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Review Article

Comparative evaluation of stability and osseointegration of dental implants placed with and without platelet-rich fibrin (PRF): A systematic review

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ABSTRACT

The survival of dental implants mainly depends on overall health of the patient, drugs affecting the osseointegration and periodontal condition of soft tissues. The addition of PRF to the implant surface to promote BIC and enhance bone regeneration in order to promote quicker bone healing and osseointegration, and to enhance the stability of endosseous implants. The aim of this systematic review was to evaluate and compare the stability and osteointegration of dental implants placed with and without platelet-rich fibrin (PRF).

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1. Introduction

The appearance of teeth and face in our society must be aesthetically pleasant and dentition must be harmonious.¹

The demand for the use of implants results from the combined effect of various factors, including² patients living longer,¹ age-related tooth loss,³ patients are more socially active and aesthetic conscious,⁴ a higher incidence of partial and complete edentulism,⁵ conventional prosthesis complications, and⁶ the inherent advantages of implant-supported restorations.²

Several methods have been introduced to increase the osseointegration and improve implant stability, including platelet concentrates.³ Platelet concentrates are concentrated suspensions that consist of growth factors and platelets derived from blood. Their primary role is to promote tissue regeneration and wound healing.⁷

The application of PRF over an implant to promote soft tissue thickening in order to improve the stability of peri-implant tissues and decrease the marginal bone loss.⁸

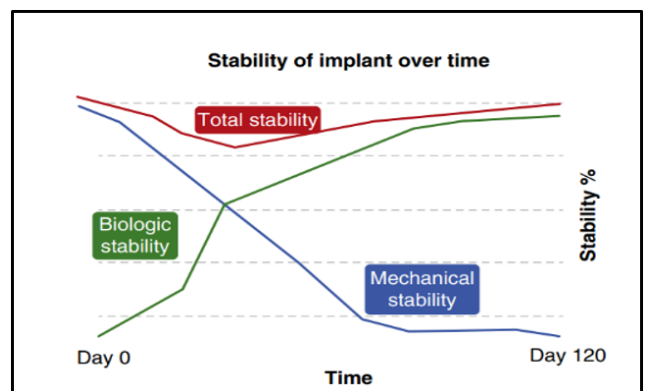


Figure 1: Implant stability graph

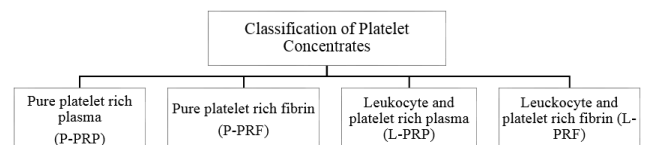


Figure 2:

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2. Materials and Methods

2.1. Review question

Which dental implants will have greater stability i.e., those placed with platelet-rich fibrin (PRF) or without platelet-rich fibrin (PRF)?

Which dental implants will have better osseointegration i.e., those placed with platelet-rich fibrin (PRF) or without platelet-rich fibrin (PRF)?

2.2. PICO

P: Patients with dental implants

I: Dental implants placed with platelet-rich fibrin (PRF)

C: Dental implants placed without platelet-rich fibrin (PRF)

O: Stability and osseointegration of dental Implants

2.3. Search strategy

A systematic search was performed to identify the in-vitro studies of interest in English language from the year January 2011 to September 2021. The search was conducted in PubMed, Cochrane, google scholar databases. Manual search of hard copies of journals available in the institute library will also be done.

The keywords used are “stability” OR “osseointegration” AND “PRF”. An additional search with keywords “osseointegration” AND “prf” OR “stability” AND “prf” was performed and the results were scanned so as to identify any studies using different terms for fixed partial dentures. Additionally, the identified studies were scanned for cross-references pertaining to previous studies of similar designs.

Criteria for Selection and Exclusion: The inclusion and exclusion criteria as mentioned in Tables 1 and 2

Table 1:

Inclusion criteria	Exclusion criteria
In vivo human studies including randomized controlled trials and clinical trials.	Articles not fulfilling inclusion criteria
Case reports	In vitro studies
Clinical study	Animal studies
Case series	

2.4. Electronic search

Electronic search of PubMed, Cochrane, Google Scholar databases for articles published from January 2011 to September 2021. Manual search of hard copies of journals available in the institute library was also be done. Articles published only in the English language included. Reference list of included studies and relevant systematic reviews searched.

Table 2: Eligibility for the study selection according to PICOS criteria:

Category	Inclusion Criteria	Exclusion Criteria
Population/ participants	In vivo human studies including randomized controlled trials and clinical trials from the year January 2011 to September 2021	In vitro studies
Intervention	Dental implants placed with platelet-rich fibrin (PRF)	Patients without dental implant placement.
Comparison	Dental implants placed without platelet-rich fibrin (PRF)	
Outcome	Stability and osseointegration of dental Implants	
Study design	1. In vivo human studies including randomized controlled trials and clinical trials. 2. Case reports 3. Clinical study 4. Case series	1. Articles not fulfilling inclusion criteria 2. In vitro studies 3. Animal studies

2.5. Manual search

Manual search of hard copies of the journals available in the institute library were done. These include the Journal of Indian Dental Association, Journal of Indian Prosthodontic Society, Journal of prosthetic dentistry and international journal of prosthodontics. A total of 1503 articles were obtained via electronic search and 0 articles were obtained through manual search, making a total of 1503 articles.

