



Ivan Mikić¹, Petra Ivanišić¹, Lara Sviličić¹, Kaja Topolnjak¹, Danica Vidović Juras^{2,3}, Vlatko Kopic^{4,5}, Vlaho Brailo^{2,3}

Dental work-up protocol of chronic kidney disease patients undergoing kidney transplant surgery – a retrospective study

Protokol stomatološke obrade bolesnika s kroničnom bubrežnom bolešću u sklopu pripreme za transplantaciju bubrega – retrospektivna studija

¹ University of Zagreb School of Dental Medicine
Sveučilište u Zagrebu, Stomatološki fakultet

² Department of Oral Medicine, University of Zagreb School of Dental Medicine
Sveučilište u Zagrebu, Stomatološki fakultet, Zavod za oralnu medicinu

³ Clinic for Dentistry, University Clinical Hospital Centre Zagreb
Klinički bolnički centar Zagreb, Klinika za stomatologiju

⁴ Faculty of Medicine Osijek, Josip Juraj Strossmayer University of Osijek
Sveučilište Josipa Jurja Strossmayera, Medicinski fakultet, Osijek

⁵ Department of Maxillofacial and Oral Surgery, University Hospital Center Osijek
Klinički bolnički centar Osijek, Zavod za maksilofacijalnu i oralnu kirurgiju

Abstract

Objective: Pre-transplant dental clearance is commonly recommended for kidney transplant candidates, although standardized protocols are lacking and supporting evidence remains limited. The aim of this study was to analyze the dental work-up protocol, treatment needs, complications, and time to clearance in patients undergoing kidney transplantation at a tertiary care center. **Materials and Methods:** A retrospective chart review was conducted of patients referred by their attending nephrologist for pre-transplant dental evaluation between 2019 and 2024. Demographic, medical, and dental data were collected, including DMFT index, type and number of procedures performed, complications, and time required to obtain dental clearance. **Results:** Seventy-four patients (median age 41 years) were included. The median DMFT index was 13.5 (range 0–28). Supragingival instrumentation was performed in 39.2% of patients, and tooth extraction in 27%, with 62 teeth removed overall. Endodontic treatment was completed in 9.5% of patients. Two postoperative complications (2.7%) were recorded and managed conservatively. Most patients (67.6%) achieved dental clearance in a single visit, and the median time to clearance was 1 day (range 1–45). **Conclusion:** Within the limitations of this single-center retrospective study, pre-transplant dental clearance was feasible, safe, and completed without evidence of clinically meaningful delay in the transplant preparation process.

Received: November 30, 2025

Accepted: February 23, 2026

Address for correspondence

prof. dr. sc. Vlaho Brailo
University of Zagreb School of Dental Medicine
Clinic for Dentistry, University Clinical Hospital Center Zagreb
Gundulićeva 5
brailo@sfzg.unizg.hr

MeSH Terms: Chronic Kidney Failure; Kidney Transplantation; Preoperative Care; Dental Care for Chronically Ill

Author Keywords: kidney transplantation; dental work-up; dental calculus; immunosuppression; chronic kidney disease

Ivan Mikić - 0009-0008-7136-7877
Petra Ivanišić - 0009-0004-3468-9309
Lara Sviličić - 0009-0003-6923-6003
Kaja Topolnjak - 0009-0008-8249-832X

Danica Vidović Juras - 0000-0001-7391-6114
Vlatko Kopic - 0000-0002-7444-4494
Vlaho Brailo - 0000-0002-8449-871X

Introduction

Renal transplantation is the optimal treatment for end-stage renal disease, offering improved survival and quality of life compared to dialysis. However, post-transplant immunosuppression significantly increases susceptibility to infections, which remain a major cause of morbidity and mortality in kidney transplant recipients. Infections are associated with increased mortality (2.22-fold higher risk) and death-censored graft failure (1.92-fold higher risk) following kidney transplantation (1–4).

Uvod

Transplantacija bubrega optimalna je terapija u liječenju terminalne bubrežne bolesti zato što omogućuje bolju stopu preživljenja i kvalitetu života u usporedbi s dijalizom. Međutim, imunosupresija poslije transplantacije značajno povećava podložnost infekcijama koje su glavni uzrok morbiditeta i mortaliteta primatelja bubrežnoga presatka. Infekcije se povezuju s povećanom smrtnošću (2,22 puta veći rizik) i gubitkom presatka (1,92 puta veći rizik) poslije transplantacije bubrega (1 – 4).

The oral cavity harbors over 700 bacterial species and represents a potential source of infection in immunocompromised transplant recipients. Pre-transplant dental evaluation and clearance have been advocated to eliminate oral foci of infection that could lead to serious post-transplant complications. Case reports have documented occult dental infections causing fever and sepsis in renal transplant recipients, with dental pathology that could have been detected and treated prior to transplantation. Furthermore, periodontal disease has been associated with adverse transplant outcomes, including graft rejection, lower graft survival, and higher mortality rates (5–8).

Despite the theoretical rationale for pre-transplant dental clearance, the evidence base remains limited. The 2020 Kidney Disease: Improving Global Outcomes (KDIGO) Clinical Practice Guideline provides only a weak recommendation (Grade 2C) for dental evaluation prior to kidney transplantation, noting that „dental screening is important prior to transplant in order to screen for and prevent post-transplant oral infections,” while acknowledging that dental evaluation is not mandated. The American Society of Transplantation guidelines recommend dental evaluation and treatment of caries before surgery, but specific protocols are not standardized (1).

Significant knowledge gaps exist regarding optimal dental clearance protocols. A 2023 survey of dental practitioners found wide variation in the provision of treatment for patients undergoing solid organ transplantation, demonstrating the lack of standardized guidelines. Studies have shown substantial discrepancies between identified dental treatment needs and actual treatment completion; while scaling is frequently performed pre-transplant (93.5% in kidney recipients when deemed necessary), tooth extractions are rarely completed (only 10.0%). The optimal extent of dental work-up—balancing infection risk reduction against treatment burden and potential transplant delays—remains controversial (1,4,9).

Given the absence of standardized protocols and limited data on current practice patterns, there is a need to document and analyze existing dental clearance approaches at transplant centers. Understanding current practices is essential for developing evidence-based guidelines and identifying areas for protocol optimization. The aim of this study was to analyze the dental work-up protocol of patients undergoing kidney transplant surgery at the Dental Clinic of the University Clinical Hospital Centre Zagreb, documenting the types and extent of dental interventions performed, procedure complications and treatment completion rates.

