M E T A - A N A L Y S I S

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Evaluating the regenerative efficacy of titanium-prepared platelet-rich fibrin in the treatment of gingival recession: a systematic review and meta-analysis

Procena regenerativne efikasnosti titanijumom-pripremljenog fibrina obogaćenog trombocitima u lečenju gingivalne recesije: sistematski pregled i meta-analiza

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Abstract

Background/Aim. Titanium-prepared platelet-rich fibrin (PRF) – T-PRF was considered a new platelet concentrate that is now frequently used in dentistry. The aim of this study was to examine T-PRF's regenerative effectiveness in treating gingival recession (GR). **Methods.** The present study is a systematic review and meta-analysis. A comprehensive search was performed in PubMed, Scopus, Embase, Web of Science, Google Scholar, and Cochrane databases. Medical Subject Headings terms like 'platelet-rich fibrin', 'platelets', 'gingival recession', 'titanium', and 'root coverage' were used to identify the final included studies. Review Manager software was used to perform the statistical analysis. The value of $p \leq 0.05$ was considered statistically significant. **Results.** A total of six studies were included in the systematic review, three of which qualified for meta-analysis. The systematic review suggested that T-PRF is a superior biomaterial in the treatment of GR and showed comparable results to those of the gold standard connective tissue graft (CTG). However, in the meta-analysis at six-month follow-up, for mean root coverage width, the combined effect size across three studies with 272 participants was a standardized mean difference of 0.07 (-0.17, 0.31), indicating no significant difference between the interventions. For mean root coverage depth, the combined effect size was 0.50 (-0.71, 1.70), also showing a non-significant trend favoring one intervention over the other. **Conclusion.** Within the limitations, the present systematic review suggests clinically improved outcomes with T-PRF. In contrast, the meta-analysis did not show any significant advantage of T-PRF over CTG or PRF.

Key words:
database; gingival recession; meta-analysis; platelet-rich plasma.

Apstrakt

Uvod/Cilj. Titanijumom-pripremljen fibrin obogaćen trombocitima [*titanium-prepared platelet-rich fibrin* (PRF) – T-PRF] smatran je novim koncentratom trombocita koji se danas često koristi u stomatologiji. Cilj rada bio je da se ispita regenerativna efikasnost T-PRF u lečenju gingivalne recesije (GR). **Metode.** Ovim sistematskim pregledom i meta-analizom izvršena je sveobuhvatna pretraga u bazama podataka *PubMed*, *Scopus*, *Embase*, *Web of Science*, *Google Scholar* i *Cochrane*. Predmetne odrednice iz medicine (*Medical Subject Headings*) kao što su '*platelet-rich fibrin*', '*platelets*', '*gingival recession*', '*titanium*' i '*root coverage*' su korišćene radi utvrđivanja konačnog skupa radova uključenih u studiju. Za statističku analizu korišćen je softver *Review Manager*. Vrednost $p \leq 0,05$ smatrana je statistički značajnom. **Rezultati.** U sistematski pregled ukupno je uključeno šest studija, od kojih su tri ispunjavale kriterijume za meta-analizu. Sistematski pregled ukazao je na to da je T-PRF superioran biomaterijal u lečenju GR i pokazao rezultate koji su bili uporedivi sa zlatnim standardom – transplantatom vezivnog tkiva (TVT). Međutim, u meta-analizi sa praćenjem od šest meseci, za srednju širinu pokrivenosti korena, kombinovana veličina efekta u tri studije sa 272 učesnika iznosila je standardizovanu srednju razliku od 0,07 (-0,17, 0,31), što ukazuje na to da nema značajne razlike između intervencija.

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Za srednju dubinu pokrivenosti korena, kombinovana veličina efekta iznosila je 0,50 (-0,71, 1,70), što takođe pokazuje neznačajan trend u korist jedne intervencije u odnosu na drugu. **Zaključak.** Uzimajući u obzir ograničenja, ovaj sistematski pregled ukazuje na klinički poboljšane ishode primenom T-PRF. S druge strane, meta-analiza nije pokazala bilo kakvu značajnu prednost T-PRF u odnosu na TVT ili PRF.

Ključne reči:
baze podataka; gingiva, povlačenje; meta-analiza; plazma bogata trombocitima.

Introduction

Gingival recession (GR) can be described as an apical shift of the gingival margin in relation to the cement-enamel junction, leading to exposure of the root surface [1, 2]. The management of this condition remains a challenge owing to its multifactorial aetiology. Poor oral hygiene, improper toothbrushing techniques, thin gingival phenotype, and buccal fenestrations are the major etiological factors contributing to the high prevalence of this condition [3]. When left untreated, GR leads to various complications like dentinal hypersensitivity, aesthetic compromise (such as long teeth), cervical abrasions, root caries, bone loss, and eventually loss of teeth [4, 5]. Early intervention not only halts the progression of the disease/condition but also provides excellent regenerative results. Almost 100% root coverage (RC) can be achieved in Miller's class I and II conditions. It also provides the patient with emotional support and confidence in extreme conditions where GR is observed in the front teeth, which affects the aesthetic appearance of patients. Hence, early identification and treatment of this condition is crucial for the success of the therapy [6].