3. Results

3.1. Description of selected studies

The characteristics of the included studies are reported in above tables for study characteristics of included studies. Of the 5 finally selected studies, 1 article was systematic review, 1 was Randomized control trial, 1 was split mouth randomized control trial and 2 were clinical studies. The present systematic review was based on 5 clinical studies including a total of 107 patients of which 114 received PRF treated implant 115 received without PRF treated implants. Implant stability and osseointegration were evaluated for 1 weeks to 3 months of time period. The implant stability of implants and osseointegration with and without PRF was evaluated for given period of time.

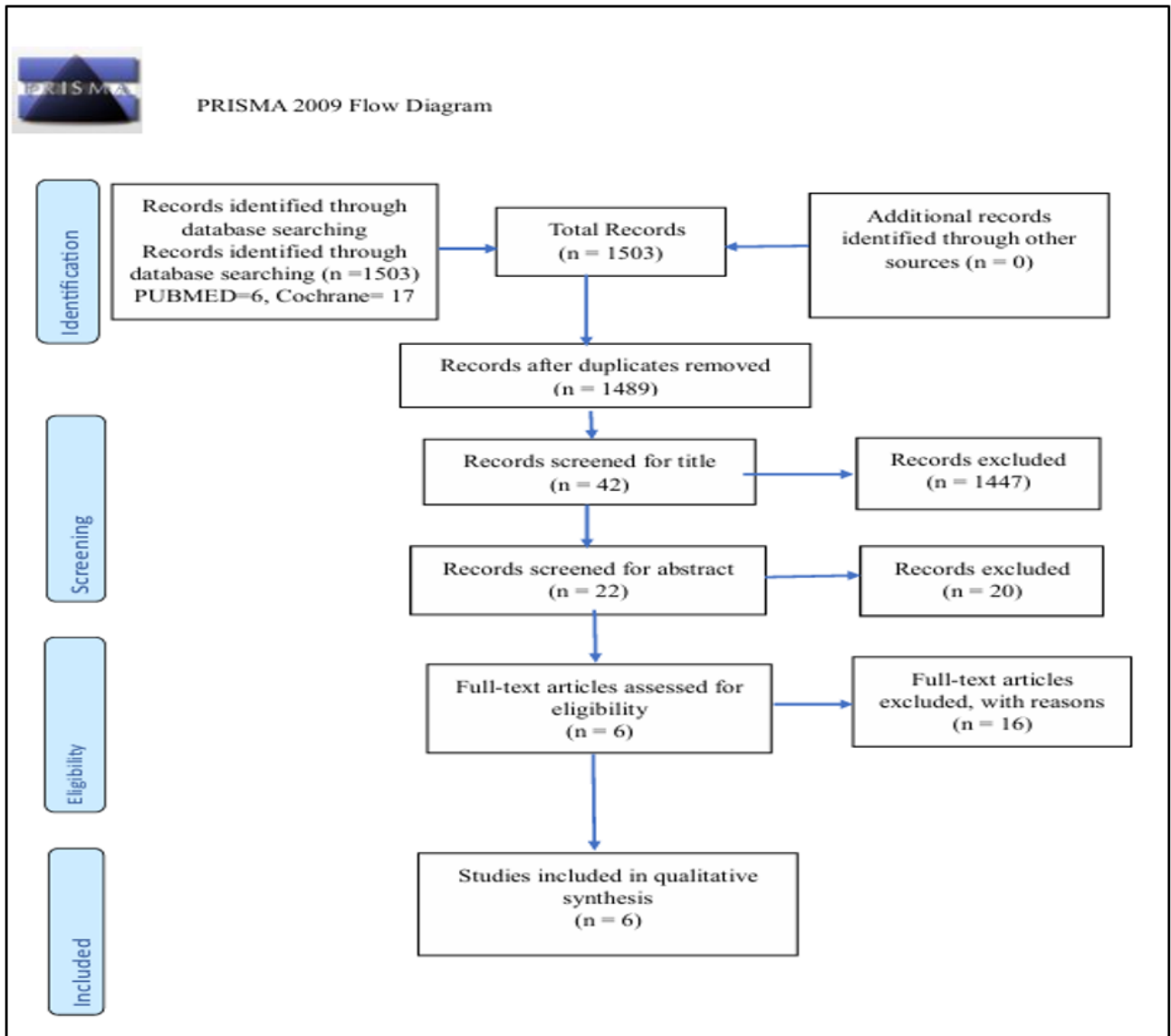


Chart 1:

3.2. Risk of bias

Systematic reviews are prone to bias from various sources such as evidence selection bias, publication bias, information bias etc. Bias within each individual study can also affect the overall results of the systematic review. To minimize the evidence selection bias, extensive searches of three databases and one search engine along with the manual search of journals available in the institute library was done. Despite these comprehensive efforts, this systematic review is affected partially by selection bias. One source of this is grey literature which was not included in the search strategy of this systematic review. Also, the English language filter was used. Each individual study included in a systematic review was assessed for key sources of bias

such as inadequate reporting, misleading interpretation and inappropriate extrapolation of data. The MINORS scale and Institute of health economics quality assessment scale have been used here based on the study design of the included studies to identify the risk of bias of the individual studies.

