



Valentin Bartha¹, Boris Krumm², Judith Schamuhn³, Aleksandra Kopunic¹, Marco M. Herz⁴

Adjunctive Povidone-Iodine Improves Bleeding Outcomes in Step 2 of Periodontal Therapy: A Retrospective Cohort Study

Adjuvantna terapija povidon-jodom poboljšava ishode krvarenja u drugom koraku parodontološke terapije – retrospektivna kohortna studija

¹ Heidelberg University, Department for Conservative Dentistry, Germany
Sveučilište u Heidelbergu, Odjel za konzervativnu stomatologiju, Njemačka

² Private practice, Frankfurt, Germany
Privatna ordinacija, Frankfurt, Njemačka

³ Private practice, Cologne, Germany
Privatna ordinacija, Köln, Njemačka

⁴ University of Tuebingen, Department for Conservative Dentistry, Germany
Sveučilište u Tübingenu, Odjel za konzervativnu stomatologiju, Njemačka

Abstract

Background: This retrospective cohort study evaluated the effects of adjunctive povidone-iodine (PVP-I), full-mouth disinfection (FMD), and conventional full-mouth scaling (FMS) following Step 2 of periodontal therapy on clinical outcomes. **Methods:** Patient records from the Department of Conservative Dentistry, University Hospital Tuebingen (2004–2016), with complete periodontal data before (T0) and after Step 2 of periodontal therapy (T1), were analyzed. The influence of treatment modality, baseline bleeding on probing (BOP%), proportion of sites with probing pocket depth (PPD) ≥ 5 mm, age, smoking, diabetes, and re-evaluation interval on changes in BOP and PPD, as well as on the clinical endpoints $BOP \leq 20\%$ and ≤ 4 sites with $PPD \geq 5$ mm, was assessed using multivariable regression. **Results:** A total of 227 patients were included (52% female; mean \pm SD age: 56.5 ± 11.2 years): 96 FMS, 93 FMD, and 38 PVP-I. Adjunctive PVP-I led to a significantly greater reduction in BOP compared with both FMD and FMS and substantially increased the likelihood of achieving $BOP \leq 20\%$ (adjusted OR = 11.5; $p = 0.03$), independent of baseline inflammation and re-evaluation period. For the pocket-related endpoint (≤ 4 sites with $PPD \geq 5$ mm), regression models were unstable due to the small number of successful cases; baseline PPD % remained the only consistent predictor. **Conclusion:** Adjunctive PVP-I use was significantly associated with improved bleeding-related outcomes after Step 2 of periodontal therapy, whereas no additional benefit was observed for deep-pocket reduction. PVP-I may therefore enhance the resolution of gingival inflammation but does not substantially affect pocket closure beyond conventional mechanical therapy.

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Address for correspondence

Dr. Valentin Bartha, MSc.
Heidelberg University, Heidelberg
University Hospital,
Department for Conservative Dentistry
Im Neuenheimer Feld 400, 69120
Heidelberg, Germany
Phone: +49 6221 5639888
valentin.bartha@med.uni-heidelberg.de

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Valentin Bartha <https://orcid.org/0000-0003-4160-3230>

Marco M. Herz <http://orcid.org/0000-0003-3953-9145>

Introduction

Periodontitis is treated in a stepwise non-surgical–surgical approach. In Steps 1 and 2 of periodontal therapy, biofilm control and subgingival instrumentation aim to reduce inflammation in order to avoid, or at least to limit, further surgical interventions, as outlined in the recent EFP S3 guideline (1). Since mechanical debridement alone does not always lead to resolution of inflammation, several adjunctive concepts have been proposed.

One of these concepts is one-stage full-mouth disinfection (FMD) according to Quirynen et al., in which scaling

Uvod

Parodontitis se liječi postupnim nekirurško-kirurškim pristupom. U 1. i 2. fazi parodontološke terapije cilj kontrole biofilma i subgingivne instrumentacije jest smanjiti upalu da bi se izbjegle ili barem ograničile daljnje kirurške intervencije, kako je navedeno u nedavnoj smjernici EFP S3 (1). Budući da samo mehaničko čišćenje zuba ne rješava uvijek upalu, predloženo je nekoliko dodatnih koncepcija.

Jedna od njih je jednofazna dezinfekcija cijelih usta (FMD) prema Quirynenu i suradnicima, u kojoj se čišćenje kamenca i struganje korijena cijele denticije unutar 24 sata

and root debridement of the entire dentition within 24 h is combined with chlorhexidine (CHX) application to all oral niches to reduce reinfection (2). Another approach is the use of povidone-iodine (PVP-I) as an antiseptic cooling solution during ultrasonic debridement, which has shown broad antimicrobial activity and is easy to integrate into clinical workflows (3, 4). Both approaches, however, have yielded heterogeneous clinical results, and it is still unclear whether they provide a clinically relevant advantage over a full-mouth scaling (FMS) without adjunctive antiseptics.

Therefore, the present retrospective cohort study compared three routinely applied Step 2 protocols within one university setting: (1) FMS with sonic scaling and hand cures, (2) FMD with CHX according to the departmental modification of the Quirynen protocol, and (3) ultrasonic debridement with 10% PVP-I as coolant. The primary objective was to analyze the association of these treatment modalities with changes in bleeding on probing (BOP%) and with residual deep pockets. A secondary objective was to evaluate the proportion of patients reaching established clinical endpoints (9).

Study population and Methodology

Study design

This retrospective cohort study included patients who received a non-surgical periodontal therapy between 2004 and 2016 at the Department of Conservative Dentistry, University Hospital Tuebingen. Treatments were performed by dentists and dental hygienists following standardized clinical protocols. Eligible cases were identified through electronic hospital records using procedure codes for periodontal therapy and were subsequently verified by manual chart review. Data collection was performed between 2016 and 2020 by two calibrated investigators (BK, JS). Demographic and clinical parameters were transferred in anonymized form into a

kombinira s primjenom klorheksidina (CHX) na sve oralne niše da bi se smanjila ponovna infekcija (2). Drugi je pristup upotreba povidon-joda (PVP-I) kao antiseptičke otopine za hlađenje tijekom ultrazvučnog čišćenja zuba, koji je pokazao široku antimikrobnu aktivnost i lagano se integrira u kliničke tijekove rada (3, 4). No s oba pristupa postignuti su heterogeni klinički rezultati i još uvijek nije jasno pružaju li klinički relevantnu prednost u usporedbi s čišćenjem cijelih usta (FMS) bez dodatnih antiseptika.

Zato su u ovoj retrospektivnoj kohortnoj studiji uspoređena tri rutinski primijenjena protokola u drugoj fazi unutar jednoga sveučilišnog okruženja: (1) FMS sa soničnim čišćenjem i ručnim kiretažama, (2) FMD s CHX-om prema odjelnoj modifikaciji Quirynenova protokola i (3) ultrazvučno čišćenje s 10-postotnim PVP-jodom kao rashladnom tekućinom. Primarni cilj bio je analizirati povezanost tih načina liječenja s promjenama u krvarenju pri sondiranju (BOP %) i s rezidualnim dubokim džepovima. Sekundarni cilj bio je procijeniti udio pacijenata kod kojih su postignute definirane kliničke krajnje točke (9).

Studijska populacija i metodologija

Studijski dizajn

U ovoj retrospektivnoj kohortnoj studiji sudjelovali su pacijenti koji su podvrgnuti nekirurškoj parodontološkoj terapiji između 2004. i 2016. godine na Odjelu za konzervativnu stomatologiju Sveučilišne bolnice u Tübingenu. Tretmane su provodili stomatolozi i dentalni higijeničari prema standardiziranim kliničkim protokolima. Prihvatljivi slučajevi identificirani su na temelju elektroničkih bolničkih zapisa korištenjem kodova postupaka za parodontološku terapiju i provjereni ručnim pregledom kartona. Prikupljanje podataka obavila su dva kalibrirana istraživača (B. K., J. S.) između 2016. i 2020. godine. Demografski i klinički parametri pre-

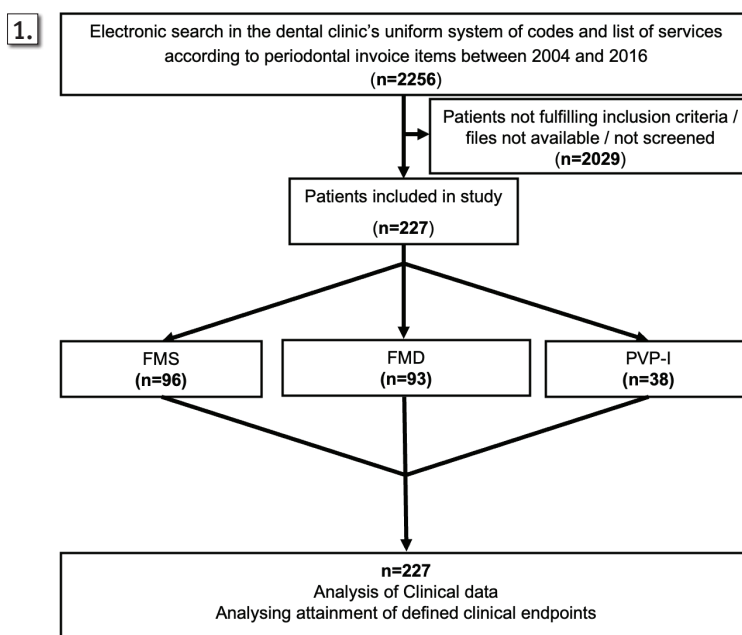


Figure 1 Study flow chart
Slika 1. Dijagram toka studije

Note: FMS = Full-mouth scaling; FMD = Full-mouth disinfection; PVP-I = PVP-Iodine
Napomena: FMS = čišćenje cijelih usta; FMD = dezinfekcija cijelih usta; PVP-I = PVP-jod

spreadsheet and subsequently analyzed in JMP 16.2.0 (SAS Institute Inc., Cary, USA). All investigators had authorized access to the institutional database, thus ensuring compliance with data protection standards. Ethical approval was granted by the Ethics Committee of the University of Tübingen (No. 557/2016BO2), and the study was registered in the German Clinical Trials Register (DRKS00025110). The need for formal patient consent was waived due to the retrospective design. Data reporting followed the STROBE and RECORD guidelines.