The success of the treatment lies in identifying and understanding the underlying aetiology of the GR condition. Once identified, the etiological factor has to be addressed as necessary. The next step will be to augment the lost tissue [7]. There are various treatment modalities for augmenting GR, which are commonly known as RC procedures. Coronally advanced flap (CAF), semilunar CAF, lateral pedicle flap, guided tissue regeneration techniques involving various biomaterials, free gingival graft, free connective tissue, periosteal pedicle graft, and subepithelial connective tissue graft (CTG) – SCTG have been used with substantial success in terms of recession depth (RD), recession width (RW), keratinized tissue width (KTW), and mean RC (MRC) percentage during the follow-up periods [8]. The application of the CAF alone for RC had presented with limited results. Later, when CAF was used along with SCTG, the results were promising and long-lasting, with greater predictability for RC [9, 10]. A recent systematic review (SR) and meta-analysis (MA) by Carrera et al. [11] stated that the tunneling technique (TT) incorporated with SCTG had greater predictability in clinical and aesthetic results when compared to leukocyte platelet-rich fibrin (PRF) – L-PRF.

Although SCTG is considered the gold standard grafting technique for the treatment of GR, it also presents serious challenges, including the need for a second surgical site, limited graft availability, and reduced patient acceptance [12]. To address these challenges, various materials such as collagen membranes, amnion-chorion membranes [13], and acellular dermal matrix allografts [14] have been combined with CAF to obtain maximum RC with minimal intervention. While these materials have demonstrated efficacy in the treatment of GR, as seen in various studies, they have their own drawbacks, which mainly refer to the high cost of the materials. At this juncture, the introduction of platelet concentrates (PCs) attracted the researchers, since it is an autologous biomaterial that can be easily procured, prepared, and applied without the need for a second surgical site. In addition to being the least expensive of all available biomaterials proposed for RC, PCs are well accepted by patients [3] due to their minimally invasive nature. By providing inherent growth factors (GF), PCs have significantly advanced periodontics and oral surgery through their ability to enhance wound healing [15].

First-generation PCs were fibrin glue and platelet-rich plasma, which were prepared by adding substances such as bovine antithrombin to activate the platelets and polymerize the fibrin. Fibrin glue utilization was restricted due to the increased risk of infection transmission [16]. While coming to platelet-rich plasma, there was a robust release of GF within the first half an hour of its placement at the disease site, and there was the addition of bovine antithrombin for platelet activation with a lengthy two-step protocol [17]. Hence, protocols shifted toward the preparation of a clot or membrane with a three-dimensional fibrin meshwork pattern. Thus, second-generation PCs were developed without the use of additives. L-PRF was introduced by Choukroun et al. [18], where blood was drawn and transferred to sterile silica tubes or silica-coated plastic tubes, then centrifuged at 2,700 rotations *per* minute for 12 min. L-PRF was an autologous concentrate that contains the GF and gradually releases them over time. It has been extensively studied in various treatment entities such as intra-bony defects, GR, sinus augmentation, post-impaction as filler of cavity of third molars, socket preservation, guided tissue, and guided bone regeneration as coverage over the grafts, and has achieved good results [19].

SR and MA conducted by Silva et al. [20] stated that PRF helped in intrabony defect (IBD) regeneration compared to other treatments. Alrayyes and Al-Jasser [21] stated that PRF showed positivity for socket preservation with and without bone grafts in periodontal surgeries. Studies that used L-PRF as a biomaterial for GR and assessed it in MA reported that L-PRF combined with CAF helped in relative RC but did not improve the keratinized mucosa width. These studies also concluded that in the least keratinized mucosa width cases, SCTGs are preferable to PRF [22]. In a recent study, Mancini et al. [22] reported that L-PRF was a better alternative to CAF alone, showing significant improvements in pain perception and discomfort when compared with CTG. They also stated that CTG was still considered the gold standard for the treatment of GR.

Extensive use of L-PRF has been reported in the literature; however, some drawbacks have been noted, including possible silica contamination, a short resorption time of 7–11 days, breakage of silica tubes, a thin and loose fibrin structure, and a thinner border area. These limitations may alter the capacity to retain GF, leading to a search for better biomaterials [23, 24]. In this context, titanium has gained attention due to its favorable properties. It is non-corrosive, non-breakable, and is commonly used in the manufacture of dental implants and other orthopaedic devices such as plates or screws [5]. Titanium, a noble metal, passivates into a titanium dioxide layer on the inner surface of the tube, is highly hemocompatible, and activates platelets similar to silica. These characteristics led to the introduction of titanium-prepared PRF (T-PRF) by Tunali et al. [25]. Histological studies have described T-PRF as having a thicker fibrin meshwork, a well-organized fibrin network pattern and border area, greater cellular entrapment, better retention of GF, and a longer resorption time of 21 days (rabbit study) [26]. In their scanning electron microscopic and immunohistochemical studies, Bhattacharya et al. [27, 28] stated that both L- and T-PRF shared a similar structure, and the mid-area of the T-PRF clot was much thicker. Immunohistochemical analysis revealed a greater distribution of lymphocytes, monocytes, and larger platelets compared with L-PRF, while a similar number of stem cells was observed. With this positivity, studies were performed regarding its usage in intra-bony defects by various authors such as Chatterjee et al. [29], Mitra et al. [30], and Gummaluri et al. [31], and achieved greater to equal amounts of bone fill, decreased probing pocket depth (PD) – PPD, and gain in clinical attachment level (CAL) when compared to L-PRF. A recent narrative review by Gummaluri et al. [32] also stated that T-PRF is a better alternative to L-PRF or advanced PRF, as it eliminates the possible risk of silica cross-contamination. Moreover, titanium tubes are reusable, and T-PRF provides a thickness comparable to that of SCTG, thereby eliminating the need for a second surgical site.