4. Discussion

PRF has been shown to promote the differentiation of bone marrow stem cells. The mechanisms of osteogenic differentiation are involved in some cell signal channels.^{9–12} According to the work of Kargarpour et al. They found that PRF suppresses osteoclastogenesis in bone marrow cultures.^{13–15} Pichotano et al. stated that After 8 months of healing, the addition of L-PRF to DBBM allowed earlier

Table 3: Dataextraction table

	Author and year of publication	Study design	Number of patients	Age of patients [range]	Implant site	No. of implants placed	Patients with test group [PRF placed]	Patients control group	Follow up duration [range]	Implant stability
1.	Franz Josef Strauss et al,2018	SR	10	18-79	Partially edentulous	-	12	12	1 month	PRF enhances implant stability during early phase of osseointegration.
2.	C.Diana et al 2018	RCT	31	28.5	One or more single rooted tooth	41	21	20	3 months	PRF did not improve implant stability or bone gain.
3.	R.Tabrizi et al 2017	Split mouth RCT	20	39.60+-6.74 years	Bilateral missing maxillary molar	40	20	20	2,4,6 weeks	PRF may enhance the post -insertion stability of dental implants.
4.	Elif oncu et al 2015	Clinical Study	20	44.2+-12.5	One or more adjacent missing teeth	64	31	33	1week 1month	PRF application increased the implant stability during early healing period.
5.	Elif oncu et al 2017	Clinical study	26	40.2+-11.5	One or two missing teeth	60	30	30	Baseline 1week 1month 3months	Mean marginal bone resorption was higher in control group at 1 year.
6.	Aditi Priya et al 2020	Clinical Study	16	Group I:18-45 Group II:21-45	Sites having buccal wall defect	16	8	8	Baseline 4months	Using PRF as membrane has several advantages: autologous origin, gradual GF release, incorporating osseoinductive features to the grafted site.

Table 4: Cochrane risk of bias assessment (rob 2)

Studies (year)	Randomization	Allocation concealment	Blinding of participants & personnel	Blinding of outcome	Incomplete outcome data	Selective reporting	Other Bias
Elif Oncu et al 2015	?	?	?	?	-	?	?
R. Tabrizi et al 2017	+	+	+	-	?	-	?
Elif Oncu et al 2017	+	+	+	+	+	?	+
Franz Josef Strauss et al 2018	+	+	?	?	+	+	?
C. Diana et al 2018	+	+	+	+	+	-	+
Aditi Priya et al 2020	+	+	?	+	-	+	+

+/: Low risk of bias; ?/: Some concerns; -/: High risk of bias

implant placement with increased new bone formation compared to DBBM alone.¹⁶ In study conducted by Xie et al. It was shown that fibrin is a safe and reliable material for sinus lifts and can shorten the healing time.¹⁷

The maxilla alone was reported as the implant site in five of the ten studies.^{16–20} The remaining four articles studied the maxilla and the mandible as the implant sites.^{21,22} Tabrizi and her team. It was found that PRF application increased implant stability during the healing period.^{18,23,24}

According to Franz Strauss, PRF might reduce alveolar width resorption and enhance stability implant during the early phase of osseointegration.²⁵ There is a lack of adequate studies for implant placement, peri-implantitis defects, soft tissue healing, and postoperative pain, although the preliminary data seems promising.²⁶

PRF is used as an adjunct in immediate implants with a low primary stability, thereby promoting the osseointegration and increasing the success rate.²⁷ The PRF also enhances the stability of implants during the remodelling & healing period, according to R. Tabrizi.

According to study conducted by Elif Oncu, PRF increases implant stability during the initial healing period. Implant stability was increased by application of the implant surface with the L-PRF.²⁸ There is significant increase in bone level in implants placed with PRF so rather than going for delayed healing protocol, which leads to significant bone loss, immediate placement along with grafting can be done efficiently and implantology can be practiced.²⁹

L-PRF application enhances the amount and rate of deposition of new bone during the early healing period.²⁹

5. Conclusion

The aim of this systematic review was to evaluate and compare the stability and osteointegration of dental implants placed with and without platelet-rich fibrin (PRF).

Based on the results of this systematic review, it can be concluded that application of PRF enhances the stability and osseointegration of implants.

The study showed that

1. PRF application prevents alveolar ridge resorption, and increases implant stability during the initial healing phases of osseointegration
2. No significant & considerable effect of PRF was seen on immediate implants with sufficient primary stability.
3. Implant stability was enhanced by application of the implant surface with L-PRF prior to the insertion in the osteotomy site.
4. Simple application of PRF enhances osseointegration.

6. Source of Funding

None.

7. Conflict of Interest

None.

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