Usna šupljina domaćin je više od 700 bakterijskih vrsta i potencijalni je izvor infekcije kod imunokompromitiranih primatelja transplantata. Stomatološka obrada i dobivanje stomatološkog odobrenja prije transplantacije potrebni su kako bi se uklonila oralna žarišta infekcije koja bi mogla biti uzrok nastanka ozbiljnih komplikacija u razdoblju poslije transplantacije. U raznim prikazima slučajeva zabilježena je pojava okultnih odontogenih infekcija koje su prouzročile vrućicu i sepsu kod primatelja transplantiranoga bubrega s prisutnom dentalnom patologijom koja se mogla otkriti i liječiti prije transplantacije. Nadalje, parodontalna bolest povezana je s nepovoljnim ishodima transplantacije, uključujući odbacivanje presatka, smanjenu stopu preživljenja presatka i veću stopu mortaliteta (5 – 8).

Unatoč teorijskom opravdanju za dobivanje stomatološkog odobrenja prije transplantacije, postojeći dokazi su ograničeni. Kidney Disease: Improving Global Outcomes (KDIGO) Clinical Practice Guideline iz 2020. godine daje samo slabu preporuku (stupanj 2C) za stomatološku procjenu i obradu prije transplantacije bubrega, uz napomenu da je *stomatološki pregled prije transplantacije važan kako bi se otkrile i spriječile oralne infekcije poslije transplantacije*, smatrajući da stomatološka procjena i obrada nije obvezna. U smjernicama Američkoga transplantacijskoga društva (American Society of Transplantation) preporučuje se stomatološka procjena i uklanjanje karijesa prije transplantacije, ali specifični protokoli nisu standardizirani (1).

Postoji značajan manjak dokaza o optimalnim protokolima stomatološke obrade prije transplantacije. Autori istraživanja iz 2023. godine istaknuli su široke varijacije u liječenju pacijenata koji se pripremaju za transplantaciju solidnih organa, što upućuje na nedostatak standardiziranih smjernica. U istraživanjima su istaknute značajne razlike između utvrđenih potreba za stomatološkim liječenjem i stvarno provedenog liječenja; uklanjanje zubnog kamenca često je prije transplantacije (93,5 % kod primatelja bubrega kada se to smatra potrebnim), a ekstrakcije se rijetko obavljaju potpuno (samo 10,0 %). Optimalni opseg stomatološke obrade sporan je i balansira između smanjenja rizika od infekcije i opterećenja liječenjem te potencijalnom odgodom transplantacije (1, 4, 9).

S obzirom na nedostatak standardiziranih protokola i ograničene podatke u literaturi o uobičajenoj kliničkoj praksi, potrebno je dokumentirati i analizirati postojeće pristupe stomatološkoj obradi i protokolu za dobivanje stomatološkog odobrenja u transplantacijskim centrima. Razumijevanje sadašnjih praksi ključno je za razvoj smjernica temeljenih na dokazima i identificiranje područja na kojima je potrebno optimizirati protokole. Cilj ovog istraživanja bio je analizirati protokol stomatološke obrade pacijenata koji se pripremaju za transplantaciju bubrega u Klinici za stomatologiju Kliničkoga bolničkoga centra Zagreb, dokumentirajući vrste i opseg obavljenih stomatoloških zahvata, nastale komplikacije i stopu završetka obrade.

Materials and methods

A retrospective chart review was performed of patients who were referred by their attending nephrologist to the Dental Unit of the University Clinical Hospital Centre Zagreb for pre-transplant dental evaluation between 2019 and 2024. Only patients formally referred to our unit by a nephrologist during this period were included in the study.

Clinical examination and panoramic x-ray were performed in each patient. Dental work-up consisted of the following: Supraperiapical instrumentation was done in all patients with visible calculus deposits. Teeth with questionable prognosis (teeth with advanced caries that could not be restored, teeth with symptomatic periapical radiolucency, teeth with asymptomatic periapical processes bigger than 5mm, teeth with advanced periodontal disease i.e. mobility of 3rd or 4th degree and/or symptoms, and symptomatic semi-impacted wisdom teeth) were extracted. Extraction wounds were sutured based on the clinical judgement of the attending dentist. Mild to moderate carious lesions were observed, while caries removal and/or endodontic treatment was done in symptomatic teeth, depending on the available time and the patient's general health. Antibiotic prophylaxis was administered according to the American Heart Association guidelines (10). Antibiotic treatment was administered based on the clinical judgement.

Following data were registered: demographic data (age and sex), medical data (kidney diagnosis - chronic kidney disease, platelet transfusion and the date of kidney transplant surgery) and dental data (number of decayed, missed and filled teeth (DMFT), number of symptomatic teeth, number of teeth with periapical radiolucency). Furthermore, number and type of all dental procedure(s) performed in each patient (supraperiapical instrumentation, number and type of extractions, number of fillings and endodontic treatments), as well as procedure complication(s) (type and treatment of the complication) were registered. Tooth extractions were categorized as simple (routine) extractions or surgical extractions involving flap elevation and/or removal of supporting alveolar bone (alveotomy). Finally, the number of dental appointments and the number of days required to obtain a dental clearance for kidney transplant surgery were registered as well.

Statistics

Comparisons according to sex and year of treatment were performed for exploratory purposes to assess potential demographic and temporal trends. Data was organized in table files (*Microsoft Excel, Microsoft Inc., USA*) and statistically processed in SPSS (*IBM Inc., USA*). The Kolmogorov-Smirnov test was used to assess the distribution of quantitative variables, which determined that the variables were not normally distributed. Therefore, the median (min-max) was used to display continuous variables. Categorical variables were expressed as absolute numbers and proportions. To assess the difference between variables chi square test was used for categorical variables and Mann Whitney or Kruskal Wallis test was used for continuous variables. Values less than 0.05 ($p < 0.05$) were considered statistically significant.

Materijali i metode

Proveden je retrospektivni pregled kartona pacijenata koje je nadležni nefrolog uputio u Kliniku za stomatologiju Kliničkoga bolničkoga centra Zagreb na predtransplantacijsku stomatološku obradu između 2019. i 2024. godine. U istraživanje su bili uključeni samo pacijenti koje je nefrolog službeno uputio na naš odjel tijekom navedenog razdoblja.

Obavljen je klinički pregled i učinjena panoramska rendgenska snimka za svakog pacijenta. Stomatološka obrada sastojala se od sljedećega: supraperiapikalna instrumentacija učinjena je kod svih pacijenata s vidljivim naslagama zubnog kamenca. Zubi s upitnom prognozom ekstrahirani su (oni s uznapredovalim karijesom koji se nisu mogli restaurirati, zubi s simptomatskim periapikalnim prosvjetljenjem, zubi s asimptomatskim periapikalnim lezijama većima od 5 mm, zubi s uznapredovalom parodontnom bolešću, tj. pomičnošću 3. ili 4. stupnja i/ili simptomima, te simptomatski poluimpaktirani umnjaci). Ekstrakcijske rane zašivene su na temelju kliničke procjene nadležnoga stomatologa. Uočene su blago do umjereno uznapredovale karijesne lezije, a uklanjanje karijesa i/ili endodontsko liječenje obavljeno je na simptomatskim zubima, ovisno o raspoloživom vremenu i općem zdravstvenom stanju pacijenta. Antibiotička profilaksa primijenjena je prema smjernicama društva American Heart Association (10). Antibiotička terapija ordinirana je na temelju kliničke procjene.

