ORIGINAL RESEARCH PAPER
Volume - 14 | Issue - 09 | September - 2025 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

SOFT AND HARD TISSUE MODIFICATION IN IMMEDIATE AND DELAYED IMPLANT PLACEMENT - A SYSTEMATIC REVIEW AND META-ANALYSIS

Dental Science

Dr Rizwan M Sanadi Professor, Department of Periodontology, Dr G D Pol Foundation YMT Dental College, Kharghar, Sector 4 , Navi Mumbai 410210.

Dr Renuka S Adbol Department of Periodontology, Dr G D Pol Foundation YMT Dental College, Kharghar, Sector 4 , Navi Mumbai 410210.

Dr Priyanka Khandekar Department of Periodontology, Dr G D Pol Foundation YMT Dental College, Kharghar, Sector 4 , Navi Mumbai 410210

Dr Nikita Kendre Department of Periodontology, Dr G D Pol Foundation YMT Dental College, Kharghar, Sector 4 , Navi Mumbai 410210

ABSTRACT

Aim: To methodically evaluate the current scientific literature and deliver a thorough, quantitative evaluation of the efficacy of immediate implant placement (IIP) in comparison to delayed implant placement (DIP) and to assess their effects on surrounding soft and hard tissues in adults through this meta-analysis. **Introduction:** Tooth extraction leads to significant bone and tissue resorption, resulting in reduced alveolar ridge dimensions. Conventional implant placement after socket healing minimizes complications, while alveolar ridge preservation (ARP) helps reduce resorption. Immediate implant placement, though efficient in reducing treatment time and cost, faces challenges like primary stability and gaps between the implant and socket walls. Delayed placement, after complete healing, is preferred for minimizing risks. Although both approaches are commonly practiced, there remains a shortage of comprehensive studies directly comparing their effects on soft and hard tissue outcomes. **Methods:** The review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines registered in PROSPERO –CRD536255. A search of electronic databases was conducted to identify relevant studies evaluating the effectiveness between immediate and delayed implant placement and to assess their effects on surrounding soft and hard tissues in terms of pink esthetic score (PES), white esthetic score (WES), marginal bone loss (MBL), crestal bone loss (CBL), peri-implantitis bone loss, implant survival, probing depth (PD), plaque index (PI), bleeding on probing (BOP). The quality of the studies included was assessed using the Cochrane risk of bias (ROB)-2 tool. Summary statistics were calculated using standardized mean difference (SMD) and risk ratio (RR) with a random effects model, and a p-value of less than 0.05 was considered statistically significant, analyzed through Review Manager (RevMan) version 5.3. **Results:** Twelve randomized controlled trials (RCTs) met the requirements for eligibility and were included in qualitative synthesis and for meta -analysis. A total of 606 implants were placed of which 327 implants were placed immediate and 279 implants were placed delayed. Included studies had moderate to low risk of bias. Pooled estimate through meta-analysis demonstrated that delayed implant placement had overall better clinical and aesthetic outcomes with minimal complications and greater survival rate (RR= 0.96 (0.91 – 1.01). DIP was clinically and statistically superior to IIP (P<0.05). Funnel plot did not reveal any significant asymmetry indicating absence of publication bias in meta-analysis. **Conclusion:** It was found that delayed implant placement showed overall better clinical and aesthetic outcomes with minimal complications and greater survival rate being clinically and statistically superior to immediate implant placement. Further clinical studies with larger The sample size and duration of follow-up need to be conducted to confirm the findings of our study, ensuring we gather high-quality evidence overall.

KEYWORDS

Dental implant, delayed loading, immediate loading, implant stability, systematic review.

INTRODUCTION

The extraction of a tooth leads to the resorption of bundle bone, resulting in notable alterations in the soft and hard tissues surrounding the socket, which ultimately causes a decrease in both horizontal and vertical dimensions that cannot be mitigated with currently available techniques. Traditionally, implants are placed only after the sockets have healed in order to minimize complications associated with implant placement. Alveolar ridge preservation (ARP) has been performed to lessen the extent of bone resorption and to enhance functional and aesthetic results.[2]

Individual implants are viewed as a reliable and effective solution for substituting teeth that cannot be preserved or repaired. [3].

They exhibit high survival and success rates, along with a low occurrence of complications both in the short and long term.[4,5] Typically, the timing of implant placement allows for differentiation between immediate implants placed right after tooth extraction and delayed implants inserted into fully healed bone.[6]

In recent years, multiple authors have shown that placing implants immediately in fresh extraction sockets can be a reliable and successful surgical technique, both in the anterior and posterior areas of the jaws. This approach decreases the number of surgical sessions required and, therefore, the treatment time and the related costs, increasing patient acceptance and satisfaction.[10]

However, immediate implant placement also presents critical aspects.[11] In fact, the stabilization of the implant in the fresh extraction socket may be technically difficult.[14,15] Numerous research studies emphasize that primary stability is crucial for successful immediate implant placement in the posterior regions, irrespective of the presence of septal bone, the gap between the socket walls and the fixture, or the addition of grafting material. Sufficient primary stability has been proven to be the most vital element in achieving osseointegration.[12,13] Another concern associated with immediate implant placement is a gap between the socket's walls and the fixture's body.