Inclusion and exclusion criteria

The following inclusion and exclusion criteria were defined:

Inclusion criteria: Complete periodontal examination prior to initiation of therapy (baseline T0) and after completion of stages I and II of periodontal therapy (re-evaluation, T1); Stage III, grade A-C periodontitis; Periodontal therapy provided by dentists or dental hygienists; Patient age at T0 ≥ 18 years; Radiographic imaging (dental films or orthopantomograms) ≤ 12 months at time T0; Anti-infective subgingival therapy purely conventional, by means of sonic scaler and currettes with adjuvant use of the full mouth disinfection protocol or by means of ultrasonic scaler and PVP-iodine.

Exclusion criteria: Treatment by undergraduate providers; Ambiguous, deficient, or erroneous documentation in patient records; Failure to complete the second level of therapy through reevaluation; Adjuvant systemic antibiotic treatment; Incomplete periodontal examination.

Applied treatment concept

Between 2004 and 2016, an active periodontal therapy (APT) at the Department of Conservative Dentistry followed a standardized two-step protocol (1). Step 1 consisted of two sessions of oral hygiene instruction and professional mechanical plaque removal (PMPR), corresponding to step 1 of the current EFP treatment guidelines. Patients were individually instructed in toothbrushing with electric brushes and the use of interdental brushes or dental floss when appropriate. Correct selection and handling of interdental brushes were demonstrated and trained under supervision until satisfactory performance was achieved.

Upon adequate plaque control and adherence, step 2 (subgingival instrumentation) was initiated. Subgingival debridement was performed according to departmental protocols, which were continuously adapted to the current state of scientific evidence during the observation period: FMD was performed in accordance with the original concept by Quirynen et al. with minor departmental adaptations (2). All subgingival debridement was completed within one day using a sonic scaler (SONICflex 2003L, KaVo, Biberach, Germany) and Gracey currettes. In addition, patients rinsed with 0.12% chlorhexidine digluconate for 60 seconds immediately before instrumentation. After completion of scaling, CHX (0.12%) was applied to the dorsum of the tongue and to all interdental and subgingival areas using soaked swabs. Patients were instructed to continue 0.12% CHX mouth rinsing twice daily for 7 days. The rationale was to reduce bacte-

neseni su u anonimnom obliku u proračunsku tablicu i zatim analizirani u JMP-u 16.2.0 (SAS Institute Inc., Cary, SAD). Svi istraživači imali su ovlaštenu pristup institucionalnoj bazi podataka kako bi se osigurala usklađenost sa standardima zaštite podataka. Etičko odobrenje dalo je Etičko povjerenstvo Sveučilišta u Tübingenu (br. 557/2016BO2), a studija je registrirana u Njemačkome registru kliničkih istraživanja (DRKS00025110). Potreba za formalnim pristankom pacijenta nije postojala zbog retrospektivnog dizajna. Izvještavanje o podatcima slijedilo je smjernice STROBE i RECORD.

Kriteriji za uključivanje i isključivanje

Kriteriji za uključivanje: potpuni parodontološki pregled prije početka terapije (početni T0) i poslije završetka I. i II. faze parodontološke terapije (reevaluacija, T1); detaljni parodontitis stadija III, stupanj A – C; parodontološku terapiju pružaju stomatolozi ili dentalni higijeničari; dob pacijenta u T0 ≥ 18 godina; radiološko snimanje (dentalni filmovi ili ortopantomogram) ≤ 12 mjeseci u vrijeme T0; antiinfekcijska subgingivna terapija isključivo konvencionalna, s pomoću soničnog skalera i kireta, uz adjuvantnu upotrebu protokola potpune dezinfekcije usta ili s pomoću ultrazvučnog skalera i PVP-joda.

Kriteriji za isključivanje: ako su liječenje provodili diplomski liječnici; dvosmislena, manjkava ili pogrešna dokumentacija u pacijentovim kartonima; nije završena druga faza terapije s reevaluacijom; adjuvantno liječenje sistemskim antibioticima; nepotpuni parodontološki pregled

Primijenjeni koncept liječenja

Između 2004. i 2016. godine aktivna parodontološka terapija (APT) na Odjelu za konzervativnu stomatologiju slijedila je standardizirani protokol u dvije faze (1). Faza 1. sastojala se od dviju sesija poduke o oralnoj higijeni i profesionalnoga mehaničkog uklanjanja plaka (PMPR), što odgovara prvom koraku aktualnih smjernica za liječenje EFP-a. Pacijenti su individualno upućeni u pranje zuba električnim četkicama i korištenje interdentalnih četkica ili zubnoga konca kada je to potrebno. Ispravan odabir i rukovanje interdentalnim četkicama demonstrirani su i uvježbavani pod nadzorom dok se nisu postigle zadovoljavajuće performanse.

Nakon adekvatne kontrole plaka i održavanja higijene, počela je druga faza (subgingivna instrumentacija). Subgingivno čišćenje obavljeno je prema odjelnim protokolima koji su kontinuirano prilagođavani aktualnim znanstvenim dokazima tijekom razdoblja promatranja:

- FMD je proveden u skladu s izvornim konceptom Quirynena i suradnika, uz manje prilagodbe (2). Subgingivno čišćenje završeno je u jednom danu korištenjem soničnoga skalera (SONICflex 2003L®, KaVo, Biberach, Njemačka) i Graceyvih kireta. Uz to, pacijenti su 60 sekunda ispirali usta 0,12-postotnim klorheksidin-digluconatom neposredno prije instrumentacije. Nakon čišćenja nanesen je CHX (0,12 %) na dorzum jezika i na sva interdentalna i subgingivna područja s pomoću natopljenih štapića. Pacijenti su upućeni da nastave ispirati usta 0,12-postotnim CHX-om dva puta na dan tijekom

rial load in all oral niches and to prevent rapid reinfection of the treated pockets (2).

Adjunctive use of PVP-I: As new research indicated benefits of adjunctive use of PVP-I, its use was integrated in the department as an alternative to FMD.

FMS: Over time, as further studies questioned the superiority of FMD, the department officially shifted away from its routine use. However, some clinicians continued to employ FMD based on their clinical discretion (5).

The treatment modality selection was guided by the departmental protocols, which were active at the time of treatment, and supplemented by individual clinician judgment during transitional periods. All treatments were documented in the patient files, including details of the procedures performed. The rationale for selecting a specific treatment modality was generally based on the prevailing protocol and according to the clinician's preference rather than individual patient factors, and specific notes on treatment choice rationale were not consistently recorded in the patient charts. However, medical contraindications, such as allergies to antiseptic agents, were a significant factor that affected the choice of treatment.

Patients in the FMS and FMD groups were treated with a sonic scaler complemented by hand instrumentation using Gracey curettes. In contrast, patients in the PVP-I group were treated with an ultrasonic device (Piezon Master 400®, EMS, Nyon, Switzerland) using 10% PVP-I diluted to a final concentration of 0.1% as cooling solution (6, 7), without additional hand curettes. This difference reflects the chronological implementation of departmental protocols and not specific patient characteristics. Since the mode of instrumentation itself may influence clinical outcomes, this variable was included in the discussion as a potential source of bias.

Clinical data and patient charts

Periodontal status was evaluated at baseline (T0) and reevaluation (T1) using data from patient records. Periodontal examinations and non-surgical periodontal therapy were performed by approximately 7 clinicians (5 periodontists/dentists with periodontal expertise and 2 dental hygienists) of the Department of Conservative Dentistry. All clinicians were involved in standardized undergraduate periodontal teaching programs, which include structured training in periodontal diagnosis and mechanical therapy. Hence, although no formal calibration exercise was conducted specifically for this retrospective analysis, examinations and treatments followed standardized departmental protocols. Recorded parameters included probing pocket depth (PPD; all sites, ≥ 5 mm, = 5 mm, ≥ 6 mm), bleeding on probing (BOP %), and number of missing teeth. In this context, PPD ≥ 5 mm was used to define the presence of residual periodontal pockets at the patient level after step 2 of periodontal therapy, whereas PPD ≥ 6 mm was applied to characterize deep pockets that are commonly considered indicative of potential need for surgical intervention. Initial diagnoses were based on the Armitage (1998) classification and were reclassified by one experienced periodontist (VB) according to the 2018 system, using radiographic bone loss, PPD,

7 dana. Cilj je bio smanjiti bakterijsko opterećenje u svim oralnim nišama i spriječiti ponovne brze infekcije tretiranih džepova (2).

- Dodatna primjena PVP-joda: kako su nova istraživanja pokazala prednosti dodatne upotrebe PVP-joda, njegova je upotreba integrirana kao alternativa FMD-u.
- FMS: s vremenom, kako je u sljedećim studijama dovedena u pitanje superiornost FMD-a, odjel je službeno prestao s njegovom rutinskom upotrebom. No neki su kliničari nastavili primjenjivati FMD na temelju svoje kliničke diskrecije (5).

Odabir načina liječenja temeljio se na protokolima odjela koji su bili na snazi u razdoblju liječenja, a nadopunjavale su ga individualne procjene kliničara tijekom prijelaznih razdoblja. Svi postupci dokumentirani su u kartonima pacijenata, uključujući detalje o obavljenim postupcima. Objašnjenje za odabir određenog načina liječenja općenito se temeljilo na prevladavajućem protokolu i prema preferencijama kliničara, a ne na individualnim čimbenicima pacijenta. Međutim, medicinske kontraindikacije, poput alergija na antiseptička sredstva, bile su značajan čimbenik koji je utjecao na izbor liječenja.