Zabilježeno je sljedeće: demografski podatci (dob i spol), medicinski podatci (dijagnoza bubrežne bolesti – kronična bubrežna bolest, transfuzija trombocita i datum transplantacije bubrega) i stomatološki podatci [broj karioznih, izgubljenih i zuba s ispunom (KEP), broj simptomatskih zuba, broj zuba s periapikalnim prosvjetljenjem]. Nadalje, zabilježeni su broj i vrsta svih stomatoloških zahvata učinjenih kod svakog pacijenta (supraperiapikalna instrumentacija, broj i vrsta ekstrakcija, broj ispuna i endodontskih liječenja) i komplikacija(e) postupka (vrsta i liječenje komplikacije). Ekstrakcije zuba kategorizirane su kao jednostavne (rutinske) ili kirurške koje uključuju podizanje režnja i/ili uklanjanje potporne alveolarne kosti (alveotomija). Konačno, zabilježen je i broj dolazaka i broj dana potrebnih za dobivanje stomatološkog odobrenja za transplantaciju bubrega.

Statistička analiza

Usporedbe prema spolu i godini liječenja učinjene su u istraživačke svrhe kako bi se procijenili potencijalni demografski i vremenski trendovi. Podatci su organizirani u tablice (*Microsoft Excel, Microsoft Inc., SAD*) i statistički obrađeni u SPSS-u (*IBM Inc., SAD*). Za procjenu raspodjele kvantitativnih varijabli korišten je Kolmogorov-Smirnovljev test kojim je utvrđeno da varijable nisu normalno distribuirane. Zato je za prikaz kontinuiranih varijabli korišten medijan (min. – maks). Kategoričke varijable izražene su kao apsolutni brojevi i proporcije. Za procjenu razlike između varijabli korišten je hi-kvadrat test za kategoričke varijable, a Mann-Whitneyjev ili Kruskal-Wallisov test za kontinuirane varijable. Vrijednosti manje od 0,05 ($p < 0,05$) smatrane su statistički značajnima.

Table 1 Baseline characteristics of the patients
Tablica 1. Osnovne karakteristike pacijenata

Sex • Spol N (%)		Difference by sex (p) • Razlika prema spolu (p)	Difference by the year of treatment (p) • Razlika prema godini obrade (p)
Male • Muškarci	53 (71,6)	n.a.	0.224
Female • Žene	21 (28,4)		
Age median (range) • Medijan dobi (raspon)	41 (5-70)	0.319	0.335
Transplant indication N (%) • Indikacija za transplantaciju N (%)			
End stage renal disease • Terminalni stadij bubrežne bolesti	63 (85.1)	0,686	0.443
Acute kidney injury • Akutna ozljeda bubrega	2 (2.7)		
Renal amyloidosis • Amiloidoza bubrega	1 (1.4)		
Glomerular disease • Glomerularna bolest	2 (2.7)		
Transplant rejection • Odbacivanje transplantata	4 (5.4)		
Other • Drugo	2 (2.7)		
DMFT median (range) • KEP medijan (raspon)	13.5 (0-28)	0.195	0.735
Teeth with periapical radiolucency N (%) • Zubi s periapikalnim prosvjetljenjem N (%)			
Yes • Da	8 (13.3)	0.039*	0.502
No • Ne	52 (86.7)		
Number of teeth with periapical radiolucency per patient median (range) • Medijan broja zuba s periapikalnim prosvjetljenjem po pacijentu (raspon)	0 (0-3)	0.041*	0.521
Patients with symptomatic teeth N (%) • Pacijenti sa simptomatskim zubima N (%)			
Yes • Da	2 (2.7)	n.a.	n.a.
No • Ne	72 (98,3)		
Number of symptomatic teeth per patient median (range) • Medijan broja simptomatskih zubi po pacijentu (raspon)	0 (0-1)	n.a.	n.a.
Teeth for extraction N (%) • Zubi za ekstrakciju N (%)			
Yes • Da	20 (27)	0.442	0.920
No • Ne	54 (73)		
Reason for extraction • Razlog ekstrakcije			
Advanced caries and/or pulp pathology • Uznappedovali karijes i/ili pulpna patologija	40 (64.5)	0.765	0.874
Advanced periodontal disease • Uznappedovala parodontna bolest	22 (35.5)		
Number of teeth for extraction per patient median (range) • Medijan broja zuba za ekstrakciju po pacijentu (raspon)	0 (0-8)	0.520	0.787

*p<0.05

Results

A total of 74 patients (53 males and 21 females), during the observed period (30.1.2019. - 5.7.2024.), underwent dental work up protocol at Dental unit Rebro, University Clinical Hospital Centre in Zagreb before having kidney transplant surgery.

Baseline characteristics of the patients are presented in Table 1. A total of 74 patients (53 males and 21 females) underwent pre-transplant dental evaluation at the Dental Unit of the University Clinical Hospital Centre Zagreb between January 2019 and July 2024. The median age was 41 years (range 5–70). The majority of patients (85.1%) had end-stage renal disease as the indication for transplantation.

The median DMFT index in the study cohort was 13.5 (range 0–28), indicating a moderate cumulative burden of dental disease. No clinically relevant differences in baseline oral health parameters were observed according to sex or year of treatment.

Eight patients (13.3%) presented with teeth exhibiting periapical radiolucency, while two patients (2.7%) had symp-

Rezultati

Ukupno 74 pacijenta (53 muškarca i 21 žena) tijekom promatranog razdoblja (30. 1. 2019. – 5. 7. 2024.) podvrgnuta su prije transplantacije bubrega protokolu stomatološke obrade u Stomatološkoj poliklinici Kliničkoga bolničkoga centra Zagreb (Rebro).

Osnovne karakteristike pacijenata nalaze se u tablici 1. Ukupno 74 pacijenta (53 muškarca i 21 žena) podvrgnuta su pretransplantacijskoj stomatološkoj obradi u Klinici za stomatologiju Kliničkoga bolničkoga centra Zagreb između siječnja 2019. i srpnja 2024. Medijan dobi iznosio je 41 godinu (raspon 5 – 70). Kod većine pacijenata (85,1 %) indikacija za transplantaciju bila je terminalna bubrežna bolest.