Delayed implant placement until after the socket has healed is recommended to reduce the chances of implant failures and complications. Immediately following tooth extraction, ridge preservation procedures can be performed on the sockets to mitigate the natural process of bone resorption.[11]

It would be beneficial to determine if we can achieve improved clinical results by conserving the extraction sites and placing implants after bone healing or if comparable outcomes can be reached by opting for immediate implant placement following tooth extraction, thus reducing the overall treatment duration by several months.[12]

After reviewing the current evidence, no studies have been conducted to date that offer a thorough qualitative and quantitative analysis of soft and hard tissue changes in immediate versus delayed implant placements. Consequently, this systematic review was conducted to evaluate the effectiveness of immediate and delayed implant placement and examine their impact on the surrounding soft and hard tissues in adults through this meta-analysis.

MATERIALS AND METHODOLOGY

Development Of Protocols

This assessment was carried out and executed following the guidelines of the preferred reporting items for systematic review and meta-analysis (PRISMA) statement[16] and registered in Prospective Registration of Systematic Review (PROSPERO)- CRD536255

Study Design

The research question provided below is centred on the Participants

(P), Intervention (I), Comparison (C) and Outcome (O) format was proposed "Is there any difference in the effectiveness between immediate and delayed implant placement for their effect on surrounding soft and hard tissue?"

The PICO Criteria For This Review Were As Follows:
P (Participants) – patients requiring implant placement
I (Intervention) – immediate implant placement (IIP)
C (Comparison) – delayed implant placement (DIP)
O (Outcome) – Pink esthetic score (PES), white esthetic score (WES), marginal bone loss (MBL), crestal bone loss (CBL), peri-implantitis bone loss, implant survival, probing depth (PD), plaque index (PI), bleeding on probing (BOP).

Eligibility Requirements: studies were chosen based on the following eligibility standards.

a) Inclusion Criteria: Following Were The Inclusion Criteria.
1) Studies published in English language
2) Studies published between January 2000 – December 2023 and having relevant sufficient data on the effectiveness between immediate and delayed implant placement and their effect on surrounding soft and hard tissue
3) Studies reporting study outcomes in terms of PES, WES, MBL, CBL, peri-implantitis bone loss, implant survival, PD, PI, BOP
4) Randomized controlled trial (RCT), comparative and prospective studies were selected
5) Studies from open access journals
6) Articles reporting the study outcomes in terms of mean and standard deviation (SD)

b) Exclusion Requirements: Following Were The Exclusion Criteria.
1) Research published prior to the year 2000 was excluded.
2) Articles published in languages other than English were not considered.
3) Reviews, abstracts, letters to the editor, editorials, animal studies, and in vitro studies were omitted.
4) Articles not sourced from open access journals were disregarded.

Search Strategy
An extensive electronic search was conducted up to December 2023 for research published over the past 23 years (from 2000 to 2023) utilizing the following databases: PubMed, Google scholar and EBSCOhost to retrieve articles in the English language. The searches in the clinical trials database, cross-referencing and grey literature were conducted using Google Scholar, Greylist, and OpenGrey.

A manual search of oral and maxillofacial surgery journals, including the Journal of Periodontology, Journal of Indian Society of Periodontology, International Journal of Periodontology and Implantology, Journal of Periodontal and Implant Sciences, British Dental Journal, International Journal of Periodontics and Restorative Dentistry, Journal of Clinical Periodontology, Periodontal Research, American Academy of Periodontology and the journal of American Dental Association was also performed.

Relevant keywords and Medical Subject Headings (MeSH) terms were chosen and linked using Boolean operators such as AND. The pertinent information was retrieved by utilizing these keywords and their various combinations.: "post extraction implant" (MeSH term) AND "immediate loading" (MeSH term); "delayed loading" (MeSH term) AND "socket preservation" (MeSH term) AND marginal bone level (MeSH term); "crestal bone level" (MeSH term) AND "wound healing" (MeSH term) AND "pink aesthetic score" AND "survival rate" AND "socket preservation" AND "randomized controlled trial" (MeSH term); "comparative study" AND "prospective study" (MeSH term).

In addition to the electronic search, a manual search was conducted, and the reference lists of the chosen articles were reviewed.

Screening Process
The search and screening process, following the established protocol, was carried out by two authors. In the first phase, both reviewers assessed the titles and abstracts of all articles. Articles that did not fulfil the inclusion criteria were excluded. In the second phase, the full articles chosen were reviewed and screened independently by the same reviewers. Any disagreements were addressed through discussion. If there was still no consensus between the two reviewers, a third reviewer was consulted to reach a final decision. The final selection was determined by consensus among all three authors. The corresponding authors of the studies were contacted via email if additional information was necessary.

Data Extraction
The subsequent details were gathered for every study included under the following heading.: author(s), country of study, year of study, sample size, total implants placed, no. of IIP/ DIP, follow-up duration, parameters assessed, and conclusion