Pacijenti u FMS i FMD skupinama liječeni su soničnim skalerom, uz ručnu instrumentaciju s pomoću Graceyjevih kireta. Suprotno tomu, pacijenti u PVP-I skupini liječeni su ultrazvučnim uređajem (Piezon Master 400®, EMS, Nyon, Švicarska) korištenjem 10-postotnoga PVP-joda razrijeđenoga do konačne koncentracije od 0,1 % kao otopine za hlađenje (6, 7), bez dodatnih ručnih kireta. Ta razlika pokazuje kronološku provedbu odjelnih protokola, a ne specifične karakteristike pacijenata. Budući da sam način instrumentacije može utjecati na kliničke ishode, ova je varijabla uključena u raspravu kao potencijalni izvor pristranosti.

Klinički podatci i kartoni pacijenata

Parodontološki status procijenjen je na početku (T0) i pri reevaluaciji (T1) korištenjem podataka iz kartona pacijenata. Parodontološke preglede i nekiruršku parodontološku terapiju obavilo je sedam kliničara (5 parodontologa/stomatologa s parodontološkom ekspertizom i 2 dentalna higijeničara) iz Odjela za konzervativnu stomatologiju. Svi kliničari bili su uključeni u standardizirane dodiplomske programe parodontološke nastave koji uključuju strukturiranu izobrazbu iz parodontološke dijagnostike i mehaničke terapije. Zato, iako nije provedena formalna kalibracijska vježba posebno za ovu retrospektivnu analizu, pregledi i provedeni postupci slijedili su standardizirane odjelne protokole. Zabilježeni parametri uključivali su dubinu parodontnih džepova (PPD; sva mjesta, ≥ 5 mm, = 5 mm, ≥ 6 mm), krvarenje pri sondiranju (BOP %) i broj nedostajućih zuba. U tom kontekstu je PPD ≥ 5 mm korišten za definiranje prisutnosti rezidualnih parodontnih džepova poslije 2. faze parodontološke terapije, a PPD ≥ 6 mm primijenjen je za karakterizaciju dubokih džepova koji se obično smatraju pokazateljem potencijalne potrebe za kirurškom intervencijom. Početne dijagnoze temeljile su se na Armitageovoj (1998.) klasifikaciji, a reklasificirao ih je jedan iskusni parodontolog (VB) prema sustavu iz 2018., koristeći se radiološki vidljivim gubitkom kosti,

furcation involvement, and mobility to determine stage and grade. Clinical attachment level (CAL) was not routinely recorded. Thus, it could not be analyzed, which limits differentiation between true and pseudo pockets. Smoking status (non-smoker, former ≥ 5 years, current) and diabetes mellitus were extracted from charts; daily cigarette number was inconsistently reported and excluded from modeling. Baseline radiographs were visually assessed for maximal interdental bone loss.

Treatment modality (FMS, FMD, or adjunctive PVP-I) and possible antibiotic use were identified from treatment documentation. Exposure, outcome, and confounder variables were defined according to RECORD guidelines. Data were checked for completeness and plausibility, with discrepancies resolved by chart review before anonymization and transfer to the analysis database.

Statistical analysis

Data were analyzed at the patient level. Distribution was assessed visually and with the Anderson–Darling test. As continuous variables were not normally distributed, data are presented as median (Q1–Q3), and non-parametric tests were applied. Baseline characteristics between treatment groups were compared using the Kruskal–Wallis test for continuous and the χ^2 test for categorical variables; post-hoc comparisons were adjusted by the Steel–Dwass method. Primary outcomes were the changes in bleeding on probing (Δ BOP %) and the proportion of sites with PPD ≥ 6 mm (Δ PPD ≥ 6 mm %) from baseline (T0) to re-evaluation (T1). Secondary outcomes were the achievement of clinical endpoints: BOP ≤ 20 % and ≤ 4 sites with PPD ≥ 5 mm. Associations between continuous variables were explored using Spearman correlation. To evaluate the influence of treatment modality (PVP-I, FMD, FMS) and confounders (age, sex, smoking, diabetes, baseline BOP %, baseline PPD ≥ 5 mm %, and re-evaluation interval), binomial logistic regression models were applied. Least-square regression was used for continuous outcomes (Δ BOP %, Δ PPD ≥ 6 mm %). The significance level was set at $\alpha = 0.05$. All analyses were performed using JMP 16.2.0 (SAS Institute Inc., Cary, USA).

Results

Baseline characteristics

A total of 227 patients (117 female) with a mean age 56.49 ± 11.24 years were monitored in the study. 96 patients (42%) were treated without adjunctive agents (FMS), 93 (41%) received FMD, and 38 (17%) were treated with PVP-I as irrigation fluid during ultrasonic scaling. A total of 29% of all patients were smokers, 5% suffered from diabetes mellitus (Table 1).

Baseline comparisons across treatment groups showed no significant differences in sex distribution, smoking status, or periodontitis grading (all $p > 0.05$).

Patients in the PVP-I group were significantly younger than those in the FMD and FMS groups ($p=0.0018$), and the observation period between baseline and re-evaluation was slightly shorter for PVP-I (median ≈ 4.1 months) compared

PPD-om, zahvaćenošću furkacije i pomičnošću za određivanje stadija i stupnja. Klinička razina pričvrsta (CAL) nije rutinski zabilježena i zato nije mogla biti analizirana, što ograničava razlikovanje pravih i pseudodžepova. Status pušenja (nepušač, bivši ≥ 5 godina, trenutni) i *diabetes mellitus* izvučeni su iz kartona; dnevni broj cigareta bio je nedosljedno prijavljen i isključen iz modeliranja. Osnovne rendgenske snimke vizualno su procijenjene da bi se ustanovio maksimalni gubitak interdentalne kosti.

Način liječenja (FMS, FMD ili dodatni PVP-I) i moguća upotreba antibiotika identificirani su iz dokumentacije o liječenju. Izloženost, ishod i zbunjujuće varijable definirane su prema smjernicama RECORD-a. Podatci su provjereni za cjelovitost i vjerodostojnost, a odstupanja su razjašnjena pregledom kartona prije anonimizacije i prijenosa u analitičku bazu podataka.

Statistička analiza

Podatci su analizirani za svakog pacijenta posebno. Distribucija je procijenjena vizualno i Anderson-Darlingovim testom. Budući da kontinuirane varijable nisu bile normalno distribuirane, podatci su prikazani kao medijan (Q1 – Q3) i primijenjeni su neparametrijski testovi. Osnovne karakteristike između skupina liječenja uspoređene su Kruskal-Wallisovim testom za kontinuirane i χ^2 testom za kategoričke varijable; post-hoc usporedbe prilagođene su Steel-Dwassovom metodom. Primarni ishodi bili su promjene u krvarenju pri sondiranju (Δ BOP %) i udio mjesta s PPD-om ≥ 6 mm (Δ PPD ≥ 6 mm %) od početne vrijednosti (T0) do ponovne evaluacije (T1). Sekundarni ishodi bili su postizanje kliničkih krajnjih točaka: BOP ≤ 20 % i ≤ 4 mjesta s PPD-om ≥ 5 mm. Povezanost između kontinuiranih varijabli istražena je Spearmanovom korelacijom. Za procjenu utjecaja modaliteta liječenja (PVP-I, FMD, FMS) i zbunjujućih čimbenika (dob, spol, pušenje, dijabetes, početni BOP %, početni PPD ≥ 5 mm % i interval reevaluacije), primijenjeni su binomni logistički regresijski modeli. Za kontinuirane ishode korištena je regresija najmanjih kvadrata (Δ BOP %, Δ PPD ≥ 6 mm %). Razina značajnosti postavljena je na $\alpha = 0,05$. Sve analize provedene su s pomoću JMP-a 16.2.0 (SAS Institute Inc., Cary, SAD).

Rezultati

Osnovne karakteristike

U studiji je praćeno ukupno 227 pacijenata (117 žena) prosječne dobi $56,49 \pm 11,24$ godina. Ukupno 96 pacijenata (42 %) liječeno je bez pomoćnih sredstava (FMS), 93 (41 %) primilo je FMD, a 38 (17 %) liječeno je PVP-jodom kao tekućinom za ispiranje tijekom ultrazvučnog čišćenja zuba. Ukupno 29 % svih pacijenata bili su pušači, 5 % je bolovalo od šećerne bolesti (tablica 1.).

Početne usporedbe među skupinama pacijenata nisu pokazale značajne razlike u spolnoj distribuciji, pušačkom statusu ili stupnju parodontitisa (sve $p > 0,05$).

Pacijenti u skupini PVP-I bili su znatno mlađi od onih u skupinama FMD i FMS ($p = 0,0018$), a razdoblje promatranja između početnoga stanja i reevaluacije bilo je nešto kraće za PVP-I (medijan $\approx 4,1$ mjeseca) u usporedbi s FMD-om (\approx

Table 1 Baseline characteristics
Tablica 1. Osnovne karakteristike

	Total • Ukupno		FMS		FMD		PVP-I	
	n	%	n	%	n	%	N	%
Number of patients • Broj pacijenata	227	100	96	42	93	41	38	17
Female • Žene	117	52	44	19	48	21	25	11
Male • Muškarci	110	48	52	23	45	20	13	6
Age in years (T_0) • Dob (T_0)	56.49 ± 11.24		57.61 ± 11.16		57.65 ± 10.79		50.82 ± 11.09	
Smoker (T_0) • Pušač (T_0)	66	29	30	13	24	11	12	5
Diabetes (T_0) • Dijabetes (T_0)	12	5	9	4	2	1	1	0.4
Initial diagnosis (T_0) • Početna dijagnoza (T_0)								
Grade A • Stupanj A	8	3	2	1	4	2	2	1
Grade B • Stupanj B	136	60	65	29	46	20	25	11
Grade C • Stupanj C	83	37	29	13	43	19	11	5
Average T_0 - T_1 period • Prosječno razdoblje T_0 - T_1	5.60 ± 3.19		6.41 ± 3.88		4.98 ± 2.37		5.09 ± 2.57	

Abbreviations: T_0 = baseline; FMS = full-mouth scaling; FMD = full-mouth disinfection; PVP-I = povidone-iodine; APT = active periodontal therapy/Step1 and 2 of periodontal therapy;

Kraticе: T_0 = početna vrijednost; FMS = potpuno čišćenje usta; FMD = potpuna dezinfekcija usta; PVP-I = povidon jod; APT = aktivna parodontološka terapija/1. i 2. faza parodontološke terapije

to FMD (\approx 4.3 months) and FMS (\approx 5.2 months; $p=0.04$). The prevalence of diabetes tended to differ ($p = 0.06$) but cell counts were small. These differences were accounted for in the multivariate models.