Medijan KEP indeksa u studijskoj kohorti iznosio je 13,5 (raspon 0 – 28), što upućuje na umjereno kumulativno opterećenje bolestima tvrdih i mekih zubnih tkiva. Nisu uočene klinički značajne razlike u osnovnim parametrima oralnoga zdravlja s obzirom na spol ili godinu liječenja.

Kod osam pacijenata (13,3 %) uočeni su zubi s periapikalnim prosvjetljenjem, a dva (2,7 %) su imala simptomatske

Table 2 Dental procedures performed in patients
Tablica 2. Provedeni stomatološki zahvati

		Difference by sex (p) • Razlika prema spolu (p)	Difference by the year of treatment (p) • Razlika prema godini obrade (p)
Tooth extraction N (%) • Ekstrakcija zuba N (%)			
Yes • Da	20 (27)	0.442	0.920
No • Ne	54 (73)		
Type of extraction N (%) • Vrsta ekstrakcije N (%)			
Simple • Jednostavna	12 (60)	0.636	0.866
Surgical extraction • Kirurška ekstrakcija	8 (40)		
Supragingival instrumentation N (%) • Supragingivna instrumentacija N (%)			
Yes • Da	29 (39.2)	0.698	0.563
No • Ne	45 (60.8)		
Endodontics N (%) • Endodontsko liječenje N (%)			
Yes • Da	7 (9.5)	0,181	0.652
No • Ne	67 (90.5)		
Antibiotics N (%) • Antibiotici N (%)			
No • Ne	70 (94.6)	0.878	0.373
Prophylactic • Profilaktički	2 (2.7)		
Treatment • Terapijski	2 (2.7)		
Type of antibiotic N (%) • Vrsta antibiotika N (%)			
Amoxicillin • Amoksicilin	1 (25)	0.505	0.750
Cephalexine • Cefaleksin	3 (75)		

omatic teeth at the time of examination. A total of 66 teeth were assessed as having questionable prognosis and were indicated for extraction.

Dental Procedures

Dental procedures performed in patients are presented in Table 2. Supragingival instrumentation was the most frequently performed procedure and was carried out in 29 patients (39.2%). Tooth extraction was performed in 20 patients (27%). In 12 patients routine/simple extractions were performed and 8 patients required surgical extractions (alveotomies) due to advanced carious lesions or complex root morphology. A total of 62 teeth were extracted (40;64.5% due to advanced carious and/or pulp pathology and 22;35.5% due to advanced periodontal disease). Endodontic treatment was performed in 7 patients (9.5%).

Antibiotic prophylaxis was administered to two patients. In one patient, amoxicillin 2 g administered 1 hour prior to tooth extraction was prescribed in accordance with AHA recommendations due to the presence of a mechanical heart valve. In another patient, prophylactic cephalexin 2 g administered 1 hour before extraction was prescribed by the attending nephrologist because the patient was a previous organ transplant recipient.

No substantial differences in treatment patterns were observed across the study period.

Complications and Time to Clearance

Complications and outcomes of the dental work-up are presented in Table 3. Two postoperative complications (2.7%) were recorded.

The first complication was a sublingual hematoma occurring two days after a simple extraction of two mandibular in-

zube u vrijeme pregleda. Za ukupno 66 zuba prognoza je bila upitna i ti su zubi bili indicirani za ekstrakciju.

Stomatološki zahvati

Stomatološki zahvati učinjeni pacijentima prikazani su u tablici 2. Najčešći zahvat bila je supragingivna instrumentacija i učinjena je 29-ero pacijenata (39,2 %). Zubi su ekstrahirani 20-ero pacijenata (27 %). Dvanaestero pacijenata bilo je podvrgnuto rutinskoj/jednostavnoj ekstrakciji, a za osmero među njima bila je potrebna kirurška ekstrakcija (alveotomija) zbog uznapredovalih karijesnih lezija ili složene morfologije korijena. Ukupno su izvađena 62 zuba (40; 64,5 % zbog uznapredovale karijesne i/ili pulpne patologije i 22; 35,5 % zbog uznapredovale parodontne bolesti). Endodontski je liječeno sedmero pacijenata (9,5 %).

Antibiotička profilaksa primijenjena je kod dva pacijenta. Jednomu je ordinirano 2 g amoksicilina 1 sat prije ekstrakcije zuba u skladu s preporukama AHA-e zbog ugrađenoga mehaničkog srčanog zaliska. Drugom pacijentu nefrolog je propisao profilaktički 2 g cefaleksina 1 sat prije ekstrakcije jer je već bio primatelj transplantiranog organa.

Nisu uočene značajne razlike u načinu liječenja tijekom promatranog razdoblja.

Komplikacije i vrijeme potrebno za dobivanje odobrenja

Komplikacije i ishodi stomatološke obrade prikazani su u tablici 3. Zabilježene su dvije postoperativne komplikacije (2,7 %). Prva je komplikacija bila sublingvalni hematoma koji se pojavio dva dana poslije jednostavne ekstrakcije dvaju

Table 3 Complications and outcome of dental work-up in patients that underwent kidney transplant surgery
Tablica 3. Komplikacije i ishod stomatološke obrade pacijenata u pripremi za transplantaciju bubrega

		Difference by sex (p) • Razlika prema spolu (p)	Difference by the year of treatment (p) • Razlika prema godini obrade (p)
Complications N (%) • Komplikacije N (%)			
Yes • Da	2 (2.7)	n.a	n.a.
No • Ne	72 (97.3)		
Type of complication N (%) • Vrsta komplikacije N (%)			
Mucosal haematoma • Hematom sluznice	1 (50)	n.a	n.a.
Oroantral communication • Oroantralna komunikacija	1 (50)		
Procedure after which the complication occurred N (%) • Zahvat nakon kojeg je nastala komplikacija N (%)			
Tooth extraction • Ekstrakcija zuba	2 (100)	n.a	n.a.
Treatment of the complication N (%) • Liječenje komplikacije N (%)			
Antibiotics and observation • Antibiotici i promatranje	1 (50)	n.a	n.a.
Communication closure and antibiotics • Zatvaranje komunikacije i antibiotici	1 (50)	n.a	n.a.
Number of appointments needed to obtain dental clearance for renal transplant N (%) • Broj dolazaka potrebnih za dobivanje stomatološkog odobrenja za transplantaciju bubrega N (%)			
1	50 (67.6)	0,089	0,531
2	10 (13.5)		
3	5 (6.8)		
4	2 (2.7)		
5	2 (2.7)		
6	1 (1.4)		
11	1 (1.4)		
Lost to follow up* • Izgubljeni iz praćenja*	3 (4.1)		
Number of days needed to obtain dental clearance for renal transplant median (range) • Medijan dana potrebnih za dobivanje stomatološkog odobrenja za transplantaciju bubrega (raspon)	1 (1-45)	0,084	0,241

*failed to attend further appointments • nisu se odazvali na daljnje kontrole

cisors in a patient receiving anticoagulant therapy (warfarin) due to a mechanical heart valve. The patient's international normalized ratio (INR) on the day of the procedure was 2.1. The hematoma measured approximately 10 × 5 cm but did not compromise airway patency, breathing, or swallowing. The patient was prescribed amoxicillin/clavulanic acid (875/125 mg every 12 hours for 7 days) and was monitored at three-day intervals. The lesion resolved spontaneously within 10 days without the need for surgical intervention.