Recently, T-PRF has also been considered a sustained drug delivery system. Ercan et al. [33] incorporated doxycycline in liquid form into T-PRF and checked for the drug release and antimicrobial efficacy. They concluded that there was a gradual release of the drug with antimicrobial activity maintained for seven days against two bacteria (*Streptococcus mutans* and *Pseudomonas aeruginosa*). Furthermore, recent histological studies by Gummaluri et al. [34, 35] reported that T-PRF maintained an intact fibrin structure after being injected with amoxiclav gel, metronidazole, and neem gels. No thinning of the membrane was observed; instead, a thicker fibrin border area with spaces was reported. Under scanning electron microscopy, the injected antibiotics and herbal extracts appeared as a surface coating in the form of haziness, indirectly indicating the holding capacity of T-PRF.

Recent SR and MA by Oza et al. [36] evaluated the use of T-PRF in periodontal regeneration and concluded that T-PRF had superior qualitative and quantitative properties, which were beneficial for the predictable restoration of lost periodontal tissues. Similarly, Manchala et al. [37] conducted an SR on the application of T-PRF in periodontal regeneration and reported improvements in both hard and soft tissue parameters, including intra-bony and recession defects. The use of T-PRF in GR has only recently begun, and the amount of available research remains limited. To the author's knowledge, no SR and MA study has yet been conducted to evaluate the efficacy of T-PRF compared with SCTG/PRF in GR.

The aim of this study was to examine the regenerative efficacy of T-PRF as a biomaterial in the treatment of GR with CAF/modified CAF (mCAF)+PRF/SCTG as a surgical treatment modality.

Methods

Protocol establishment and focused question

The present study was an SR and MA of T-PRF with CAF and CAF alone in the treatment of GR. This study protocol was developed based on the Preferred Reporting Items for SRs and MAs (PRISMA) statement (www.prisma-statement.org) to review the literature of T-PRF+CAF and CAF alone systematically in the treatment of GR. The trial was registered under the International Prospective Register of SRs (PROSPERO) [Center for Reviews and Dissemination (CRD), University of York, the United States] with a number CRD42023467568 (https://www.crd.york.ac.uk/PROSPERO/view/CRD42023467568). The search strategy was established based on the population, index test, comparator, and outcome framing question format. The framing question was: "Can the treatment outcome of GR be enhanced by covering the recession site with T-PRF membrane underneath the CAF surgical technique compared with CAF alone?".

Search strategy

An electronic search was conducted in PubMed/Medline, Scopus, Web of Science, Embase, Google Scholar, and the Cochrane database to identify studies published up to January 31, 2024, for inclusion in this SR and MA. Additional searches were cross-verified to ensure no recent studies were missed. A manual search of available hard-copy journals was also performed to capture any further data. The search strategy used Medical Subject Headings – MeSH terms such as 'platelet-rich fibrin', 'platelets', 'gingival recession', 'titanium', and 'root coverage', combined with Boolean operators (AND/OR). All proper steps were taken to make the searches more authentic with the syntactic rules of all databases.

Inclusion and exclusion criteria

Randomized clinical trials and case series with a minimum follow-up period of six months were included in the study. The considered articles had to be published in English. Case reports, articles without the proper follow-up, incomplete titles, animal studies, and studies with fewer than five patients *per* group were excluded from the study.

Selection of studies

Duplicate articles identified during the search process were excluded. The remaining articles were screened by title and abstract for eligibility, followed by a full-text review to determine inclusion or exclusion. The initial selection of studies was performed by authors Shiva Shankar Gummaluri and Sai Karthikeyan SS, and subsequently cross-verified by Trinath Kishore Damera and Kaarthikeyan Gurumoorthy, with all authors reaching a common agreement.

Risk of bias and synthesis of data

Risk of bias was assessed using Review Manager software 5.4.1. The following data were extracted from the included studies: authors, study design, demographic data, follow-up, number of GR sites, type of surgical technique, smoking status, MRC, and classification of recession defects according to Miller and Cairo. Each of the randomized controlled trials (RCTs) was categorized into TT with PRF vs. TT with T-PRF, mCAF with SCTG vs. mCAF with T-PRF, and CAF with T-PRF vs. CAF with PRF.

Statistical analysis

The mean and standard deviations were used to express the data. Using Review Manager software 5.4.1, risk of bias, odds ratio, forest plots, and MA were calculated. Statistical significance was defined as a significance level of $p \leq 0.05$.

Results

A total of 6,571 searches across several databases were found. Following appropriate screening, 6,518 search duplicates were removed. Later, the remaining 53 articles underwent another step of screening, where 47 articles were removed because they did not match the inclusion criteria. Finally, a total of six publications were finalized for the SR. Further, for the MA, three out of six SR publications were recruited (Figure 1).