Changes in clinical parameters

Adjunctive use of PVP-I achieved a significantly lower BOP (%) value at T_1 compared to both FMD and FMS.

The change of PPD from T_0 to T_1 showed a noticeable shift toward a higher proportion of PPD less than 5 mm, similarly the BOP dropped (Table 2). Comparing the treatment groups at T_0 showed similar BOP (%) values and percentage of sites with a PPD \geq 5 mm. All treatment methods resulted in a significant reduction of BOP (%) and PPD (%), ($p < 0.001$). At T_1 the BOP (%) value of patients treated with the adjunctive use of PVP-I was significantly lower. However, there was no statistically significant difference regarding T_1 PPD (%). Similarly, the change in relative BOP and PPD between T_0 and T_1 was without significant difference between the treatment-groups (Table 2). Moreover, after categorizing the T_0 BOP in $< 10\%$ vs. $10 - 30\%$ vs. $> 30\%$ still showed no differences in BOP reduction.

Correlation analysis

Regarding the change of relative BOP and PPD \geq 6 mm (%) between T_0 and T_1 , we found a strong association between T_0 BOP (%), Δ BOP (%), (Spearman ρ 0.759, $p < 0.01$). Also, we found a weak association between T_0 BOP % and Δ PPD \geq 6 mm (Spearman ρ 0.276, $p < 0.001$).

Similarly, there was a strong association between T_0 PPD \geq 6 mm and Δ PPD \geq 6 mm (Spearman ρ = 0.89, $p < 0.001$) and a moderate correlation with Δ BOP (%) (Spearman ρ = 0.32, $p < 0.001$).

After adjusting for T_0 BOP (%) and T_0 PPD \geq 6 mm (%), the reduction of BOP got significantly positively associated with the use of PVP-I ($\beta = 4.12$, $p < 0.001$) and

4,3 mjeseca) i FMS-om (\approx 5,2 mjeseca; $p = 0,04$). Prevalencija dijabetesa obično se razlikovala ($p = 0,06$), ali broj stanica bio je malen. Te su razlike uzete u obzir u multivarijantnim modelima.

Promjene u kliničkim parametrima

Dodatnom upotrebom PVP-joda postignuta je značajno niža vrijednost BOP-a (%) na T_1 u usporedbi s FMD-om i FMS-om.

Promjena PPD-a od T_0 do T_1 pokazala je primjetan pomak prema većem udjelu PPD-a manjega od 5 mm, slično tomu, BOP se smanjio (tablica 2.). Usporedba tretiranih skupina u T_0 pokazala je slične vrijednosti BOP-a (%) i postotak mjesta s PPD-om \geq 5 mm. Sve metode liječenja rezultirale su značajnim smanjenjem BOP-a (%) i PPD-a (%) ($p < 0,001$). Na T_1 vrijednost BOP-a (%) pacijenata liječenih dodatnom primjenom PVP-joda bila je značajno niža. No nije bilo statistički značajne razlike kad je riječ o T_1 PPD-u (%). Slično tomu, promjena relativnoga BOP-a i PPD-a između T_0 i T_1 bila je bez značajne razlike između tretiranih skupina (tablica 2.). Štoviše, nakon kategorizacije T_0 BOP-a u $< 10\%$ vs. $10 - 30\%$ vs. $> 30\%$ i dalje nije bilo razlika u smanjenju BOP-a.

Korelacijska analiza

Kad je riječ o promjeni relativnoga BOP-a i PPD-a \geq 6 mm (%) između T_0 i T_1 , pronašli smo snažnu povezanost između T_0 BOP-a (%) i Δ BOP-a (%) (Spearman $\rho = 0,759$, $p < 0,01$), te slabu povezanost između T_0 BOP-a % i Δ PPD-a \geq 6 mm (Spearman $\rho = 0,276$, $p < 0,001$).

Slično tomu, postojala je snažna povezanost između T_0 PPD-a \geq 6 mm i Δ PPD-a \geq 6 mm (Spearman $\rho = 0,89$, $p < 0,001$) te umjerena korelacija s Δ BOP-om (%) (Spearman $\rho = 0,32$, $p < 0,001$).

Nakon prilagodbe T_0 BOP-a (%) i T_0 PPD-a \geq 6 mm (%), smanjenje BOP-a bilo je značajno pozitivno povezano s primjenom PVP-joda ($\beta = 4,12$, $p < 0,001$) i negativno pove-

Table 2 BOP and PPD (%) at T0 and T1 for different patient groups and therapy methods. p-values by Steel-Dwass-Test with $p < 0.05$ marked by an asterisk. All data for $n = 227$

Tablica 2. BOP i PPD (%) u T0 i T1 za različite skupine pacijenata i vrste terapije; p-vrijednosti dobivene Steel-Dwassovim testom s $p < 0,05$ označenim zvjezdicom; svi podatci za $n = 227$

	Parameter • Parametar	Overall • Ukupno			Treatment groups • Terapijske skupine									p-values • p-vrijednosti		
		Med	Q1	Q3	FMS			FMD			PVP-I			FMS vs. FMD	FMS vs. PVP-I	FMD vs. PVP-I
					Med	Q1	Q3	Med	Q1	Q3	Med	Q1	Q3			
T(0)	BOP (%)	27.20	15.00	40.91	27.32	18.05	40.05	26.14	13.77	44.57	30.38	12.12	48.34	0.955	0.995	0.994
	PPD ≤ 4mm (%)	85.71	76.41	91.67	86.65	79.07	91.54	82.14	75.23	90.66	87.40	76.24	93.26	0.212	0.978	0.326
	PPD = 5mm (%)	6.40	3.79	11.77	6.46	3.35	11.06	6.90	4.64	12.58	5.83	3.04	9.31	0.256	0.881	0.211
	PPD ≥ 5mm (%)	14.29	8.33	23.59	13.36	8.46	20.93	17.86	9.35	24.78	12.60	6.74	23.76	0.212	0.978	0.326
	PPD ≥ 6mm (%)	6.90	2.53	12.34	6.05	2.23	12.07	7.34	2.55	12.51	7.02	2.49	13.30	0.575	0.968	0.802
T(1)	BOP (%)	9.09	3.80	18.25	10.20	4.55	17.60	11.11	4.11	24.23	5.04	1.12	14.12	0.888	0.021*	0.007*
	PPD ≤ 4mm (%)	94.94	90.48	97.89	95.70	91.05	98.44	93.89	90.03	96.82	94.78	90.26	97.60	0.160	0.733	0.805
	PPD = 5mm (%)	5.06	2.11	9.52	4.31	1.57	8.95	6.11	3.19	9.97	5.23	2.41	9.74	0.097	0.878	0.517
	PPD ≥ 5mm (%)	3.03	1.15	5.30	2.33	0.91	4.52	3.62	1.44	5.62	3.31	1.29	5.03	0.160	0.733	0.805
	PPD ≥ 6mm (%)	1.72	0	4.24	1.43	0	3.96	2.27	0.57	4.76	1.67	0.42	4.81	0.931	0.826	0.379
T(0)	ΔBOP (%)	14.37	5.55	25.35	15.02	5.98	23.53	11.56	4.21	25.52	20.39	9.80	33.54	0.640	0.154	0.064
	ΔPPD = 5 mm (%)	3.23	1.11	6.88	3.58	0.81	6.76	3.08	1.13	7.65	2.76	1.10	5.52	0.926	0.655	0.531
T(1)	ΔPPD ≥ 5mm (%)	8.28	3.88	14.73	8.62	3.45	14.60	9.44	4.61	16.65	6.61	3.74	13.96	0.431	0.908	0.416
	ΔPPD ≥ 6mm (%)	3.88	1.52	8.95	3.64	1.36	9.44	4.52	1.61	8.90	3.39	1.45	8.56	0.835	0.996	0.640

Abbreviations: T(0) = baseline; T(1) = reevaluation; FMS = full-mouth scaling; FMD = full-mouth disinfection; PVP-I = povidone-iodine; APT = active periodontal therapy; Med = Median; Q1 = 1st quartile; Q3 = 3rd quartile;

Kratice: T(0) = početna vrijednost; T(1) = reevaluacija; FMS = čišćenje cijelih usta; FMD = dezinfekcija cijelih usta; PVP-I = povidon jod APT = aktivna parodontološka terapija; Med = medijan; Q1 = 1. kvartil; Q3 = 3. kvartil

negatively associated with the use of FMD ($\beta = -2.70$, $p = 0.006$), compared to FMS. Moreover, these correlations remained stable after adding age, sex, smoking and diabetes to the model. Regarding $\Delta\text{PPD} \geq 6$ mm (%) there was still no significant association after adjusting for these confounders.

Clinical endpoints

A significant number of patients treated with PVP-I achieved the T1 endpoint of BOP ≤ 20 %.

The majority of all patients (79%) reached the clinical endpoint of BOP ≤ 20 %, whereas only 7% of the overall cohort reached the endpoint of ≤ 4 sites with a PPD ≥ 5 mm. Comparing the three treatment methods regarding their effect on reaching the defined clinical endpoints, there was a statistically significant difference regarding the endpoint for BOP (%) with the highest relative number of patients in the PVP-I group (Table 3). The PPD endpoint was reached by 2% of the patients treated by FMD, compared to 8% of the patients treated with adjunctive PVP-I and 10% without adjunctive agents. However, this difference was not statistically significant (Table 3).

Multivariate analysis

In the multivariate logistic regression, the baseline BOP (%) was the strongest predictor of treatment success: OR per 1% increase 0.96; 95% CI 0.94–0.98; $p < 0.001$).

After adjustment for baseline BOP, observation period, and potential confounders, treatment modality remained significantly associated with the outcome ($p = 0.0006$).