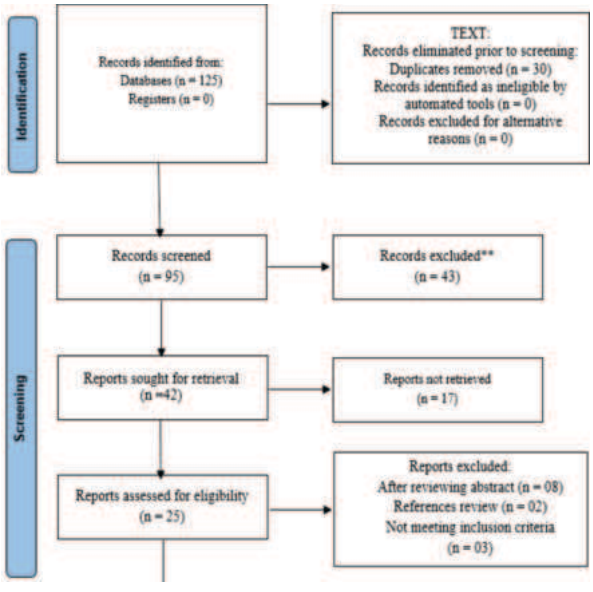
Evaluation Of Methodological Quality
The quality assessment of the studies included was conducted using the Cochrane Collaborative Risk Assessment (ROB)-2 tool. This tool examines several aspects, including random sequence generation (selection bias), allocation concealment (selection bias), blinding of personnel and equipment (performance bias), blinding of outcome assessment (detection bias), incomplete outcome data (attrition), selective reporting (reporting bias), and other biases through their signal questions in Review Manager (RevMan) 5.3. The overall risk of each study was classified as low, moderate, or high based on various regions and criteria. A study was categorized as having a low overall risk only if all areas were assessed as low risk. An overall risk was deemed high if one or more of the six domains were rated as high risk. Studies received a moderate risk designation if one or more areas were classified as uncertain, with none classified as high risk.

Statistical Evaluation
Statistical evaluation was performed utilizing RevMan 5.3, with standardized mean difference (SMD) and risk ratio (RR) used as summary measures. A significance level of $p<0.05$ was established to determine significance.[18]

Evaluation Of Variability
The Cochranes test for heterogeneity was utilized to evaluate the significance of variations in treatment effect estimates across the trials. A P-value of <0.01 indicated that heterogeneity was considered statistically significant.[19]

Examination Of Bias In Publication
The research evaluated publication bias through Begg's funnel plot, which graphs the effect size in relation to the standard error. An asymmetrical appearance in the funnel plot could suggest the presence of potential publication bias.[20]

RESULTS
Selection Of Studies
After removing duplicates, the reference list of studies was screened, excluding certain studies. Subsequently, full-text articles were evaluated for eligibility, and those that failed to meet the inclusion criteria were discarded. A total of fifteen studies were included in the review and were used for the meta-analysis as illustrated in **Figure 1 below**



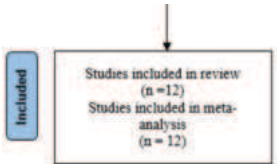


Figure 1. PRISMA 2020 Flow Diagram Assessment

Characteristics Of The Study

As shown in Table 1 below, the data was analyzed from twelve studies21-33 from a collection of 606 implants placed, of which 327 implants were placed immediately (IIP) and 279 implants were placed delayed (DIP). All the studies included were designed as randomized controlled trials, with an average follow-up period of 18.25 months. Among the included studies, four studies[24,26,27,29] were conducted in Italy, two studies[22,32] in Netherlands, one study each in Greece[21], USA[23], New Zealand[25], Sweden[28], India[30], Lithuania[32]. The effectiveness between the two treatment protocols were assessed in terms of pink esthetic score (PES), white esthetic score (WES), marginal bone loss (MBL), crestal bone loss (CBL), peri-implantitis bone loss, implant survival, implant stability, probing depth (PD), plaque index (PI), bleeding on probing (BOP), sulcus depth, pain and post-operative complications. From the results of the study, it was found that majority of the study reported equal and comparable outcomes between the two techniques, while four studies[23-25,28] reported that greater complications, impaired wound healing and less success rate was seen with IIP, while two studies[21,22] reported that IIP quickly achieves an effective aesthetic outcome, decreasing both the number of procedures required and the length of treatment; it may also be suitable for chronic periapical lesions.

BOP: bleeding on probing; CBL: crestal bone level; DIP: direct implant placement; IIP: immediate implant placement; KTW: keratinized tissue width; MBL: marginal bone level; PES: pink aesthetic score, PI: plaque index; WES: white esthetic score, PD: probing depth

Table 1: Showing Descriptive Study Details Of Included Studies

Author, years of study	Country	Study design	Total implant placed	IIP/DIP	Follow up period (months)	Parameters assessed	Conclusion
Tsirilis et al., 2005[21]	Greece	RCT	13	10/3	24	MBL, bone loss, sulcus depth,	IIP within a very short time leads to successful aesthetic result, reducing the number of operations and the length of therapy
Lindeboom et al., 2006[22]	Netherlands	RCT	50	32/18	3	Survival rates of implants, average Implant Stability Quotient scores, appearance of the gums, and radiographic assessment of bone loss.	IIP might be indicated in chronic periapical lesion
Block et al., 2009[23]	USA	RCT	76	38/38	24	Crestal bone level, bone loss, implant survival	No notable difference was observed between the two methods.
Scilian o et al., 2009[24]	Italy	RCT	30	15/15	12	PPD, CAL, BOP, PI, Survival rate	Impaired wound healing and less favourable outcomes were seen with IIP
Atieh et al., 2013[25]	New Zealand	RCT	4	12/12	12	Success rate, survival rate, bone level changes, implant stability	High failure rates were observed with IIP
Mangano et al., 2012[26]	Italy	RCT	40	22/18	31.09	PES, WES	Comparable outcomes were seen with both treatment modalities
Esposito et al., 2015[27]	Italy	RCT	50	25/25	12	PES, peri-implant bone level	No notable distinction was observed between the two methods.
Felice et al., 2015[28]	Sweden	RCT	106	54/52	12	PES, peri-implant bone level, success, failure, complications	Greater complications were seen with IIP
Cucchi et al., 2017[29]	Italy	RCT	97	49/48	12-36	KTW width, CBL, Survival rate, complications	Equal and comparable outcomes were seen in both techniques
Santhanakrishnan et al., 2021[30]	India	RCT	50	25/25	6	PES, Pain	IIP showed better clinical outcomes compared to DIP
Slagter et al., 2022[31]	Netherlands	RCT	40	20/20	60	Marginal bone level, buccal bone thickness, PI, BOP, PD, PES, WES, peri-implant mucositis	The results for hard and soft tissues were similarly effective for both methods.
Puisys et al., 2022[32]	Lithuania	RCT	50	25/25	12	PES, CBL, MBML, peri-implant soft tissue and	Excellent outcomes were seen with both treatment modalities