All finalized MAs found a low risk of bias for random sequence generation (selection bias). However, the risk was higher for allocation concealment (selection bias), blinding of participants and personnel (performance bias), and blinding of outcome assessment (detection bias) across all three included studies. Further, reporting bias (selective reporting) and attrition bias (incomplete outcome data) were assessed as low risk in the same studies (Figures 2 [38–40] and 3).

This MA comprised three RCTs to assess the effectiveness of various GR treatment approaches. These trials compared T-PRF with conventional CTG at a total of 272 sites across various patient categories.

MAs were conducted for two primary outcomes at the six-month follow-up: MRC width and MRC depth. For MRC, the combined effect size across three studies and 272 participants was a standardized mean difference (IV, random, 95% confidence interval) of 0.07 (-0.17, 0.31), indicating no significant difference between the interventions. For MRC depth, the combined effect size was 0.50 (-0.71, 1.70),

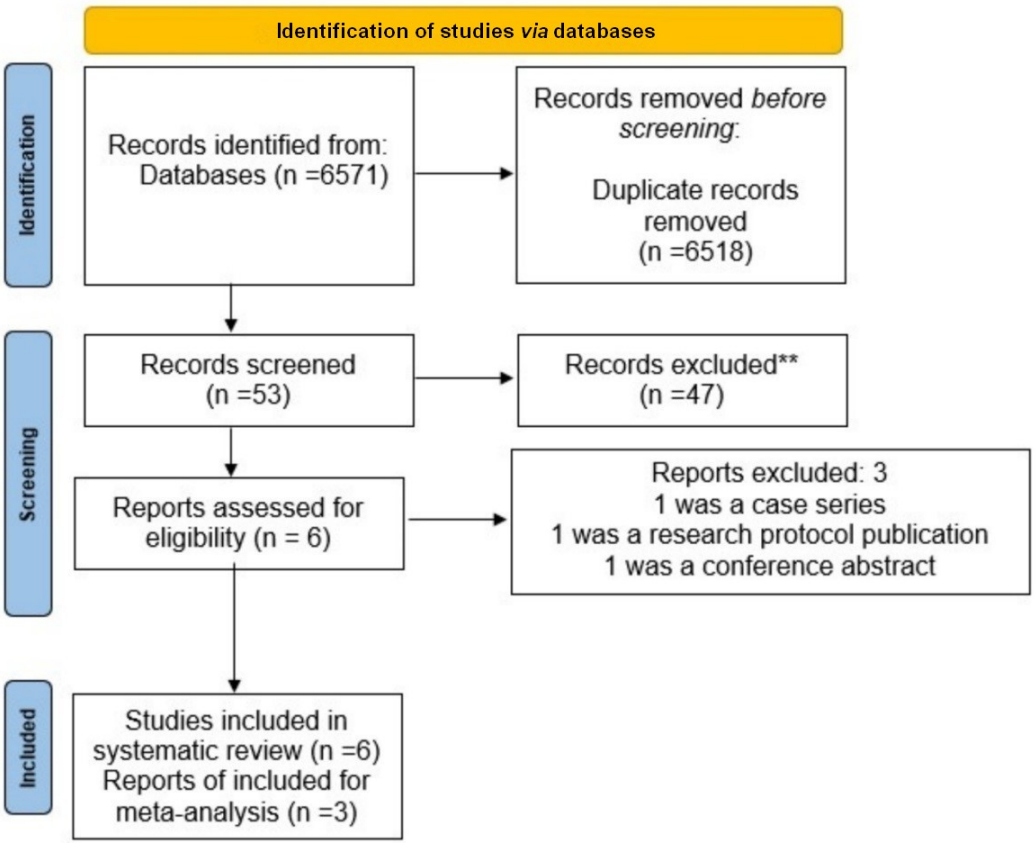

Fig. 1 – PRISMA flow diagram.