Compared to conventional full-mouth scaling (reference), patients treated with PVP-I had significantly higher

zano s primjenom FMD-a ($\beta = -2,70$, $p = 0,006$) u usporedbi s FMS-om. Štoviše, te su korelacije ostale stabilne nakon davanja u model dobi, spola, pušenja i dijabetesa. Što se tiče $\Delta\text{PPD-a} \geq 6$ mm (%), i dalje nije bilo značajne povezanosti nakon prilagodbe za te čimbenike.

Klinički ishodi

Znatno više pacijenata liječenih PVP-jodom postiglo je T1 završnu točku BOP-a ≤ 20 %.

Većina svih pacijenata (79 %) dosegla je kliničku završnu točku BOP-a ≤ 20 %, a samo 7 % ukupne kohorte doseglo je završnu točku ≤ 4 mjesta s PVP-jodom ≥ 5 mm. Uspoređujući tri metode liječenja s obzirom na njihov učinak na postizanje definiranih kliničkih završnih točaka, uočena je statistički značajna razlika kad je riječ o završnoj točki za BOP (%) s najvećim relativnim brojem pacijenata u skupini PVP-I (tablica 3.). Završnu točku PPD-a doseglo je 2 % pacijenata liječenih FMD-om, u usporedbi s 8 % pacijenata liječenih dodatnim PVP-jodom i 10 % bez dodatnih sredstava. No ta razlika nije bila statistički značajna (tablica 3.).

Multivarijatna analiza

U multivarijatnoj logističkoj regresiji početni BOP (%) bio je najjači prediktor uspješnog liječenja (OR po povećanju od 1 % (0,96; 95 % CI 0,94 – 0,98; $p < 0,001$). Nakon prilagodbe na početno razdoblje promatranja BOP-a i potencijalne zbujujuće čimbenike, način liječenja ostao je značajno povezan s ishodom ($p = 0,0006$). U usporedbi s konvencionalnim čišćenjem cijelih usta (referencija), pacijenti liječeni PVP-jodom imali su znatno veću mogućnost postizanja

Table 3 Number and Percentage of patients reaching the endpoints BOP $\leq 20\%$ and ≤ 4 sites with PPD ≥ 5 mm for each treatment modality (PVP-I, FMD, and FMS), p-values by Chi-square test

Tablica 3. Broj i postotak pacijenata koji su dosegli krajnje točke BOP-a $\leq 20\%$ i ≤ 4 mjesta s PPD-om ≥ 5 mm za svaki način liječenja (PVP-I, FMD i FMS), p-vrijednosti s pomoću hi-kvadrat testa

	BOP (%) $\leq 20\%$			≤ 4 sites with PPD ≥ 5 mm		
	outcome reached • Ishod postignut n (%)	outcome not reached • Ishod nije postignut n (%)	p-value • p-vrijednost	outcome reached • Ishod postignut n (%)	outcome not reached • Ishod nije postignut n (%)	p-value • p-vrijednost
PVP-I	37 (97%)	1 (3%)	0.003	3 (8%)	35 (92%)	0.068
FMD	66 (71%)	27 (29%)		2 (2%)	91 (98%)	
FMS	77 (80%)	19 (20%)		10 (10%)	86 (90%)	

Abbreviations: PVP-I = povidone-iodine, FMD = full-mouth disinfection, FMS = full-mouth scaling, BOP = bleeding on probing, PPD = probing pocket depth • Kratice: PVP-I = povidon jod, FMD = dezinfekcija cijelih usta, FMS = čišćenje cijelih usta, BOP = krvarenje pri sondiranju, PPD = dubina džepa pri sondiranju

Table 4 Multivariable logistic regression analysis for achievement of the clinical endpoint (BOP $\leq 20\%$) after non-surgical periodontal therapy, adjusted for baseline BOP (%), observation period (months), percentage of sites with PPD ≥ 5 mm, age, sex, smoking, diabetes, and grading.

Tablica 4. Multivarijantna logistička regresijska analiza za postizanje kliničkog ishoda (BOP $\leq 20\%$) poslije nekirurške parodontološke terapije, prilagođena za početni BOP (%), razdoblje promatranja (mjeseci), postotak mjesta s PPD-om ≥ 5 mm, dob, spol, pušenje, dijabetes i gradaciju

Variable • Varijable	OR	95% CI	p-value • p-vrijednost
Treatment group • Terapijska skupina			
PVP-I vs. FMS	11.5	1.32–99.47	0.027*
FMD vs. FMS	0.57	0.26–1.25	0.16
Baseline BOP (%)	0.96	0.94–0.98	<0.001*
ΔT_0-T_1 (months)	0.90	0.81–1.01	0.08
PPD ≥ 5 mm (%)	0.55	0.02–14.70	0.72
Age (years)	0.98	0.94–1.01	0.19
Male sex	1.07	0.41–2.47	0.72
Smoking	0.74	0.27–2.00	0.55
Diabetes	3.20	0.31–32.65	0.33
Grading B/C	0.94 / 0.30	0.35–2.54 / 0.04–2.04	0.91 / 0.22

Abbreviations: PVP-I = povidone-iodine, FMD = full-mouth disinfection, FMS = full-mouth scaling, BOP = bleeding on probing, PPD = probing pocket depth • Kratice: PVP-I = povidon jod, FMD = dezinfekcija cijelih usta, FMS = čišćenje cijelih usta, BOP = krvarenje pri sondiranju, PPD = dubina džepa pri sondiranju

Note: Reference category = FMS • Napomena: referentna kategorija = FMS

odds of reaching BOP $\leq 20\%$ (adjusted OR ≈ 11.5 ; 95% CI 1.3–99.5; $p = 0.027$), while FMD did not differ significantly ($p = 0.16$).

A shorter time interval between baseline and re-evaluation tended to be associated with higher success rates (OR ≈ 0.90 per month; $p = 0.08$) (Table 4).

Due to a limited number of patients achieving the pocket-related endpoint (≤ 4 sites with PPD ≥ 5 mm), the multivariable model showed instability with extremely wide confidence intervals. Baseline proportion of deep sites was the only consistent predictor, while other covariates could not be reliably estimated.

Discussion

The purpose of this retrospective study was to investigate whether full mouth disinfection (FMD) or the use of povidone iodine (PVP-I) as a cooling fluid are superior to a con-

BOP-a $\leq 20\%$ (prilagođeni OR ≈ 11.5 ; 95% CI 1,3 – 99,5; $p = 0,027$), a FMD se nije značajno razlikovao ($p = 0,16$). Kraći interval između početnog stanja i reevaluacije obično je bio povezan s većim stopama uspjeha (OR $\approx 0,90$ mjesečno; $p = 0,08$) (tablica 4).

Zbog malo pacijenata koji su postigli cilj povezan s džepovima (≤ 4 mjesta s PPD-om ≥ 5 mm), multivarijabilni model pokazao je nestabilnost s iznimno širokim intervalima pouzdanosti. Početni udio dubokih mjesta bio je jedini konzistentni prediktor, a ostale kovarijante nisu se mogle pouzdanost procijeniti.

Rasprava

Svrha ove retrospektivne studije bila je istražiti jesu li dezinfekcija cijelih usta (FMD) ili upotreba povidon-joda

ventional non-surgical full-mouth scaling (FMS) in clinical outcome parameters. Subgingival instrumentation alone, or in combination with the investigated adjuvants, was an efficient method in reducing probing pocket depth (PPD) and bleeding on probing (BOP). All three treatment methods resulted in significant improvement ($p < 0.001$) of PPD and BOP between T_0 and T_1 . We did not observe any beneficial effects of FMD or adjunctive PVP-I on the change of PPD (%) compared to FMS. Reaching the endpoint of ≤ 4 sites with a PPD ≥ 5 mm was achieved by just a minority of all patients. Bleeding on probing at T_1 showed a statistically significantly lower value in the PVP-I group compared to both FMD and FMS, with no difference observed between the latter two. The change in BOP from T_0 to T_1 , as well as achieving the BOP $\leq 20\%$ endpoint, was significantly positively associated with the adjunctive use of PVP-I.

There is broad scientific evidence supporting the efficacy of subgingival instrumentation in effectively reducing periodontal inflammation (8, 9). A relative mean number of closed pockets of 57% - 74% was reported, which is in alignment with our findings regarding the estimated reduction of PPD ≥ 4 mm of around 80%. However, this calculation includes 4 mm sites with positive BOP. Moreover, after six to eight months, a mean BOP reduction by 57-63% can be achieved (8). In the present study, the mean change in BOP (Δ BOP) after 5.60 ± 3.19 months was 18.94 % from the T_0 value of 31.58%, representing a relative reduction of 60%.

Regarding the reduction of PPD and PPD related outcomes, none of the three treatment methods analyzed demonstrated significantly superior results. Hence, the findings of this study do not align with those of numerous other studies that have reported positive effects associated with the FMD concept (2, 10-13) or the adjunctive use of PVP-I (6, 7, 14, 15). On the other hand, in terms of PPD they are in line with a number of studies that showed FMD (16-20) or PVP-I (21-23) not superiorly affecting periodontal therapy outcomes compared to FMS. However, the concentration of PVP-I used in these studies was anything from 0.1%, 0.5%, 1% or 10%, and the number of participants varied from 20 to 60 (21). Within the meta-analysis of El Mobadder et al., the effect of adjunctive PVP-I on BOP (%) was reported by three of 10 included studies, showing no beneficial effect (22). Similarly, Svellenti et al. (2024) presented no significant improvements regarding PPD and CAL under use of PVP-I compared to FMS (23). At this point, it should also be noted that only a small proportion of patients achieved the pocket-related endpoint (≤ 4 sites with PPD ≥ 5 mm), resulting in sparse events for this outcome. Consequently, in this context the present study was likely underpowered to sufficiently detect differences between treatment modalities with respect to pocket-related success. Hence, any findings related to pocket-related endpoints should be interpreted as exploratory rather than confirmatory.