The second complication was an oroantral communication following extraction of a maxillary posterior tooth (16). It was managed with primary wound closure (suturing) and antibiotic therapy (amoxicillin/clavulanic acid 875/125 mg every 12 hours for 7 days), with uneventful healing.

The number of appointments required to obtain dental clearance ranged from 1 to 11. Most patients (67.6%) achieved clearance in a single visit. The median time required to obtain clearance was 1 day (range 1–45). No clinically meaningful differences in time to clearance were observed according to sex or year of treatment. One patient required 11 appointments to complete dental clearance. This was a 24-year-old male with extensive treatment needs, including extraction of one third molar (tooth 48), endodontic treatment of three teeth with advanced carious lesions (16, 32, 46), and endodontic management of two maxillary incisors (11, 12) prior to planned cystectomy.

mandibularnih sjekutića kod pacijenta na antikoagulantnoj terapiji (varfarin) koju je uzimao zbog mehaničkoga srčanog zaliska. Međunarodni normalizirani omjer (INR) pacijenta na dan zahvata iznosio je 2,1. Hematom je bio približnih dimenzija 10 × 5 cm, ali nije ugrozio prohodnost dišnih putova, disanje ili gutanje. Pacijentu je propisana amoksisilin/klavulanska kiselina (875/125 mg svakih 12 sati tijekom 7 dana) i praćen je u razmacima od tri dana. Lezija se spontano povukla poslije 10 dana pa nije bila potrebna kirurška intervencija.

Druga je komplikacija bila oroantralna komunikacija poslije ekstrakcije stražnjega zuba u gornjoj čeljusti (16). Sanirana je primarnim zatvaranjem rane (šivanjem) i antibiotskom terapijom (amoksisilin/klavulanska kiselina 875/125 mg svakih 12 sati tijekom 7 dana) s neometanim cijeljenjem.

Broj dolazaka potrebnih za dobivanje stomatološkog odobrenja kretao se od 1 do 11. Većina pacijenata (67,6 %) dobila ga je nakon jednog posjeta. Medijan vremena potrebnoga za dobivanje odobrenja bio je 1 dan (raspon 1 – 45). Nisu uočene klinički značajne razlike u vremenu potrebnom za odobrenje ovisno o spolu ili godini obrade. Jednom pacijentu bilo je potrebno 11 dolazaka za dobivanje odobrenja. Bio je to 24-godišnji muškarac s potrebom za opsežnom terapijom, uključujući ekstrakciju trećeg kutnjaka (zub 48), endodontsko liječenje triju zuba s uznapredovalim karijesnim lezijama (16, 32, 46) i endodontsko liječenje dvaju maksilarnih sjekutića (11, 12) prije planirane cistektomije.

The patient expressed a strong preference for tooth preservation, and given his stable medical condition, as confirmed in consultation with the attending nephrologist, comprehensive conservative treatment was undertaken rather than extraction. The complexity of these procedures necessitated multiple visits.

Three patients were lost to follow-up and did not complete the dental clearance process.

Discussion

The present study evaluated the safety, feasibility, and clinical implementation of a pre-transplant dental work-up protocol in kidney transplant candidates treated at a tertiary care center. The findings suggest that dental clearance can be achieved efficiently, with a low complication rate and without apparent delay in transplantation.

The median DMFT index in our cohort was 13.5, reflecting a moderate burden of dental disease. This value is comparable to the reported average DMFT of 12.5 in the adult Croatian population, as described by Radić et al. (11). These findings suggest that, within this transplant candidate cohort, caries experience does not appear markedly different from that of the general population. However, the relationship between CKD and caries experience remains controversial. Menezes et al. reported a lower mean DMFT index in patients with CKD compared with systemically healthy controls (12), a finding that has been attributed to biochemical alterations in saliva. Elevated salivary urea levels and increased pH due to ammonia production may exert antibacterial effects, while higher phosphate concentrations may enhance remineralization of early carious lesions (13). In contrast, Tiwari et al. observed higher DMFT values in patients with renal disease compared to controls (14). Given these conflicting data and the absence of a matched control group in the present study, direct comparisons should be interpreted cautiously. Nevertheless, our findings indicate that cumulative caries experience did not represent a substantial obstacle to achieving dental clearance in this cohort.

Although a statistically significant difference in the number of teeth with periapical radiolucency between males and females was observed, this finding did not influence treatment decisions or clinical outcomes. Management was guided by the presence and severity of pathology rather than demographic characteristics. Given the limited number of affected teeth and the relatively small sample size, this statistically significant result should be interpreted cautiously, as it may not represent a clinically meaningful difference. This observation underscores the importance of interpreting statistical significance within a clinical context, particularly in exploratory analyses involving small cohorts. While sex-related differences in oral health status and healthcare utilization have been reported in previous literature, larger studies would be required to determine whether the present finding reflects a true biological difference or is merely a result of a relatively small sample (15,16).

Regarding the dental work-up protocol, supragingival instrumentation was the most frequently performed proce-

Pacijent je izrazio snažnu želju za očuvanjem zuba te je provedeno sveobuhvatno konzervativno liječenje umjesto ekstrakcija, uzimajući u obzir njegovu stabilno zdravstveno stanje koje je potvrđeno u konzultaciji s nadležnim nefrologom. Zbog složenosti takvog liječenja bilo je potrebno više posjeta.

Tri se pacijenta nisu odazvala na daljnje kontrole i nisu dovršili proces dobivanja stomatološkog odobrenja.

Rasprava

U ovom istraživanju procijenjena je sigurnost, izvedivost i klinička primjena protokola predtransplantacijske stomatološke obrade kandidata za transplantaciju bubrega liječenih u tercijarnom centru. Rezultati upućuju na to da se stomatološka obrada može obaviti učinkovito, s niskom stopom komplikacija i bez odgode transplantacije.