Evaluation Of The Quality Of Studies That Were Included

A significant risk of bias was identified concerning allocation concealment, random sequence generation, and incomplete outcome data. The studies included in the review indicated a moderate to low risk of bias overall. The domains assessing blinding of outcome evaluation, blinding of participants and personnel, selective reporting, and other biases were evaluated as having the lowest risk of bias by the included studies, as illustrated in **Figures 2 and 3** shown below.

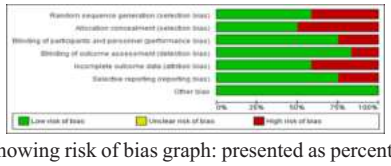


Figure 2: showing risk of bias graph: presented as percentages across all included studies.

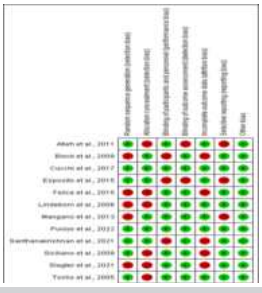


Figure 3: Displaying a summary of bias risk: for every study included

RESULTS SUMMARY

The meta-analysis was performed to assess the effectiveness of immediate and delayed implant placement and evaluate their effect on soft and hard tissue in terms of PES, WES, MBL, CBL, peri-implantitis bone loss, implant survival, PD, PI, and BOP, **as shown below in figures 4-21.**

A) Pink Esthetic Score (PES)

A total of six studies[26,27,28,30-32] were analyzed, encompassing data from 319 implants, with (n=165) of these implants being immediately placed (IIP) and (n=154) experiencing delayed placement (DIP) for the assessment of PES. As illustrated in **Figure 4**, the standardized mean difference (SMD) is 0.10 (-0.12 – 0.32), and the combined estimates indicate a preference for the immediately placed group, suggesting that the PES was, on average, 0.10 times greater in the immediately placed implant category (p>0.05).

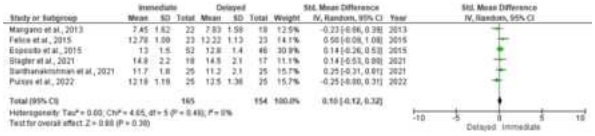


Figure 4: comparison between IIP and DIP for PES

The funnel plot revealed no considerable asymmetry, suggesting that publication bias is not present, as illustrated in **Figure 5**.

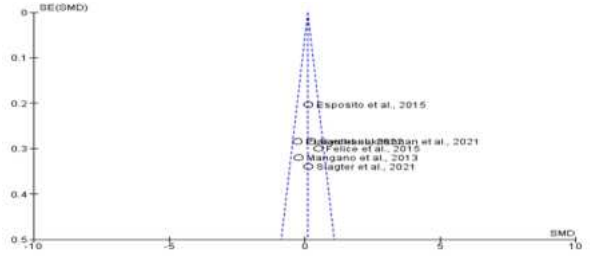


Figure 5: showing Begg's Funnel plot demonstrating absence of publication bias.

B) White Aesthetic Score (WES)

Two studies[26,31] containing data on 75 implants, of which (n=40) implants were immediately placed (IIP) and (n=35) implants were delayed placed (DIP) for evaluation of WES. As shown in **Figure 6.** the SMD is -0.10 (-0.87 – 0.67) and the pooled estimates favours immediately placed signifying that WES on an average was 0.10 times lesser in delayed placed implant group (p>0.05).

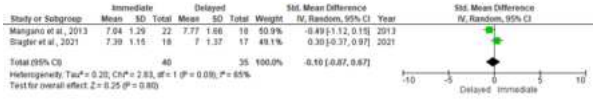


Figure 6: Comparison between IIP and DIP for WES

The funnel plot demonstrated no noteworthy asymmetry, suggesting that there is no publication bias, as illustrated in **Figure 7**.

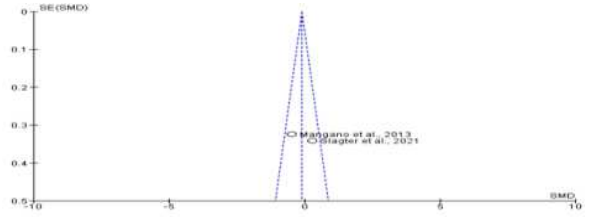


Figure 7: showing Begg's Funnel plot demonstrating absence of publication bias.

C) Marginal Bone level (MBL)

Three studies[25,27,28] containing data on 190 implants, of which (n=91) implants were immediately placed (IIP) and (n=89) implants were delayed placed (DIP) for evaluation of MBL.

As shown in **Figure 8.** the SMD is -0.25 (-0.93 – 0.43) and the combined estimates signifying that MBL on an average was -0.25 times lesser in delayed placed implant group (p>0.05).