Regarding the BOP related results, we found a lower T_1 BOP level and a beneficial association with BOP reduction after 5.09 ± 2.57 months. Comparable to the present study, do Vale et al. used a 10% PVP-I cooling solution along with ultrasonic scaling (24). They analyzed data from 28 study

(PVP-I) kao rashladne tekućine superiorne u odnosu prema konvencionalnom nekirurškom čišćenju (FMS) u parametrima kliničkoga ishoda. Subgingivna instrumentacija, sama ili u kombinaciji s ispitivanim adjuvansima, bila je učinkovita metoda u smanjenju dubine džepova sondiranja (PPD) i krvarenja pri sondiranju (BOP). Sve tri metode liječenja rezultirale su značajnim poboljšanjem ($p < 0,001$) PPD-a i BOP-a između T_0 i T_1 . Nismo uočili nikakav blagotvorni učinak FMD-a ili dodatnoga PVP-joda na promjenu PPD-a (%) u usporedbi s FMS-om. Dostizanje krajnje točke od ≤ 4 mjesta s PPD-om ≥ 5 mm postigao je samo manji dio svih pacijenata. Krvarenje pri sondiranju u T_1 pokazalo je statistički značajno nižu vrijednost u skupini PVP-I u usporedbi s FMD-om i FMS-om, bez uočene razlike između dvaju posljednjih. Promjena BOP-a od T_0 do T_1 , te postizanje krajnje točke BOP-a $\leq 20\%$, bila je značajno pozitivno povezana s dodatnom primjenom PVP-joda.

Postoje mnogobrojni znanstveni dokazi koji podupiru učinkovitost subgingivne instrumentacije u uspješnom smanjenju parodontne upale (8, 9). Prijavljen je relativni prosječni broj zatvorenih džepova od 57 % do 74 %, što je u skladu s našim nalazima u vezi s procijenjenim smanjenjem PPD-a ≥ 4 mm za oko 80 %. No taj izračun uključuje mjesta od 4 mm s pozitivnim BOP-om. Štoviše, nakon šest do osam mjeseci može se postići prosječno smanjenje BOP-a za 57 do 63 % (8). U ovoj studiji je prosječna promjena BOP-a (Δ BOP) poslije $5,60 \pm 3,19$ mjeseci bila 18,94 % od vrijednosti T_0 od 31,58 %, što je relativno smanjenje od 60 %.

Kad je riječ o smanjenju PPD-a i ishoda povezanih s njime, ni jedna od triju analiziranih metoda liječenja nije pokazala značajno bolje rezultate. Zato se nalazi u ovoj studiji ne poklapaju s nalazima brojnih drugih studija u kojima su autori izvijestili o pozitivnim učincima povezanim s konceptom FMD-a (2, 10 – 13) ili dodatnom primjenom PVP-joda (6, 7, 14, 15). S druge strane, u smislu PPD-a, oni su u skladu s nizom studija u kojima je istaknuto da FMD (16 – 20) ili PVP-jod (21 – 3) ne utječu na ishode parodontološke terapije u usporedbi s FMS-om. No koncentracija PVP-joda korištena u tim studijama bila je od 0,1 %, 0,5 %, 1 % ili 10 %, a broj sudionika varirao je od 20 do 60 (21). U metaanalizi El Mobaddera i suradnika o učinku dodatnoga PVP-joda na BOP (%), istaknuto je da tri od 10 uključenih studija ne pokazuju blagotvorni učinak (22). Slično tomu, Svellenti i suradnici (2024.) nisu postigli značajna poboljšanja kad je riječ o PPD-u i CAL-u primjenom PVP-joda u usporedbi s FMS-om (23). Treba također napomenuti da je samo malo pacijenata postiglo krajnju točku povezanu s džepom (≤ 4 mjesta s PPD-om ≥ 5 mm), što je rezultiralo događajima rijetkim za ovaj ishod. Posljedično, u tom kontekstu ova studija vjerojatno nije imala dovoljnu statističku snagu da bi otkrila razlike između modaliteta liječenja kad je riječ o uspjehu povezanom s džepom. Zato sve nalaze vezane uz krajnje točke povezane s džepom treba tumačiti kao eksperimentalne, a ne potvrdne.

U vezi s rezultatima povezanim s BOP-om, pronašli smo nižu razinu T_1 BOP-a i korisnu povezanost sa smanjenjem BOP-a poslije $5,09 \pm 2,57$ mjeseci. U usporedbi s ovom studijom, Vale i suradnici koristili su se 10 %-postotnom otopinom za hlađenje PVP-joda, uz ultrazvučno uklanjanje ka-

participants suffering from generalized aggressive periodontitis. They did not observe any difference compared to subgingival therapy without antiseptic irrigation after three and six months. In terms of microbiological investigations, they found a beneficial effect for the PVP-I group in decreasing levels of *Aggregatibacter actinomycetemcomitans*. Similar results were reported by Perrella et al. (25). The discrepancies in these results compared to the present study could be explained by different periodontal diagnosis and the lower number of participants. However, Hoang et al. reported beneficial results on clinical parameters, using a 10 % PVP-I concentration (7). An important methodological aspect should be mentioned. The investigated treatment modalities reflect combined interventions. In particular, the PVP-I protocol combines ultrasonic instrumentation with antiseptic cooling. Consequently, the observed association with improved bleeding outcomes may be influenced by factors beyond the antiseptic agent alone. Although current guideline-based evidence indicates that non-surgical subgingival instrumentation is effective irrespective of the instrument type (1, 8), residual confounding related to protocol characteristics cannot be excluded in this retrospective design. Moreover, the observed adjusted odds ratio for achieving the BOP \leq 20% endpoint in the PVP-I group was large and associated with a wide confidence interval, reflecting the relatively small size of the PVP-I subgroup, the high overall proportion of patients achieving the endpoint, and the resulting sparse event distribution in between-group comparisons. Consequently, the magnitude of the odds ratio is likely inflated and should not be interpreted as a precise estimate of treatment effect. Rather, the finding should be considered exploratory and indicative of the direction of association with improved short-term inflammatory control. In this broader context, short-term improvements in periodontal inflammatory status following adjunctive anti-infective strategies have been reported in randomized clinical studies in selected high-risk patient populations, such as heavy smokers (26).

Regarding FMD, we found no beneficial effects on Δ BOP (%) and on reaching the clinical endpoint of BOP \leq 20% compared to FMS or PVP-I. However, the clinical studies that reported significant benefits of FMD mainly generated their results by using small groups of participants ($n < 20$) and shared the design of a randomized controlled trial, which significantly reduces the numerous shortcomings associated with a retrospective study (Bollen et al., 1998; Mongardini et al., 1999; Fonseca et al., 2015). Especially, the precise application of FMD requires sufficient time and expertise, and someone could argue that the application of FMD could be done more thoroughly under RCT conditions compared to daily clinical practice. For the full FMD protocol, the patient needs very good adherence to continue both optimized home plaque control and the chlorhexidine regime immediately after SRP (2, 10). Moreover, regarding the antimicrobial effects of typical CHX formulation it was recently reported that after an initial decrease in bacterial load, recovery follows quickly, accompanied by distinct alterations in case of repeated CHX exposure (27). Similar results were reported in a study on patients after treatment of

menca (24). U studiji su analizirali podatke 28 sudionika koji su bolovali od generaliziranoga agresivnog parodontitisa. Nisu uočili nikakvu razliku u usporedbi sa subgingivnom terapijom bez antiseptičke irigacije poslije tri i šest mjeseci. Kad je riječ o mikrobiološkim istraživanjima, otkrili su blagotvorni učinak za skupinu PVP-I u smanjenju razine *Aggregatibacter actinomycetemcomitans*. Slične rezultate dobili su Perrella i suradnici (25). Razlike u tim rezultatima, u usporedbi s ovom studijom, mogle bi se objasniti različitim dijagnozom i manjim brojem sudionika. Međutim, Hoang i suradnici izvjestili su o povoljnim rezultatima kliničkih parametara koristeći se 10-postotnom koncentracijom PVP-joda (7). Treba spomenuti važan metodološki aspekt. Ispitivani načini liječenja odražavaju kombinirane intervencije. Konkretno, u protokolu za PVP-I kombinira se ultrazvučna instrumentacija s antiseptičkim hlađenjem. Posljedično, na uočenu povezanost s poboljšanim ishodima krvarenja mogu utjecati čimbenici koji nisu samo antiseptičko sredstvo. Iako trenutačni dokazi temeljeni na smjernicama upućuju na to da je nekirurška subgingivna instrumentacija učinkovita bez obzira na vrstu instrumenta (1, 8), rezidualni zbnjujući faktori povezani s karakteristikama protokola ne mogu se isključiti u ovom retrospektivnom dizajnu. Štoviše, uočeni prilagođeni omjer izgleda za postizanje krajnje točke BOP-a \leq 20 % u skupini PVP-I bio je velik i povezan sa širokim intervalom pouzdanosti, što odražava razmjerno malu veličinu podskupine PVP-I, visok ukupni udio pacijenata koji su postigli krajnju točku i rezultirajuću rijetku raspodjelu događaja u usporedbama između skupina. Posljedično, veličina omjera je napuhana i ne treba je tumačiti kao preciznu procjenu učinka liječenja. Umjesto toga nalaz treba smatrati eksperimentalnim i indikativnim za smjer povezanosti s poboljšanom kratkoročnom kontrolom upale. U ovom širem kontekstu, kratkoročna poboljšanja parodontološkog upalnog statusa nakon dodatnih antiinfekcijskih strategija zabilježena su u randomiziranim kliničkim studijama u odabranim populacijama pacijenata visokog rizika, poput teških pušača (26).