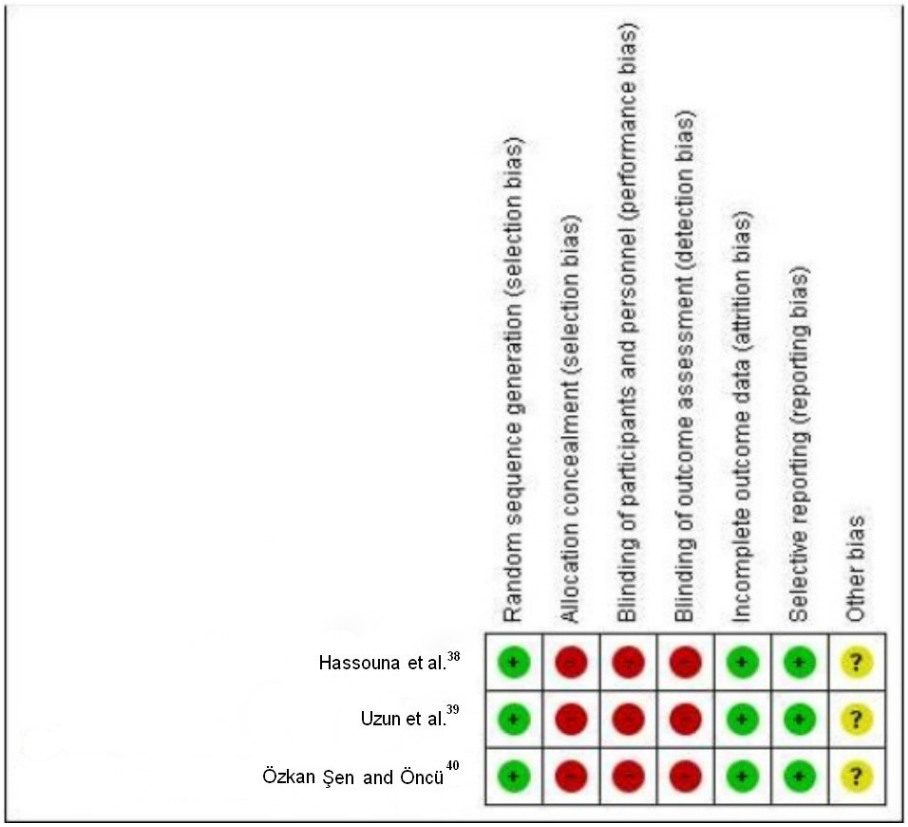

Fig. 2 – Risk of bias graph that shows the bias items of all included studies.

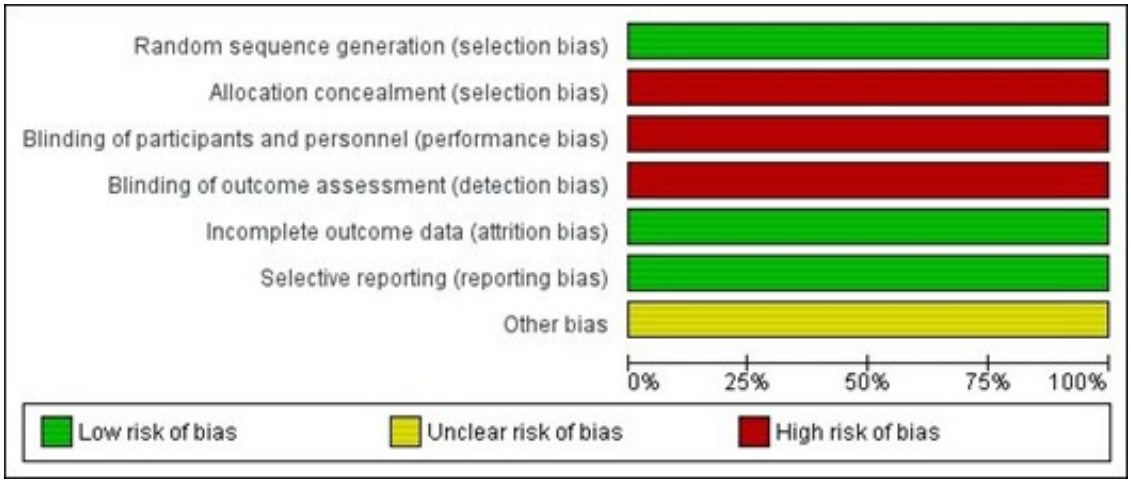

Fig. 3 – Risk of bias summary that shows the bias item for each included study.

also showing a non-significant trend favoring one intervention over the other. Heterogeneity was assessed using the I^2 statistic, with moderate to high levels of heterogeneity observed. This suggests variability in the study outcomes. Specifically, for MRC width and depth, the heterogeneity values were indicative of substantial differences between the studies' results.

Regarding the forest plot analysis for the MRC outcome, there was a favored trend towards the control (CAF alone). For RC depth at six months, two studies (Hassouna et al. [38] and Uzun et al. [39]) showed a neutral pattern, while one study (Özkan Şen and Öncü [40]) favored the control (Figures 4 and 5).

Publication bias was evaluated using funnel plots, which did not indicate significant asymmetry for either MRC width or depth, suggesting minimal publication bias. However, the high risk of bias in several domains across the studies highlights the need for future well-designed RCTs with better blinding and allocation concealment to confirm these findings. Additionally, the moderate to high heterogeneity underscores the necessity for standardized outcome measures in future studies (Figures 6 and 7).