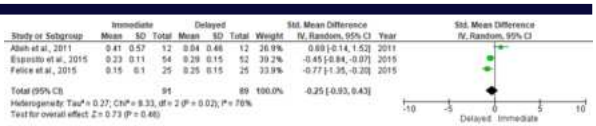


Figure 8: comparison between IIP and DIP for MBL

The funnel plot did not show significant asymmetry, indicating absence of publication bias as shown in **Figure 9.**

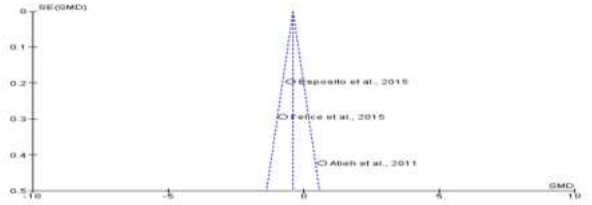


Figure 9: showing Begg's Funnel plot demonstrating absence of publication bias.

D) Crestal Bone level (CBL)

Two studies[25,29] containing data on 121 implants, of which (n=61) implants were immediately placed (IIP) and (n=60) implants were delayed placed (DIP) for evaluation of CBL. As shown in **Figure 10.** the SMD is -0.56 (-0.92 – 0.19) and the combined estimates signifying that CBL on an average was -0.56 times lesser in immediately placed implant group (p<0.05).

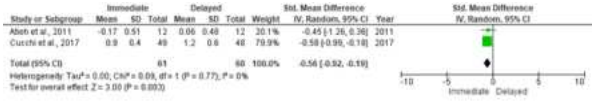


Figure 10: comparison between IIP and DIP for CBL

The funnel plot displayed no notable asymmetry, suggesting there is no publication bias as illustrated in **Figure 11.**

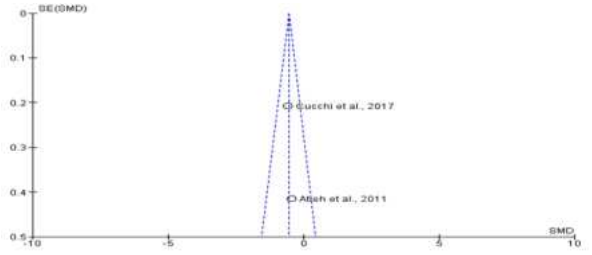


Figure 11: showing Begg's Funnel plot demonstrating absence of publication bias.

E) Peri-implant Bone Loss

Two studies[21,29] included data of 113 implants, of which (n=66) implants were immediately placed (IIP) and (n=47) implants were delayed placed (DIP) for evaluation of peri-implantitis bone loss. As shown in **Figure 12.** the SMD is -0.24 (-0.63 – 0.15) and the pooled estimates signifying that peri-implantitis bone loss on average, it was-0.24 times lesser in delayed placed implant group (p>0.05).

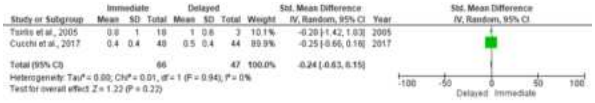


Figure 12: Comparison between IIP and DIP for peri-implantitis bone loss

The funnel plot revealed no notable asymmetry, suggesting that publication bias is not present, as illustrated in **Figure 13**.

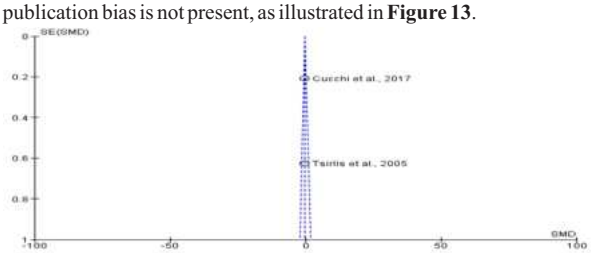


Figure 13: showing Begg's Funnel plot demonstrating absence of

publication bias.

F) Implant Survival

Five studies[22,23,25,29,31] included data of 239 implants, of which (n=119) implants were immediately placed (IIP) and (n=120) implants were delayed placed (DIP) for evaluation of implant survival. As shown in **Figure 14.** the RR is 0.96 (0.91 – 1.01) and the combined estimates signifying that implant survival on an average was 0.96 times higher in delayed placed implant group (p>0.05).

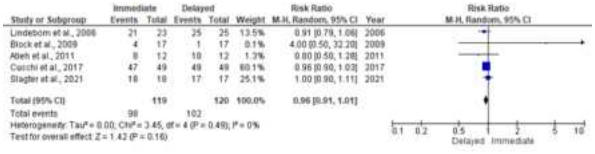


Figure 14: comparison between IIP and DIP for implant survival

The funnel plot exhibited no substantial asymmetry, suggesting there is no evidence of publication bias, as illustrated in **Figure 15.**

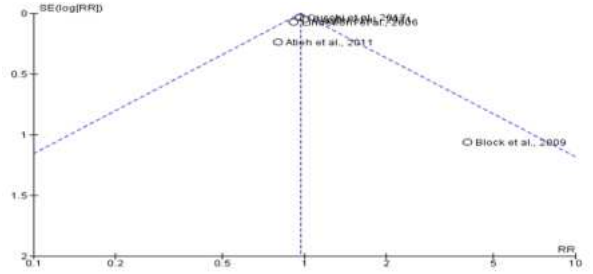


Figure 15: showing Begg's Funnel plot demonstrating absence of publication bias.

G) Probing Depth (PD)

Two studies[24,29] included data of 127 implants, of which (n=64) implants were immediately placed (IIP) and (n=63) implants were delayed placed (DIP) for evaluation of PD. As shown in **Figure 16.** the SMD is 0.74 (-0.39 – 1.87) and the combined estimates that mean PD on an average was 0.74 times higher in immediately placed implant group (p>0.05).