Kad je riječ o FMD-u, nismo pronašli povoljne učinke na Δ BOP (%) i na postizanje krajnje kliničke točke BOP-a \leq 20 % u usporedbi s FMS-om ili PVP-jodom. No u kliničkim studijama o značajnim koristima FMD-a uglavnom su generirani rezultati korištenjem malih skupina sudionika ($n < 20$) i dijelile su dizajn randomiziranoga kontroliranog ispitivanja, što znatno smanjuje mnogobrojne nedostatke povezane s retrospektivnom studijom (Bollen i sur., 1998., Mongardini i sur., 1999., Fonseca i sur., 2015.). Precizna primjena FMD-a zahtijeva dovoljno vremena i stručnosti, a netko bi mogao tvrditi da bi se primjena FMD-a mogla temeljitije provesti u uvjetima RCT-a u usporedbi sa svakodnevnom kliničkom praksom. Za puni protokol FMD-a potrebna je vrlo dobra suradnja pacijenta kako bi i kod kuće nastavio s optimiziranom kontrolom plaka i režimom klorheksidina odmah nakon SRP-a (2, 10). Štoviše, u vezi s antimikrobnim učincima tipične formulacije CHX, nedavno je objavljeno da nakon početnog smanjenja bakterijskoga opterećenja, oporavak slijedi brzo, a popraćen je izrazitim promjenama u slučaju ponovljenog izlaganja CHX-u (27). Slični rezultati zabilježeni su u studiji u kojoj su sudjelovali pacijentima poslije liječenja

aggressive periodontitis (28). Moreover, adaptations of oral pathogens to CHX were reported (29).

Residual periodontal pockets, particularly when PPD exceeds 5 mm, harbor the risk of further loss of periodontal attachment, with an even more elevated risk in cases of bleeding on probing (30). Moreover, bleeding scores > 20% have been shown to be a risk factor for subsequent disease progression (31). Beyond local periodontal outcomes, increasing attention has been drawn to the potential systemic relevance of periodontal inflammatory burden. In this context, an exploratory case-control study by Radujković et al. reported associations between PISA, bleeding scores, probing depth, and ischemic stroke-related clinical parameters (32). The observed associations between the use of PVP-I and better BOP outcomes in combination with microbiological benefits reported in other studies (24, 33) could support the use of PVP iodine in patients who do not suffer from allergies or have other contraindications such as pregnancy. However, according to van der Sluijs et al., and to the best of our knowledge, there are currently no known adverse events associated with PVP-I as cooling agent for subgingival instrumentation (21). Moreover, according to Sahrman et al., PVP-I was able to reduce subgingival treatment related bacteremia and could therefore be beneficial for high-risk patients (34).

Our overall cohort showed a balanced distribution of female and male participants. Likewise, the gender distribution was balanced in the FMS and FMD group. Within PVP-I, female patients were overrepresented with almost twice as many as male participants. There is an indication from a retrospective analysis that male gender negatively affects the success of periodontal therapy, suggesting that clinical parameters such as BOP and PPD reduction were less favorable in men than in women (35). This could affect the risk of bias in our results. However, gender was not statistically significant as confounding variable in the regression analysis.

The following limitations should be addressed: 1. Clinical examinations and treatments were performed by multiple examiners. Although all clinicians were trained within a standardized institutional teaching framework and followed uniform departmental protocols, formal study-specific calibration was not performed. Therefore, inter-examiner variability cannot be completely excluded and represents a limitation of this retrospective study. 2. The present study assessed short-term outcomes at re-evaluation after completion of step 2 periodontal therapy. Accordingly, the results reflect clinical stability at this treatment stage, which represents a key decision point for either transition into supportive periodontal therapy or indication for further surgical intervention. This harbors the limitation that no conclusions regarding long-term periodontal stability can be drawn from this dataset. 3. Treatment allocation was non-randomized and followed evolving departmental protocols and clinician preference. In addition, the PVP-I group differed not only with respect to the adjunctive antiseptic but also regarding the overall treatment protocol, which may have introduced residual confounding. Randomized treatment allocation would be required to confirm the observed associations. 4. Due to a lack of consequent documentation of clinical attachment

agresivnog parodontitisa (28). Štoviše, zabilježene su prilagodbe oralnih patogena na CHX (29).

Rezidualni parodontni džepovi, posebno kada PPD prelazi 5 mm, rizični su zbog daljnjeg gubitka parodontnog pripoja, s još većom opasnošću u slučaju krvarenja pri sondiranju (30). Štoviše, pokazalo se da su rezultati krvarenja > 20 % čimbenik rizika za naknadnu progresiju bolesti (31). Osim lokalnih ishoda, sve se više pozornosti posvećuje potencijalnoj sistemskoj važnosti parodontnoga upalnog opterećenja. U tom kontekstu, u istraživačkoj studiji slučaj-kontrola Radujkovića i suradnika ističe se povezanost između PISA-e, rezultata krvarenja, dubine sondiranja i kliničkih parametara povezanih s ishemijskim moždanim udarom (32). Uočene povezanosti između upotrebe PVP-joda i boljih ishoda BOP-a u kombinaciji s mikrobiološkim koristima prijavljenima u drugim studijama (24, 33), mogle bi poduprijeti upotrebu PVP-joda kod pacijenata koji ne pate od alergija ili nemaju druge kontraindikacije poput trudnoće. Međutim, prema van der Sluijsu i suradnicima, a koliko je nama poznato, trenutno nema poznatih nuspojava povezanih s PVP-jodom kao rashladnim sredstvom za subgingivnu instrumentaciju (21). Štoviše, prema Sahrmanu i suradnicima, PVP-jod uspio je smanjiti bakterijemiju povezanu sa subgingivnim liječenjem te bi stoga mogao biti koristan za visokorizične pacijente (34).

Naša ukupna kohorta pokazala je uravnoteženu raspodjelu ženskih i muških sudionika. Slično tomu, spolna raspodjela bila je uravnotežena u skupini FMS i FMD. Unutar skupine PVP-I, pacijentica je bilo gotovo dvostruko više od pacijenata. Retrospektivna analiza pokazuje da muški spol negativno utječe na uspjeh parodontološke terapije, što sugerira da su klinički parametri poput smanjenja BOP-a i PPD-a bili manje povoljni kod muškaraca nego kod žena (35). To bi moglo utjecati na rizik od pristranosti u našim rezultatima. No spol nije bio statistički značajan kao zbnunjuća varijabla u regresijskoj analizi.

Treba uzeti u obzir sljedeća ograničenja: 1. Kliničke preglede i terapijske postupke obavljalo je više ispitivača. Iako su se svi kliničari educirali unutar standardiziranoga institucionalnog okvira za poučavanje i slijedili su jedinstvene odjelne protokole, formalna kalibracija specifična za studiju nije provedena. Zato se varijabilnost među ispitivačima ne može potpuno isključiti i ograničenje je ove retrospektivne studije. 2. U ovoj studiji procijenjeni su kratkoročni ishodi pri reevaluaciji poslije završetka 2. faze parodontološke terapije. U skladu s tim, rezultati pokazuju kliničku stabilnost u ovoj fazi liječenja, što je ključna točka za odluku na prelazak na potpurnu parodontološku terapiju ili indikaciju za daljnju kiruršku intervenciju. To krije ograničenje da se iz ovoga skupa podataka ne mogu izvući zaključci o dugoročnoj stabilnosti. 3. Raspodjela liječenja nije bila randomizirana i slijedila je razvoj odjelnih protokola i preferencije kliničara. Uz to, skupina PVP-I razlikovala se ne samo s obzirom na dodatni antiseptik, nego i s obzirom na cjelokupni protokol liječenja, što je moglo unijeti rezidualne zbnunjuće efekte. Za potvrdu uočenih povezanosti bila bi potrebna randomizirana raspodjela liječenja. 4. Zbog nedostatka dosljedne dokumentacije o kliničkom gubitku pričvrstka i recesiji, nije se mogla oba-

loss and recession, no analysis on these parameters could be conducted. 5. The reclassification of the periodontal diagnosis contains the risk of bias in patient diagnosis. 6. The study was conducted in a single university clinic center, hence local clinical practices, patient demographics, prevalence of certain diseases like diabetes and the German healthcare system may not be representative internationally. 7. As reported by Marruganti et al., the response to periodontal therapy is significantly affected by lifestyle factors such as diet, physical activity, smoking, or alcohol consumption (36). Only smoking was assessed within the present study. In the context of their results, Marruganti et al. recommended to include assessment of these lifestyle factors in future studies to address confounding effects within the statistical analysis. Furthermore, data on patient weight and body mass index was not routinely collected. Such conditions could act as confounders and affect the effectiveness of periodontal therapy. In future studies and clinical practice, comprehensive assessments of patients' general health conditions and lifestyle factors, such as overweight, obesity, diet, and physical activity should be assessed to gain understanding regarding their impact on periodontal treatment outcomes. Moreover, given the emerging evidence of beneficial effects of the adjunctive use of nutraceuticals such as omega-3 capsules and other ingredients (37-41), future studies could examine combined strategies such as the combination of topical antiseptics such as PVP-I and nutraceuticals such as omega-3. 8. Although baseline characteristics were largely balanced, patients in the PVP-I group were younger and had a slightly shorter re-evaluation period. These factors may have influenced treatment response and were therefore included as covariates in the adjusted regression models. 9. Limited subgroup size and sparse events may have affected the stability of regression estimates, particularly for binary clinical endpoints.

One strength of this retrospective study could be that a larger number of patients were included compared to most studies on this topic. Furthermore, to our knowledge, there is a lack regarding comparative studies comparing both, FMD and the use of PVP-iodine with conventional and subgingival instrumentation provided as FMS. Following the recent recommendations of Feres et al., we used the success criteria defined in their publication as one part of our analysis (31). Moreover, due to heterogeneity in PVP-I concentrations, used in studies of the past, future studies should aim to standardize PVP-I related treatment concept.