Medijan KEP indeksa u našoj kohorti iznosio je 13,5, što pokazuje umjereno opterećenje dentalnim bolestima. Ta vrijednost usporediva je s prosječnim KEP-om od 12,5 u odrasloj hrvatskoj populaciji koji su zabilježili Radić i suradnici (11). Takvi nalazi upućuju na to da se unutar ove kohorte kandidata za transplantaciju prisutnost karijesa ne razlikuje značajno od prisutnosti u općoj populaciji. No kontroverzan je odnos između kronične bubrežne bolesti i karijesa. Menezes i suradnici uočili su niži prosječni KEP indeks kod pacijenata s kroničnom bubrežnom bolešću u usporedbi sa sistemski zdravim kontrolama (12). Takav nalaz pripisuje se biokemijskim promjenama u slini. Povišene razine uree u slini i povećani pH zbog proizvodnje amonijaka mogu imati antibakterijske učinke, a visoke koncentracije fosfata mogu poboljšati remineralizaciju ranih karijesnih lezija (13). Suprotno tomu, Tiwari i suradnici zabilježili su više vrijednosti KEP-a kod pacijenata s bubrežnom bolešću u usporedbi s kontrolnom skupinom (14). S obzirom na takve oprečne podatke i odsutnost odgovarajuće kontrolne skupine u ovom istraživanju, izravne usporedbe treba interpretirati s oprezom. Ipak, naši nalazi upućuju na to da kumulativno opterećenje karijesom nije značajna prepreka za dobivanje stomatološkog odobrenja u našoj skupini.

Iako je uočena statistički značajna razlika u broju zuba s periapikalnom radiolucencijom između muškaraca i žena, ona nije utjecala na terapijske odluke ili kliničke ishode. Stomatološka obrada bila je vođena prisutnošću i opsegom patologije, a ne demografskim obilježjima. S obzirom na ograničeni broj zahvaćenih zuba i razmjerno mali uzorak, takav rezultat možda ne pokazuje klinički značajnu razliku i treba ga tumačiti s oprezom. Takvo zapažanje također ističe važnost tumačenja statističke značajnosti unutar kliničkoga konteksta, posebno u istraživačkim analizama koje obuhvaćaju male skupine. Iako su razlike u zdravlju usne šupljine i primjeni zdravstvene zaštite povezane sa spolom zabilježene u postojećoj literaturi, potrebna su veća istraživanja kako bi se ustanovilo odražava li ovaj nalaz stvarnu biološku razliku ili je rezultat razmjerno malog uzorka (15, 16).

Kad je riječ o protokolu stomatološke obrade, supragingivna instrumentacija bila je najčešći zahvat, što je u skladu sa spoznajama o povećanom stvaranju zubnog kamenca

ture, consistent with reports of increased calculus formation in CKD patients (12). Honarmand et al. demonstrated a significantly higher prevalence of calculus among hemodialysis patients compared with healthy controls (17). Elevated salivary urea, phosphate, and protein levels may contribute to this phenomenon (18, 19). Teeth with questionable prognosis were extracted as potential sources of infection in the anticipated post-transplant immunosuppressed state. Endodontic treatment was performed when clinically appropriate and when timing allowed, with the priority being avoidance of unnecessary delay in transplantation. Similar treatment distributions have been reported in other retrospective analyses of transplant candidates (20).

Antibiotic prophylaxis at our unit was administered in accordance with AHA recommendations in patients meeting high-risk criteria (10). In one patient, antibiotic prophylaxis was prescribed by the attending nephrologist because the patient was a prior organ transplant recipient, despite not meeting current AHA high-risk criteria. This decision was based on individualized clinical judgment. Evidence supporting the use of antibiotic prophylaxis among patients with solid organ transplants before dental treatment is very limited, and there is no consensus guideline; nonetheless, many transplant centers have recommended antibiotic prophylaxis on a case-by-case basis due to perceived increased risk of infection in immunosuppressed patients (4,21).

The overall complication rate was low, with two postoperative events recorded: a sublingual hematoma and an oroantral communication. The hematoma occurred in a patient receiving anticoagulant therapy but did not result in airway compromise or long-term morbidity. The oroantral communication was managed successfully with primary closure and antibiotic therapy. Although bleeding risk in CKD patients may be increased due to platelet dysfunction, anemia, or anticoagulant use, no severe hemorrhagic events or transplant-postponing complications were observed in this cohort (22).

Approximately two thirds of patients obtained dental clearance in a single visit, and the median time to clearance was one day. Because dental clearance is required prior to placement on the transplant waiting list at our institution, the dental work-up process did not postpone scheduled transplant procedures. However, formal analysis of transplant scheduling timelines was beyond the scope of this study.

Our study has several limitations that need to be addressed. First, the sample size was relatively small ($n = 74$), which limits statistical power and reduces the ability to detect rare adverse events. Given the exploratory nature of the study, the relatively small sample size and the limited number of outcome events, no formal adjustment for multiple comparisons was performed. The results should therefore be interpreted as descriptive and hypothesis-generating. The cohort represents all consecutively referred patients during a five-year period in a tertiary university hospital, reflecting real-world clinical practice. However, it should be noted that dental clearance is not exclusively performed at our in-house Dental Clinic. Some transplant candidates obtained dental clearance from their general dental practitioners or oth-

er kod pacijenata s kroničnom bubrežnom bolešću (12). Honarmand i suradnici istaknuli su značajno veću prevalenciju kamenca među pacijentima na hemodijalizi u usporedbi sa zdravim kontrolnim skupinama (17). Povišene razine uree, fosfata i proteina u slini mogu pridonijeti tom fenomenu (18, 19). Zubi s upitnom prognozom ekstrahirani jer su bili potencijalni izvor infekcije u očekivanom immunosuprimiranom stanju poslije transplantacije. Endodontsko liječenje provedeno je kada je bilo klinički indicirano i ako je vrijeme to dopuštalo, s naglaskom na izbjegavanje nepotrebnog odgađanja transplantacije. Slični omjeri provedenih zahvata zabilježeni su i u drugim retrospektivnim analizama kandidata za transplantaciju (20).

Antibiotička profilaksa u našem zavodu primijenjena je u skladu s preporukama AHA-e kod pacijenata koji su ispunjavali kriterije visokog rizika (10). Jednom pacijentu takvu je profilaksu propisao nefrolog jer je već bio primatelj transplantiranog organa, unatoč tomu što nije ispunjavao trenutne kriterije visokoga rizika AHA-e. Takva odluka temeljila se na individualiziranoj kliničkoj procjeni. Dokazi koji podupiru upotrebu antibiotičke profilakse među pacijentima s transplantatima solidnih organa prije stomatološkog liječenja vrlo su ograničeni i ne postoji konsenzus o smjernicama; ipak, mnogi transplantacijski centri preporučuju antibiotičku profilaksu zbog percipiranoga povećanog rizika od infekcije kod immunosuprimiranih pacijenata (4, 21).