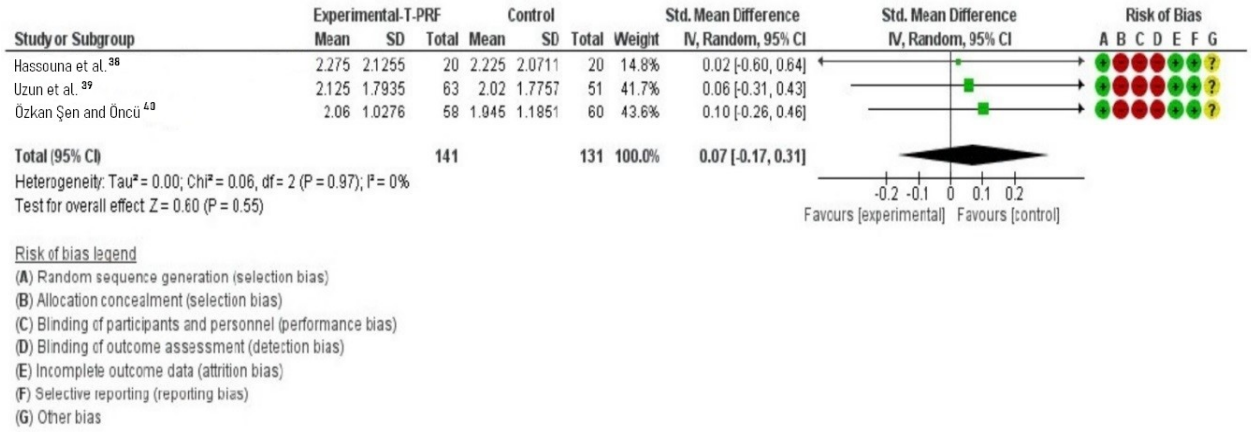

Fig. 4 – Forest plot diagram of mean root coverage outcome width in 6 months.
T-PRF – titanium-prepared platelet-rich fibrin; SD – standard deviation; CI – confidence interval; Std. – standardized.

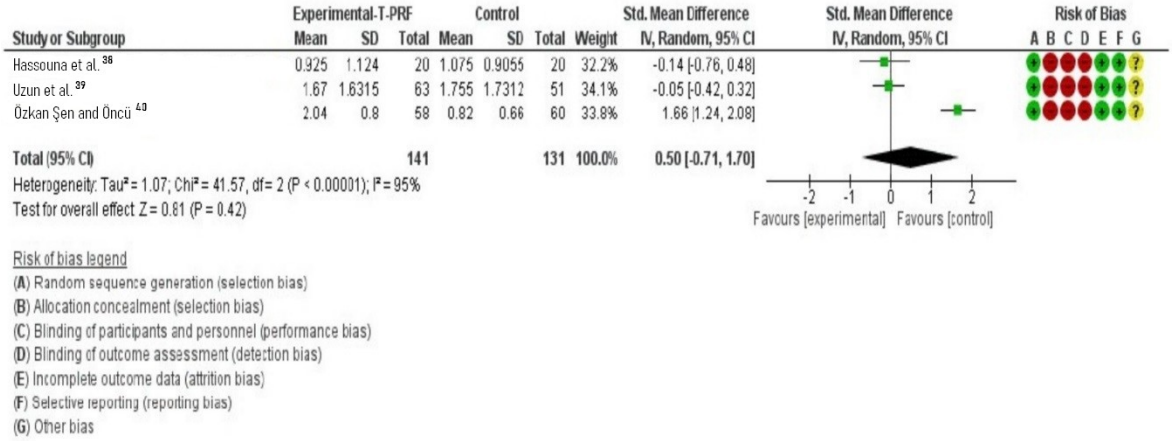

Fig. 5 – Forest plot diagram of the mean root coverage depth outcome in 6 months.
For abbreviations, see Figure 4.

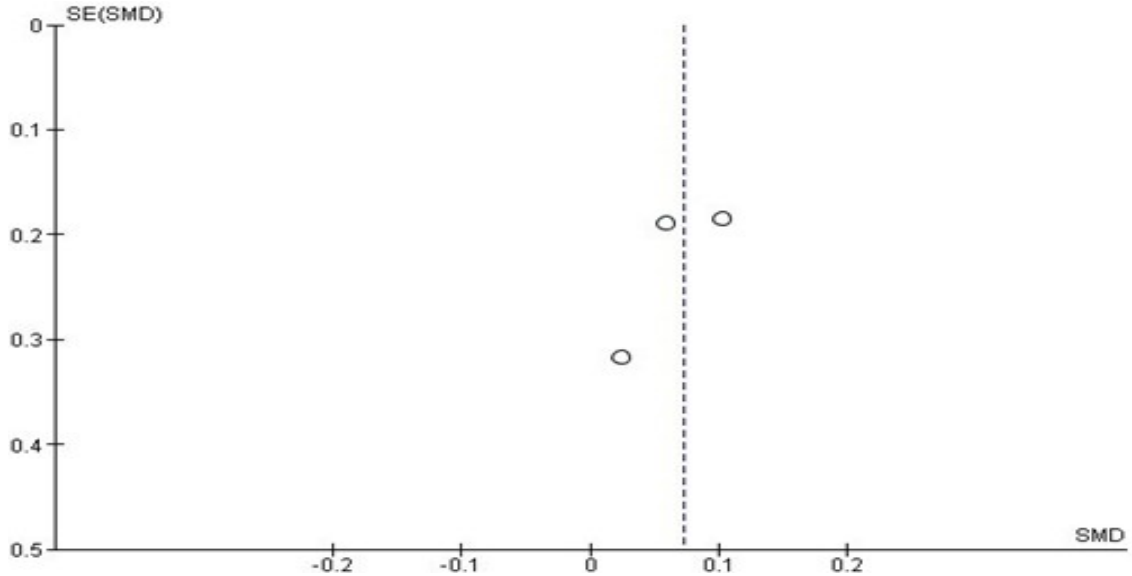

Fig. 6 – Funnel plot diagram of the mean root coverage width outcome in 6 months.
SE – standard error; SMD – standardized mean difference.