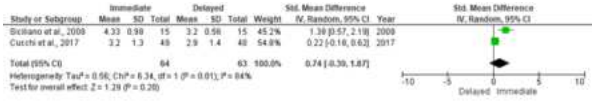


Figure 16: comparison between IIP and DIP for PD

The funnel plot displayed no notable asymmetry, suggesting that there is no evidence of publication bias, as illustrated in **Figure 17.**

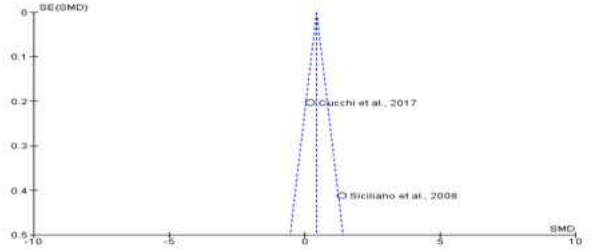


Figure 17: showing Begg's Funnel plot demonstrating absence of publication bias.

H) Plaque Index (PI)

Two studies[29,31] included data of 65 implants, of which (n=33) implants were immediately placed (IIP) and (n=32) implants were delayed placed (DIP) for evaluation of PI.

As shown in Figure 18, the SMD is -0.04 (-0.76 – 0.68), and the combined estimates show that mean PI on an average was 0.10 times higher in the immediately placed implant group (p>0.05).

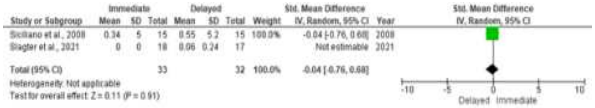


Figure 18: Comparison between IIP and DIP for PI

The funnel plot did not show significant asymmetry, indicating absence of publication bias as shown in **Figure 19.**

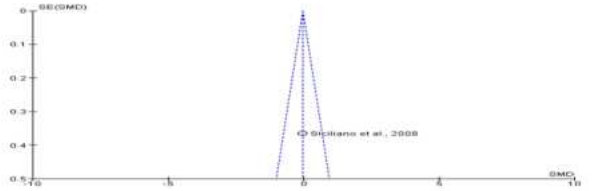


Figure 19: showing Begg's Funnel plot demonstrating absence of publication bias.

I) Bleeding On Probing (BOP)

Two studies[24,31] included data of 65 implants, of which (n=32) implants were immediately placed (IIP) and (n=33) implants were delayed placed (DIP) for evaluation of BOP. As shown in **Figure 20.** the SMD is -0.12 (-1.34 – 1.11) and the combined estimates that mean BOP on an average was -0.12 times lesser in immediately placed implant group (p>0.05).

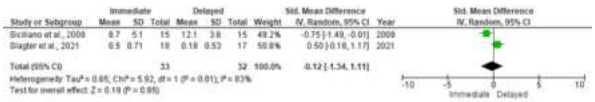


Figure 20: Comparison between IIP and DIP for BOP

The funnel plot did not display notable asymmetry, suggesting a lack of publication bias as illustrated in **Figure 21**.

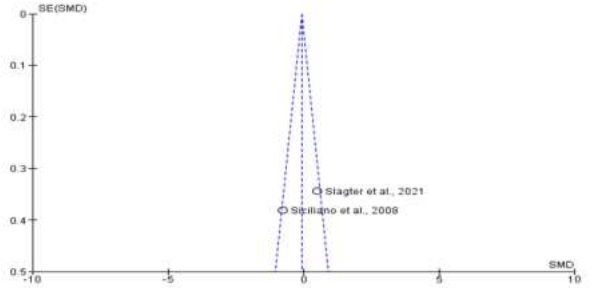


Figure 21: showing Begg's Funnel plot demonstrating absence of publication bias.

DISCUSSION

Yan et al(2016)[33]., conducted a systematic review with an aim to compare the soft and hard tissue changes following the placement of single tooth implant. Databases were searched from January 2001 till December 2014 for RCTs reporting soft and hard tissue changes after placement of single tooth implant with the outcomes assessed were marginal bone level changes (mesial, distal and mean bone level), peri-implant soft tissue changes papilla level, midbuccal mucosa and probing depth and aesthetic index. 13 RCTs fulfilled the eligibility criteria. With regard to bone level changes, no notable differences were observed in the bone level at the mesial site. (SMD = -0.04; -0.25 – 0.17), distal side (SMD= -0.15; -0.38 – 0.09) and mean bone level (SMD= 0.05; -0.18 – 0.27), also there was no significant statistical difference observed in the marginal bone levels and changes in soft tissue. The study's findings indicate that implants placed immediately in the aesthetic zone yield comparable changes in hard and soft tissues when compared to the traditional method.

Cosyn et al(2022)[34]., performed a comprehensive review and meta-analysis to evaluate the efficacy of immediate implant placement (IIP) versus delayed implant placement (DIP) regarding implant survival (primary outcome), along with various surgical, clinical, aesthetic, radiographic, and patient-reported outcomes (secondary outcome). Databases were reviewed up to May 2018 for randomized controlled trials (RCTs) and non-randomized controlled trials (NRCTs) that compared immediate implant placement (IIP) with delayed implant placement (DIP), requiring at least one year of follow-up. A total of three RCTs and five NRCTs involved the placement of 473 single implants (IIP-233 and DIP-240). The study's results found that the survival rate in DIP was higher (98%) compared to IIP (95%). Similar probing depth, PES, and aesthetic outcomes were seen between IIP and DIP. Patient-reported outcomes were the same in both. Based on the findings of the research, it was determined that increased implant loss

was observed with IIP.