Ukupna stopa komplikacija bila je niska, s dvjema zabilježenim postoperativnim komplikacijama: sublingvalnim hematomom i oroantralnom komunikacijom. Hematom se pojavio kod pacijenta koji je primao antikoagulantnu terapiju, ali nije rezultirao kompromitiranjem dišnih putova ili dugoročnim morbiditetom. Oroantralna komunikacija uspješno je zbrinuta primarnim zatvaranjem i antibiotičkom terapijom. Iako rizik od krvarenja kod pacijenata s kroničnom bubrežnom bolešću može biti povećan zbog disfunkcije trombocita, anemije ili upotrebe antikoagulansa, u promatranj skupini nisu zabilježene teške hemoragijske komplikacije ili komplikacije koje bi odgađale transplantaciju (22).

Otpriblike dvije trećine pacijenata dobilo je stomatološko odobrenje u jednom posjetu, a median vremena do odobrenja iznosio je jedan dan. Budući da je u našoj ustanovi stomatološko odobrenje potrebno prije stavljanja na listu čekanja za transplantaciju, proces stomatološke obrade nije odgodio dogovorene postupke transplantacije. Međutim, formalna analiza vremenskog okvira za dogovorene transplantacije izvan je opsega ovog istraživanja.

Naše istraživanje ima nekoliko ograničenja. Prvo, veličina uzorka bila je razmjerno mala ($n = 74$), što ograničava statističku važnost i smanjuje mogućnost da se uoče rijetke neželjene pojave. S obzirom na istraživačku prirodu studije, razmjerno mali uzorak i ograničeni broj ishodnih događaja, nije provedena formalna prilagodba za višestruke usporedbe. Rezultate zato treba tumačiti kao deskriptivne i kao osnovu za formuliranje hipoteza. Kohorta predstavlja sve upućene pacijente tijekom petogodišnjeg razdoblja u tercijarnu sveučilišnu bolnicu, što odražava stvarnu kliničku praksu. Treba napomenuti da se stomatološka obrada ne obavlja isključivo u našoj stomatološkoj poliklinici. Neki kandidati za tran-

er external dental services. These patients were therefore not referred to our clinic and were not included in the present study. Second, the single-center design may limit the generalizability of our findings to other institutions with different referral pathways or treatment protocols. On the other hand, the uniform clinical management within a single center ensured consistency of the dental work-up protocol. Furthermore, due to the retrospective design, some data may have been incomplete, and long-term post-transplant outcomes were not evaluated. However, our primary intention was to assess the safety and feasibility of obtaining a dental clearance prior to renal transplant and to evaluate whether such a protocol could be implemented without causing significant treatment delays or perioperative complications.

Conclusion

Within the limitations of a single center retrospective study, our results indicate that pre-transplant dental clearance can be carried out safely and efficiently in kidney transplant candidates, with minimal short-term complications and without evidence of clinically relevant delays in the transplant preparation process.

Conflict of interest: The authors declare that there is no conflict of interest.

Author's contribution: Conceptualization – V.B., L.S.; Methodology – V.B., I.M., L.S., K.T. and P.I.; Validation – D.V.J., V.K.; Formal analysis – V.B.; Investigation – V.B.; Data Curation – V.B., D.V.J., V.K.; Writing – original draft preparation – V.B., I.M., L.S., K.T. and P.I.; Writing – review and editing – V.B.; Supervision – V.B.; Project administration – V.B.

splantaciju dobili su stomatološko odobrenje od svojih izabranih doktora dentalne medicine ili drugih ustanova koje pružaju stomatološku skrb. Takvi pacijenti nisu upućeni u našu kliniku i nisu uključeni u istraživanje. Nadalje, unicentrični oblik istraživanja može ograničiti mogućnost generalizacije naših nalaza na druge ustanove s različitim načinima upućivanja ili protokolima liječenja. Istodobno, konzistentna klinička praksa unutar jednog centra osigurava dosljednost protokola stomatološke obrade. Također, neki podatci mogu biti nepotpuni zbog retrospektivne prirode istraživanja, a dugoročni ishodi poslije transplantacije nisu procijenjeni. No naša je glavna namjera bila procijeniti sigurnost i izvedivost protokola stomatološke obrade i dobivanja stomatološkog odobrenja prije transplantacije bubrega te može li se takav protokol provesti bez značajnih odgoda planiranog liječenja ili perioperativnih komplikacija.

Zaključak

Uzimajući u obzir ograničenja unicentričnoga retrospektivnog istraživanja, naši rezultati pokazuju da se predtransplantacijska stomatološka obrada pacijenata može provesti sigurno i učinkovito, s minimalnim kratkoročnim komplikacijama i bez dokaza o klinički značajnim odgodama u procesu pripreme za transplantaciju.

Sukob interesa: Autori nisu bili u sukobu interesa.

Doprinos autora: V. B., L. S. – konceptualizacija; V. B., I. M., L. S., K. T. i P. I. – metodologija; D. V. J., V. K. – validacija; V. B. – formalna analiza, istraživanje, pisanje i uređivanje teksta, nadzor i administracija; V. B., D. V. J., V. K. – kuriranje podataka; V. B., I. M., L. S., K. T., P. I. – pisanje teksta i priprema izvornog nacrt.

Sažetak

Svrha rada: Stomatološka obrada i dobivanje stomatološkog odobrenja prije transplantacije obično se preporučuje kandidatima za transplantaciju bubrega, iako ne postoje standardizirani protokoli i podupirući dokazi. Svrha ovog istraživanja bila je analizirati protokol stomatološke obrade, potrebu za stomatološkim liječenjem, nastanak komplikacija i vrijeme potrebno za dobivanje stomatološkog odobrenja kad je riječ o pacijentima koji se pripremaju za transplantaciju bubrega u ustanovi tercijarne zdravstvene skrbi. **Materijali i metode:** Proveden je retrospektivni pregled kartona pacijenata koje je nadležni nefrolog uputio na stomatološku obradu prije transplantacije između 2019. i 2024. godine. Prikupljeni su demografski, medicinski i stomatološki podatci, uključujući KEP indeks, vrstu i broj obavljenih zahvata, nastale komplikacije i vrijeme potrebno za dobivanje stomatološkog odobrenja. **Rezultati:** Uključena su bila sedamdeset i četiri pacijenta (medijan 41 godina). Medijan KEP indeksa iznosio je 13,5 (raspon 0 – 28). Supragingivna instrumentacija provedena je kod 39,2 % pacijenata, a ekstrakcija zuba kod 27 % s ukupno izvađena 62 zuba. Na endodontsko liječenje upućeno je 9,5 % pacijenata. Zabilježene su dvije postoperativne komplikacije (2,7 %) koje su zbrinute konzervativno. Većina pacijenata (67,6 %) dobila je stomatološko odobrenje poslije jednog posjeta, a medijan vremena potrebnoga do dobivanja stomatološkog odobrenja iznosio je 1 dan (raspon 1 – 45). **Zaključak:** Unatoč ograničenjima unicentričnog oblika retrospektivnog istraživanja, dobivanje stomatološkog odobrenja prije transplantacije bubrega bilo je obavljeno na siguran način, a protokol obrade proveden je bez dokaza o klinički značajnom gubitku vremena u procesu pripreme pacijenata za transplantaciju.