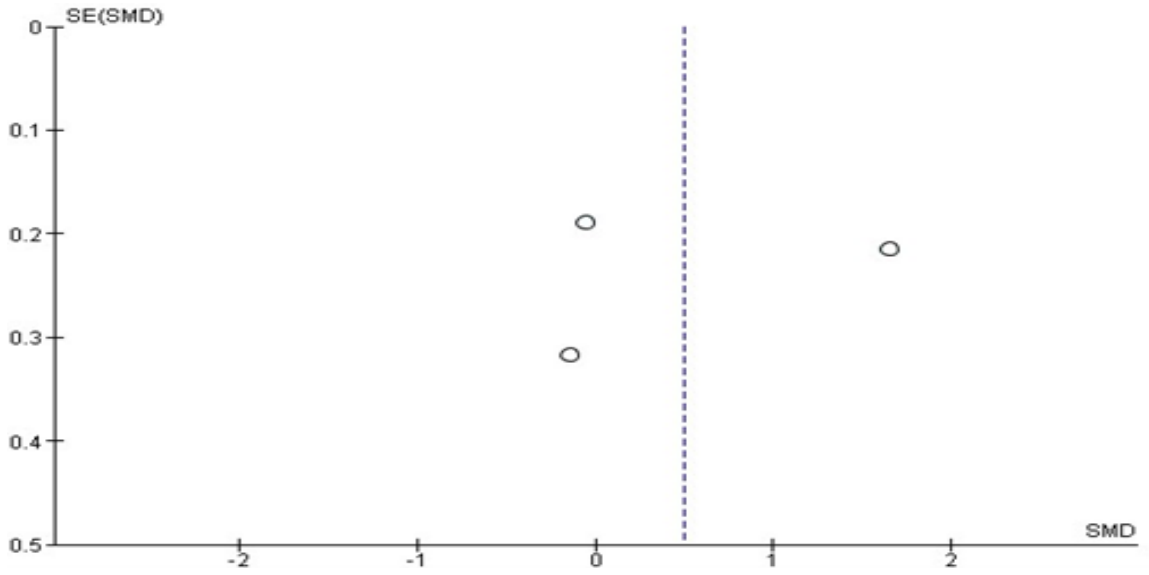

Fig. 7 – Funnel plot diagram of the mean root coverage depth outcome in 6 months. For abbreviations, see Figure 6.

Discussion

The present study was an SR and MA where T-PRF+CAF was compared with CTG/PRF+CAF/tunneling CAF studies. Out of six SR and MA-related articles (Table 1 [38–43]), three were eliminated (one case series, one treatment protocol, and one conference presentation), and three were included in the MA (Table 2 [38–40]). The eliminated studies are summarized below. Bhattacharya et al. [41] reported a case series in which surgeries for GR were performed using T-PRF+CAF as a treatment protocol, with a 6-month follow-up. The outcomes showed improved CAL, reduced PD, and decreased RD and RW. The study by Salian and Dhadse [42] evaluated a treatment protocol comparing T-PRF and L-PRF in the modified vestibular incision subperiosteal tunnel access (M-VISTA) technique. Özdemir et al. [43] presented conference data on the use of T-PRF+CAF for the treatment of Miller's class I and II GR. They concluded that T-PRF had a better treatment outcome for GR by eliminating the second surgical site. However, as this was only a conference presentation, detailed recession parameters were not included. These studies were excluded because they did not meet the inclusion criteria of the present study.

A clinical study by Ustaoğlu et al. [44] utilized T-PRF for palatal wound healing, in which free gingival grafts were harvested from the palate and T-PRF membranes were placed. Epithelialization was subsequently assessed using the hydrogen peroxide bubbling test at 3, 7, 14, and 21 days. These studies were excluded as they did not meet the selection criteria for the present study. Another study by Koyuncuoğlu et al. [45] employed T-PRF as a biomaterial to treat deep GRs and compared it with the CTG group. The surgical technique that was used in this study was modified coronally advanced TT. The authors concluded that T-PRF produced results comparable to CTG and reported a similar complete RC percentage. Further, they also stated that T-PRF can be a safe treatment strategy for Miller's class I and II GR without requiring a second surgical harvesting site.

The study by Uzun et al. [39] included 114 tooth sites in 34 patients, with interventions using T-PRF and CTG for GR. Various clinical parameters were assessed, including plaque index (PI), gingival index (GI), PD, RW, RD, CAL, KTW, gingival thickness (GT), and more. The risk of bias assessment revealed a low risk for random sequence generation and attrition bias, whereas allocation concealment, performance bias, and detection bias were assessed as high risk. In the study by Özkan Şen and Öncü [40], 118 defects in 20 patients with bilateral defects were evaluated. The interventions included an SCTG group and a T-PRF group. Parameters were measured at baseline and six months, including GI, PI, CAL, PD, GT, keratinized gingival width, recession height, and RW. This study, like the previous one, also showed a low risk for random sequence generation and attrition bias, while high risk was recorded for allocation concealment, performance bias, and detection bias. The third study by Hassouna et al. [38] included 40 sites in 24 patients, with treatment interventions using TT with PRF or T-PRF membranes. Clinical parameters were measured at baseline, 3, 6, and 9 months, including PI, GI, PPD, RW, RD, CAL, KTW, GT, and a visual analogue scale for post-operative discomfort. This study demonstrated a low risk for random sequence generation and attrition bias, but a high risk for allocation concealment, performance bias, and detection bias (Tables 1 and 2).