Garcia-Sanchez et al. (2022)[35], conducted a meta-analysis to evaluate the effectiveness of immediate implant placement (IIP) compared to delayed implant placement (DIP) regarding survival rates, success rates, radiographic marginal bone levels, thickness of the buccal wall, position of the peri-implant mucosal margin, aesthetic results, and patient-reported outcomes. Databases were searched till November 2019 for RCTs and controlled clinical trials (CCTs). RCTS were part of the analysis. The findings from the study indicated that IIP demonstrated a high survival rate (97%) along with a significant PES score. It was concluded that, IIP and DIP both had equally clinically and statistically (P>0.05) with IIP reported with more early and twice delayed complications.

This systematic review and meta-analysis were conducted to offer a detailed qualitative and quantitative analysis of the soft and hard tissue modification in immediate and delayed implant placements. Databases were explored up to December 2023 for randomized controlled trials assessing the effectiveness between the two modalities in terms of pink esthetic score (PES), white esthetic score (WES), marginal bone loss (MBL), crestal bone loss (CBL), peri-implantitis bone loss, implant survival, implant stability, probing depth (PD), plaque index (PI), bleeding on probing (BOP), sulcus depth, pain and post-operative complications with a sum of 606 implants positioned regarding which 327 implants were placed immediately (IIP) and 279 implants were placed delayed (DIP). From the results of the review, it was found that the majority of the studies reported equal and comparable outcomes between the two techniques. The studies included indicated a moderate low risk of bias was present.

Meta-analysis was performed to assess the effectiveness between immediate and delayed implant placement and evaluate their effect on soft and hard tissues in terms of PES, WES, MBL, CBL, peri-implantitis bone loss, implant survival, PD, PI, BOP. It was found that delayed implant placement showed overall better clinical and aesthetic outcomes with minimal complications and a greater survival rate (RR= 0.96 (0.91 – 1.01). DIP was clinically and statistically superior to IIP (P<0.05). The funnel plot showed no notable asymmetry, suggesting no publication bias in the meta-analysis.

This systematic review was enhanced by compliance with the PRISMA guidelines, a comprehensive and unrestricted search of the literature, the application of robust methods for qualitative data synthesis, and the evaluation of evidence quality using the Cochrane ROB-2 tool for the selected RCTs and comparative studies. The quality assessment for all included studies indicated a low to moderate risk of bias, while the overall quality was rated high, indicating few potential and unavoidable sources of bias, with limited variability and deficiencies in reporting.

However, there were also some limitations. A review of the evidence shows that the literature on comparative evaluation of IIP with DIP is sparse when evaluating clinical and esthetic outcomes, as mentioned in the study. Even after an unlimited search and eligibility criteria, there were very few studies with qualitative synthesis and quantitative synthesis. Only twelve studies were included in the final assessment. More randomized controlled trials, prospective or follow-up studies comparing IIP with DIP are needed to evaluate the above-mentioned results to show a better effectiveness between the two treatment protocols.

A systematic review is an organized and clear method for locating, choosing, and thoroughly assessing published and unpublished information to address a particular research question. It frequently incorporates meta-analysis, a statistical technique that combines numerical data from similar studies. While systematic reviews and meta-analyses are considered the highest level of evidence, their reliability depends on the quality of the included studies.

In this systematic review, the selected studies had a limited observation period and a recognized risk of bias. Despite these constraints, the existing evidence is adequate to provide therapeutic recommendations based on the study's research question.

CONCLUSION

This systematic review and meta-analysis assessed the soft and hard tissue modifications in immediate and delayed implant placement. In the included studies, it was observed that the Pink esthetic score (PES)[30], White esthetic score (WES)[31], Bleeding and probing (BOP)[24], and Crestal bone level (CBL)23 were better in immediate implant placement. Whereas Peri-implant bone loss27, implant survival25, probing depth, and plaque index[24] were better in delayed implant placement.

Hence, it can be concluded that delayed implant placement showed overall better stability[21]. Immediate implants showed better aesthetic outcomes with minimal complications. Delayed implant placement showed a greater survival rate, being clinically and statistically superior to immediate implant placement. Additional clinical research with a larger participant pool and extended follow-up duration should be conducted to confirm our study results and achieve a comprehensive body of high-quality evidence.