Finally, it should be mentioned that the present study was conducted in a single university-based periodontal center within a specific healthcare system, characterized by standardized treatment and maintenance protocols and a relatively low prevalence of systemic conditions such as diabetes mellitus. Consequently, the generalizability of the findings may be limited. Patient adherence, clinician expertise, and organizational structures may differ substantially in non-academic or private practice settings, thus potentially affecting clinical outcomes. Therefore, the results should be interpreted with caution when extrapolating to other clinical environments.

viti analiza tih parametara. 5. Reklasifikacija parodontološke dijagnoze sadržava rizik od pristranosti u dijagnozi. 6. Studija je provedena u jednom sveučilišnom kliničkom centru, stoga lokalne kliničke prakse, demografija pacijenata, prevalencija određenih bolesti poput dijabetesa te njemački zdravstveni sustav možda nisu reprezentativni na međunarodnoj razini. 7. Kao što su izvjestili Marruganti i suradnici, na odgovor na parodontološku terapiju značajno utječu čimbenici kao što su prehrana, tjelesne aktivnosti, pušenje ili konzumacija alkohola (36). U ovoj studiji procijenjeno je samo pušenje. U kontekstu svojih rezultata, Marruganti i suradnici preporučili su uključivanje procjene tih čimbenika o načinu života u buduće studije kako bi se riješili zbujujući učinci unutar statističke analize. Nadalje, podatci o težini i indeksu tjelesne mase pacijenata nisu rutinski prikupljeni. Takva stanja mogla bi djelovati kao zbujujući čimbenici i utjecati na učinkovitost parodontološke terapije. U budućim studijama i kliničkoj praksi trebalo bi procijeniti sveobuhvatne procjene općega zdravstvenog stanja pacijenata i njihov načina života, poput prekomjerne težine, pretilosti, prehrane i tjelesne aktivnosti kako bi se shvatio njihov utjecaj na ishode parodontološkog liječenja. Štoviše, s obzirom na nove dokaze o korisnim učincima dodatne upotrebe nutrijenata poput kapsula omega-3 i drugih sastojaka (37 – 41), autori budućih studija mogli bi proučiti kombinirane strategije poput kombinacije lokalnih antiseptika poput PVP-joda i nutrijenata kao što je omega-3. 8. Iako su početne karakteristike bile uglavnom uravnotežene, pacijenti u skupini PVP-I bili su mlađi i imali su nešto kraće razdoblje reevaluacije. Ti čimbenici mogli su utjecati na odgovor na liječenje i zato su uključeni kao kovarijante u prilagođene regresijske modele. 9. Ograničena veličina podskupine i rijetki događaji mogli su utjecati na stabilnost regresijskih procjena, posebno za krajnje binarne kliničke točke.

Jedna od snaga ove retrospektivne studije mogla bi biti to što je uključen veći broj pacijenata u usporedbi s većinom studija o toj temi. Nadalje, koliko znamo, nedostaju komparativne studije u kojima se uspoređuju FMD i upotreba PVP-joda s konvencionalnom i subgingivnom instrumentacijom kao što je FMS. Slijedeći nedavne preporuke Feres i suradnika, u našoj analizi koristili smo se kriterijima uspjeha definiranim u njihovu radu (31). Štoviše, zbog heterogenosti koncentracija PVP-joda korištenih u dosadašnjim studijama, autorima budućih studija trebao bi biti cilj standardizacija koncepta liječenja povezanog s PVP-jodom.

Konačno, treba spomenuti da je ova studija provedena u jednom sveučilišnom parodontološkom centru unutar specifičnoga zdravstvenog sustava, karakteriziranoga standardiziranim protokolima liječenja i održavanja te razmjerno niskom prevalencijom sistemskih stanja poput dijabetesa. Posljedično, generalizacija nalaza može biti ograničena. Liječenje pacijenata, stručnost kliničara i organizacijske strukture mogu se znatno razlikovati u neakademskim ili privatnim ordinacijama, što potencijalno utječe na kliničke ishode. Zato rezultate treba tumačiti s oprezom u slučaju ekstrapolacije na druga klinička okruženja.

Conclusion

Within the limitations of this retrospective cohort study, adjunctive use of PVP-I during Step 2 of periodontal therapy was significantly associated with greater improvement in bleeding on probing (BOP %) compared with both full-mouth disinfection (FMD) and full-mouth scaling (FMS), suggesting a beneficial anti-inflammatory effect. No significant differences were observed among the treatment modalities regarding the reduction of sites with probing pocket depth (PPD) ≥ 6 mm, indicating that none was superior in reducing deep periodontal pockets that might require further surgical intervention. Patients treated with PVP-I also showed a higher likelihood of achieving the clinical endpoint BOP ≤ 20 %, whereas achieving ≤ 4 sites with PPD ≥ 5 mm was uncommon across all groups without a significant inter-group difference. Overall, the applied adjunctive PVP-I treatment concept appears to be associated with improved BOP-related outcomes, whereas conclusions regarding pocket-related success and avoidance of surgical treatment are limited and should be considered exploratory. The findings are limited to short-term outcomes after completion of Step 2 periodontal therapy and do not allow conclusions regarding long-term periodontal stability.

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Conflict of interest: The authors declare no conflicts of interest.

Author contributions: All authors contributed substantially through drafting, data interpretation, and critical revision of the paper. Moreover, they approved the final version of the paper and agreed with all aspects of the work. Additionally, B.K. and J.S. collected the data; V.B. and B.K. analyzed the data statistically; M.M.H. and V.B. conceived the study design; and V.B., M.M.H., A.K. performed the writing.

Zaključak

Unutar ograničenja ove retrospektivne kohortne studije, dodatna primjena PVP-joda tijekom 2. faze parodontološke terapije bila je značajno povezana s većim poboljšanjem kad je riječ o krvarenju pri sondiranju (BOP %) u usporedbi s dezinfekcijom cijelih usta (FMD) i klasičnim čišćenjem cijelih usta (FMS), što sugerira koristan protuupalni učinak. Nisu uočene značajne razlike među modalitetima liječenja kad je riječ o smanjenju mjesta s dubinom parodontnih džepova (PPD) ≥ 6 mm, što upućuje na to da ni jedan nije bio superiorniji u smanjenju dubokih parodontnih džepova koji bi mogli zahtijevati daljnju kiruršku intervenciju. Pacijenti liječeni PVP-jodom također su pokazali veću vjerojatnost u postizanju kliničkog cilja BOP-a ≤ 20 %, a postizanje ≤ 4 mjesta s PPD-om ≥ 5 mm bilo je neuobičajeno u svim skupinama bez značajne razlike među njima. Sveukupno, primijenjeni koncept dodatnog liječenja PVP-jodom čini se da je povezan s poboljšanim ishodima povezanim s BOP-om, a zaključci o uspjehu povezanom s džepovima i izbjegavanju kirurškoga liječenja ograničeni su i treba ih smatrati eksperimentalnima. Nalazi su ograničeni na kratkoročne ishode poslije završetka 2. faze parodontološke terapije i ne dopuštaju zaključke o dugoročnoj stabilnosti stanja parodonta.

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Dostupnost podataka i materijala: Skupovi podataka korišteni i/ili analizirani u ovoj studiji mogu se dobiti od odgovarajućeg autora ako je zahtjev opravdan.

Etičko odobrenje i pristanak na sudjelovanje: Protokol studije odobrilo je Etičko povjerenstvo Sveučilišta u Tübingenu (referentni broj 557/2016BO2; 19. kolovoza 2016.) i registriran je u Njemačkome registru kliničkih ispitivanja 10. svibnja 2021. (URL: <https://www.drks.de>; ID: DRKS00025110). Za ovu vrstu studije, u skladu s §13 LDSG-a, nije bio potreban potpisani informirani pristanak.

Sukob interesa: Autori nisu bili u sukobu interesa.

Doprinos autora: B. K. i J. S. – prikupljanje podataka; V. B. i B. K. – statistička analiza podataka; M. M. H. i V. B. – dizajn studije; V. B., M. M. H., A. K. – pisanje teksta. Svi autori pridonijeli su studiji i sudjelovali u su izradi nacrtu, interpretaciji podataka ili kritičkom revidiranju teksta. Svi su odobrili konačnu verziju rada i složili se sa svim njegovim aspektima.

Sažetak

Svrha rada: U ovoj retrospektivnoj kohortnoj studiji procijenjeni su učinci dodatne terapije povidon-jodom (PVP-I), dezinfekcija cijelih usta (FMD) i konvencionalno čišćenje cijelih usta (FMS) poslije druge faze parodontološke terapije na kliničke ishode. **Metode:** Analizirani su kartoni pacijenata s Odjela za konzervativnu stomatologiju Sveučilišne bolnice u Tübingenu (2004. – 2016.) s potpunim parodontološkim podacima prije (T0) i poslije 2. faze parodontološke terapije (T1). Utjecaj načina liječenja, početnog krvarenja pri sondiranju (BOP %), udjela mjesta s dubinom sondiranja (PPD) ≥ 5 mm, dobi, pušenja, dijabetesa i intervala ponovne procjene na promjene BOP-a i PPD-a, te na kliničke krajnje točke BOP-a ≤ 20 % i ≤ 4 mjesta s PPD-om ≥ 5 mm, procijenjen je multivarijantnom regresijom. **Rezultati:** Ukupno je bilo uključeno 227 pacijenata (52 % žena; srednja dob \pm SD: 56,5 \pm 11,2 godine): 96 FMS-a, 93 FMD-a i 38 PVP-I-ja. Dodatni PVP-I potaknuo je značajno veće smanjenje BOP-a u usporedbi s FMD-om i FMS-om te je znatno povećao vjerojatnost postizanja BOP-a ≤ 20 % (prilagodeni OR = 11,5; $p = 0,03$), neovisno o početnoj upali i razdoblju ponovne procjene. Za krajnju točku povezanu s džepom (≤ 4 mjesta s PPD-om ≥ 5 mm) regresijski modeli bili su nestabilni zbog malo uspješnih slučajeva; početni postotak PPD-a ostao je jedini dosljedan prediktor. **Zaključak:** Dodatna primjena PVP-joda bila je statistički značajno povezana s poboljšanim ishodima u vezi s krvarenjem poslije 2. faze parodontološke terapije, dok nije uočena dodatna korist za smanjenje dubokih džepova. PVP-jod stoga može poboljšati rješavanje upale gingive, ali ne utječe značajno na zatvaranje džepova izvan konvencionalne mehaničke terapije.

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Adresa za dopisivanje

Dr. Valentin Bartha, MSc.
Heidelberg University, Heidelberg
University Hospital
Department for Conservative Dentistry
Im Neuenheimer Feld 400, 69120
Heidelberg, Germany
tel: +49 6221 5639888
e-adresa: valentin.bartha@med.uni-heidelberg.de

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