDs. There were significantly more losses of the proximal contacts in metal-acrylic FPDs than in full crowns and metal-ceramic FPDs.

**Abstract**

**Aim:** To evaluate abutments and status of FPDs of patients who asked for replacement of FPDs. **Materials and Methods:** A total of 115 people were who referred to Ege University, School of Dentistry, Department of Prosthodontics for the removal of their FPDs for various reasons participated. Their age ranged from 35 to 76 (53.98±8.55) years. The FPDs evaluated were as follows: 15 (13%) full metal crowns, 63 (54.8%) metal-acrylic bridges and 37 (32.2%) metal-ceramic bridges. The numbers of units, the location of restorations in the arch, the age and the type of restorations were recorded. The Modified United States Public Dental Health (USPDH) criteria were used to evaluate the occlusion, and the Modified California Dental Association (CDA) criteria were utilized for evaluation of the clinical quality of restorations. **Results:** A total of 100 bridges with 727 units were examined, containing 464 abutments and 263 pontics. The mean age of FPDs was 6.53(±7.04) years for the crowns, 8.16(±9.28) years for metal-ceramic bridges, and 10.00(±6.21) years for the metal-acrylic bridges. The mean age of FPDs was significantly higher in the metal-acrylic group than in the metal-ceramic ( $p=0.017$ ) and the full metal crown groups ( $p=0.015$ ). The clinical assessment revealed that periodontal health ( $p=0.011$ ), esthetics ( $p=0.000$ ) and hygiene ( $p=0.002$ ) were lower in the metal acrylic FPDs than in the other FPDs. The loss of proximal contacts were the highest in the metal-acrylic FPDs ( $p=0.003$ ). **Conclusions:** Prior to the removal of FPDs, it was found, based on the CDA criteria, that, 'unacceptable' ratings of periodontal health, esthetics and hygiene were higher in the metal-acrylic FPDs than in the metal-ceramic and the full crown FPDs.

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Dental abutments; Dentures, partial, fixed; Dental crowns; Metal ceramic alloys

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