Zaprimljen: 30. studenoga 2025.
Prihvaćen: 23. veljače 2026.

Adresa za dopisivanje
prof. dr. sc. Vlaho Brailo
Stomatološki fakultet Sveučilišta u Zagrebu
Zavod za oralnu medicinu
Klinika za stomatologiju, Klinički
bolnički centar Zagreb
Gundulićeva 5
brailo@sfgz.unizg.hr

MeSH pojmovi: kronično zatajenje bubrega; transplantacija bubrega; prijeoperativna priprema; stomatološka skrb za kronične bolesnike
Autorske ključne riječi: transplantacija bubrega, stomatološka obrada, zubni kamenac, imunosupresija, kronična bubrežna bolest

References

- Chadban SJ, Ahn C, Axelrod DA, Foster BJ, Kasiske BL, Kher V, et al. KDIGO Clinical Practice Guideline on the Evaluation and Management of Candidates for Kidney Transplantation. *Transplantation*. 2020 Apr;104(4S1):S11–103.
- Guggenheimer J, Mayher D, Eghtesab B. A survey of dental care protocols among US organ transplant centers. *Clin Transplant*. 2005 Feb;19(1):15–8.
- O'Leary F, Coffey N, Burke FM, Roberts A, Plant B, Hayes M. Current practices and attitudes of dental practitioners regarding the provision of dental treatment for patients with solid organ transplants. *Clin Transplant*. 2023 Nov;37(11):e15086.
- Kwak EJ, Kim DJ, Choi Y, Joo DJ, Park W. Importance of oral health and dental treatment in organ transplant recipients. *Int Dent J*. 2020 Dec;70(6):477–81.

5. Li L, Zhang YL, Liu XY, Meng X, Zhao RQ, Ou LL, et al. Periodontitis Exacerbates and Promotes the Progression of Chronic Kidney Disease Through Oral Flora, Cytokines, and Oxidative Stress. *Front Microbiol.* 2021;12:656372.
6. Sharma P, Fenton A, Dias IHK, Heaton B, Brown CLR, Sidhu A, et al. Oxidative stress links periodontal inflammation and renal function. *J Clin Periodontol.* 2021 Mar;48(3):357–67.
7. Parsegian K, Randall D, Curtis M, Ioannidou E. Association between periodontitis and chronic kidney disease. *Periodontol 2000.* 2022 Jun;89(1):114–24.
8. García-Ríos P, Rodríguez-Lozano FJ, Pérez-Guzmán N. Oral Findings Linked to Chronic Kidney Disease: A Comprehensive Systematic Review. *J Clin Med.* 2025 Jun 19;14(12):4380.
9. Moest T, Lutz R, Jahn AE, Heller K, Schiffer M, Adler W, et al. Frequency of the necessity of dentoalveolar surgery or conservative treatment in patients before kidney transplantation depending on the duration of dialysis and causative nephrological disease. *Clin Oral Investig.* 2022 Mar;26(3):2383–90.
10. Wilson WR, Gewitz M, Lockhart PB, Bolger AF, DeSimone DC, Kazi DS, et al. Prevention of Viridans Group Streptococcal Infective Endocarditis: A Scientific Statement From the American Heart Association. *Circulation.* 2021 May 18;143(20):e963–78.
11. Radić M, Benjak T, Vukres VD, Rotim Ž, Zore IF. Presentation of DMFT/dmft Index in Croatia and Europe. *Acta Stomatol Croat.* 2015 Dec;49(4):275–84.
12. Menezes CR, Pereira AL, Ribeiro CC, Chaves CO, Guerra RN, Thomaz ÉB, et al. Is there association between chronic kidney disease and dental caries? A case-controlled study. *Med Oral Patol Oral Cir Bucal.* 2019 Mar;24(2):e211–6.
13. Tadakamadla J, Kumar S, Mamatha GP. Comparative evaluation of oral health status of chronic kidney disease (CKD) patients in various stages and healthy controls. *Spec Care Dentist.* 2014;34(3):122–6.
14. Tiwari V, Saxena V, Bhambhal A, Tiwari U, Singh A, Goud S. The oral health status of patients with renal disease in central India: a preliminary study. *J Ren Care.* 2013 Dec;39(4):208–13.
15. Lipsky MS, Su S, Crespo CJ, Hung M. Men and Oral Health: A Review of Sex and Gender Differences. *Am J Mens Health.* 2021;15(3):15579883211016361.
16. Su S, Lipsky MS, Licari FW, Hung M. Comparing oral health behaviours of men and women in the United States. *J Dent.* 2022 Jul;122:104157.
17. Honarmand M, Farhad-Mollashahi L, Nakhaee A, Sargolzaie F. Oral manifestation and salivary changes in renal patients undergoing hemodialysis. *J Clin Exp Dent.* 2017 Feb;9(2):e207–10.
18. Anuradha BR, Katta S, Kode VS, Praveena C, Sathe N, Sandeep N, et al. Oral and salivary changes in patients with chronic kidney disease: A clinical and biochemical study. *J Indian Soc Periodontol.* 2015;19(3):297–301.
19. Ābola I, Emuliņa DE, Skadiņš I, Brinkmane A, Gailīte L, Auzenbaha M. Dental Status and Periodontal Health of Patients with Phenylketonuria in Latvia. *Acta Stomatol Croat.* 2022 Jun;56(2):109–119.
20. Moses J, Soumya S. Dental management of patients before and after renal transplantation – a retrospective study. *J Popl Ther Clin Pharmacol.* 2024 Dec 13;31(11):1292–7.
21. Vidović Juras D, Škrinjar I, Križnik T, Andabak Rogulj A, Lončar Brzak B, Gabrić D, et al. Antibiotic Prophylaxis Prior to Dental Procedures. *Dent J (Basel).* 2024 Nov 15;12(11):364.
22. Albagieh H, Alosimi A, Alduhayan A, AlAbdulkarim A, Fatani B, Alabood A. Dental management of patients with renal diseases or undergoing renal transplant. *Saudi Dent J.* 2024 Feb;36(2):270–6.