A recent SR and MA on T-PRF usage by Oza et al. [36] for the treatment of IBD reported that T-PRF is a better biomaterial compared with open flap debridement alone, and larger randomized trials with extended follow-ups are needed to confirm these findings. Further MAs conducted by Chambrone et al. [46] and Miron et al. [47] demonstrated

Table 1

Systematic review and meta-analysis included studies comparing TT with PRF vs. TT with T-PRF, mCAF with SCTG vs. mCAF with T-PRF, and CAF with T-PRF vs. CAF with SCTG

Study	Type of research	Type of technique	Type of recession	Total number of defects	Surgical site	Duration of study in months	Age, years (range/ mean)	Mean gingival recession depth (mm)		Mean gingival recession width (mm)		Centrifugation speed (rpm)	Centrifugation time (min)	Blood drawn (mL)
								baseline	after study	baseline	after study			
Hassouna et al. [38]	RCT	TT+PRF (Group I)	Miller's class I and II defects	20	NA	9	23–41	1.9	0.38	4.2	2.4	NA	NA	NA
		TT+T-PRF (Group II)		20	NA			1.85	0.17	4.3	1.6	NA	NA	NA
Uzun et al. [39]	RCT	T-PRF+CAF	Miller's class I (42 teeth) Miller's class II (21 teeth)	63	NA	12	40.3	3.07	0.21	3.47	0.61	3,500	15	10
		CTG+CAF	Miller's class I (37 teeth) Miller's class II (14 teeth)	51	NA			3.25	0.26	3.59	0.56	NA	NA	NA
Özkan Şen and Öncü [40]	RCT	mCAF+SCTG	Cairo RT1 type defects of at least 3 mm	60	Incisors, canines, and premolars of both jaws	6	NA	2.15	0.51	2.63	1.26	NA	NA	NA
		mCAF+T-PRF		58				2.04	0.82	2.6	1.52	3,500	15	10
Bhattacharya et al. [41]	Case series	CAF+T-PRF	Cairo's type 1	34	NA	6	30.3	3.05	0.25	3.55	0.55	3,500	15	10
Salian and Dhadse [42]	Treatment protocol	M-VISTA+T-PRF and M-VISTA+PRF	Miller's class I and II	NA	Maxilla and mandible multiple recession sites	3, 6, and 9	-	-	-	-	-	2,700	12	10
Özdemir et al. [43]	Conference presentation	CAF+T-PRF	Miller's class I and II	12	NA	6	-	4.96	-	-	-	-	-	-
		CAF+free CTG		7	NA		-	5.29	-	-	-	-	-	-

TT – tunnel technique; PRF – platelet-rich fibrin; T-PRF – titanium-prepared PRF; CAF – coronally advanced flap; mCAF – modified CAF; CTG – connective tissue graft; SCTG – subepithelial CTG; rpm – revolutions *per* minute; RCT – randomized controlled trials; M-VISTA – modified vestibular incision subperiosteal tunnel access; NA – not applicable; RT1 – recession type 1.

Table 2

Main characteristics of studies included in the meta-analysis

Study	Study design (follow-up)	Number of treated recessions (*per* group) and number of patients	Age, years (range or mean)	Gender	Smoking status	Miller's class	Recession sites	Author's conclusion
Hassouna et al. [38]	Randomized control trial	n = 40 sites in 24 patients	23–41	NA	Not included	Miller's class I and II	NA	T-PRF procedure is a safe, effective method for localized or multiple-adjacent gingival recessions without additional surgery.
Uzun et al. [39]	Randomized control trial	n = 114 tooth sites in 34 patients [n = 63 (16) in T-PRF group, n = 51 (18) in CTG group]	40.3	15 male, 19 female	Smoking ≤ 5 cigarettes/day was included	Miller's class I and II	NA	T-PRF is an effective treatment option for multiple Miller class I/II GR defects.
Özkan Şeran dÖncü[40]	Randomized split-mouth control trial	n = 118 defects in 20 patients with bilateral defects	NA	7 male, 13 female	Not included	Cairo RT1 type	Incisors, canines, and premolars of both jaws	T-PRF is an alternative to SCTG, considering effective results, patient satisfaction, and rapid recovery

GR – gingival recession; n – number. For other abbreviations, see Table 1.

that CAF with PRF showed better results compared with CAF alone, and SCTG remains a highly effective option for treating GR.

Limitations of this study included a smaller sample size (three studies), the limited number of completed RCTs, ongoing studies that were not yet published, and the relative scarcity of data on GR and CAF. Additionally, the establishment of newer surgical techniques that were not incorporated in the study data because of inclusion criteria constraints might have led to changes in the treatment outcomes.

Conclusion

Within the limitations of this study, clinical findings from the included studies suggest improved outcomes with T-PRF. In contrast, the meta-analysis did not show a statistically significant advantage of T-PRF over connective tissue grafts or platelet-rich fibrin. Further, well-designed randomized controlled trials are necessary to evaluate T-PRF in gingival recession treatment so that a proper conclusion can be provided regarding the efficacy of T-PRF through a highly valued meta-analysis.

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