REFERENCES

1. Schulte W. The intraosseous Al2O3 (Frialit) Tuebingen implant. Developmental status after eight years (II). Quintessence Int. 1984;15(3):19-35.
2. Gelb DA. Immediate implant surgery: three-year retrospective evaluation of 50 consecutive cases. Int J Oral Maxillofac Implants. 1993;8(3):388-399.
3. Rosenquist B, Grenthe B. Immediate placement of implants into extraction sockets: implant survival. Int J Oral Maxillofac Implants. 1996;11(5):205-209.
4. Schwartz-Arad D, Chaushu G. The ways and wherefores of immediate placement of implants into fresh extraction sites: a literature review. J Periodontol. 1997;68(10):915-923.
5. Becker W, Clokie C, Sennerby L, Urist MR, Becker BE. Histologic findings after implantation and evaluation of different grafting materials and titanium micro screws into extraction sockets: case reports. J Periodontol. 1998;69(5):414- 421.
6. Schwartz-Arad D, Chaushu G. Immediate implant placement: a procedure without incisions. J Periodontol. 1998;69(8):743- 750.
7. Wilson TG Jr, Schenk R, Buser D, Cochran D. Implants placed in immediate extraction sites: a report of histologic and histometric analyses of human biopsies. Int J Oral Maxillofac Implants. 1998;13(11):333-341.
8. Cornelini R, Scarano A, Covani U, Petrone G, Piattelli A. Immediate one-stage postextraction implant: a human clinical and histologic case report. Int J Oral Maxillofac Implants. 2000;15(1):432-437.
9. Rosenquist B, Ahmed M. The immediate replacement of teeth by dental implants using homologous bone membranes to seal the sockets: clinical and radiographic findings. Clin Oral Implants Res. 2000;11(2):572-582.
10. Schwartz-Arad D, Gulayev N, Chaushu G. Immediate versus non-immediate implantation for full-arch fixed reconstruction following extraction of all residual teeth: a retrospective comparative study. J Periodontol. 2000;71(10):923-928.
11. Chaushu G, Chaushu S, Tzohar A, Dayan D. Immediate loading of single-tooth implants: immediate versus nonimmediate implantation. A clinical report. Int J Oral Maxillofac Implants. 2001;16(10):267-272.
12. Paolantonio M, Dolci M, Scarano A, d'Archivio D, di Placido G, Tumini V, et al. Immediate implantation in fresh extraction sockets. A controlled clinical and histological study in man. J Periodontol. 2001;72(2):1560-1571.
13. Schultes G, Gaggl A. Histologic evaluation of immediate versus delayed placement of implants after tooth extraction. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2001;92(4):17-22.
14. Becker W, Dahlin C, Becker BE, Lekholm U, van Steenberghe D, Higuchi K, et al. The use of e-PTFE barrier membranes for bone promotion around titanium implants placed into extraction sockets: a prospective multicenter study. Int J Oral Maxillofac Implants. 1994;9(7):31-40.
15. Huys LW. Replacement therapy and the immediate post-extraction dental implant. Implant Dent. 2001;10(8):93-102.
16. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, Shamseer L, Tetzlaff JM, Akl EA, Brennan SE, Chou R. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. International journal of surgery. 2020;88(3):59-60
17. Corbett MS, Higgins JP, Woolacott NF. Assessing baseline imbalance in randomised trials: implications for the Cochrane risk of bias tool. Research Synthesis Methods. 2014;5(1):79-85.
18. DerSimonian R, Laird N. Meta-analysis in clinical trials revisited. Contemporary clinical trials. 2015;45(8):139-45.
19. Higgins JP, Thompson SG. Quantifying heterogeneity in a meta.analysis. Statistics in medicine. 2002;21(11):1539-58.
20. Sterne JA, Becker BJ, Egger M. The funnel Plot. Publication bias in meta-analysis: Prevention, assessment and adjustments. 2005;13(6):75-98.
21. Tsirlis AT. Clinical evaluation of immediate loaded upper anterior single implants. Implant Dentistry. 2005;14(1):94-103.
22. Lindeboom JA, Tjiook Y, Kroon FH. Immediate placement of implants in periapical infected sites: a prospective randomized study in 50 patients. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology. 2006;101(6):705-10.
23. Block MS, Mercante DE, Lirette D, Mohamed W, Ryser M, Castellon P. Prospective evaluation of immediate and delayed provisional single tooth restorations. Journal of Oral and Maxillofacial Surgery. 2009;67(11):89-107.
24. Siciliano VI, Salvi GE, Matarasso S, Cafiero C, Blasi A, Lang NP. Soft tissues healing at immediate transmucosal implants placed into molar extraction sites with buccal self.contained dehiscences. A 12.month controlled clinical trial. Clinical oral implants research. 2009;20(5):482-8.
25. Atieh MA, Alsabeeha NH, Duncan WJ, de Silva RK, Cullinan MP, Schwass D, Payne AG. Immediate single implant restorations in mandibular molar extraction sockets: a controlled clinical trial. Clinical oral implants research. 2013;24(5):484-96.
26. Mangano FG, Mangano C, Ricci M, Sammons RL, Shibli JA, Piattelli A. Esthetic Evaluation of Single-Tooth Morse Taper Connection Implants Placed in Fresh Extraction Sockets or Healed Sites. Journal of Oral Implantology. 2012;39(2):172-81.
27. Esposito M, Barausse C, Pistilli R, Jacotti M, Grandi G, Tuco L, Felice P. Immediate loading of post-extractive versus delayed placed single implants in the anterior maxilla: outcome of a pragmatic multicenter randomised controlled trial 1-year after loading. Eur J Oral Implantol. 2015;8(4):347-58.
28. Felice P, Pistilli R, Barausse C, Trullenque-Eriksson A, Esposito M. Immediate non-occlusal loading of immediate post-extractive versus delayed placement of single implants in preserved sockets of the anterior maxilla: 1-year post-loading outcome of a randomised controlled trial. Eur J Oral Implantol. 2015;8(4):361-72.
29. Cucchi A, Vignudelli E, Franco S, Levrini L, Castellani D, Pagliani L, Rea M, Modena C, Sandri G, Longhi C. Tapered, double-lead threads single implants placed in fresh

extraction sockets and healed sites of the posterior jaws: A multicenter randomized controlled trial with 1 to 3 years of follow-Up. BioMed Res Int. 2017;13(5):20-32.
30. Santhanakrishnan M, Ramesh N, Kamaleeshwari R, Subramanian V. Variations in soft and hard tissues following immediate implant placement versus delayed implant placement following socket preservation in the maxillary esthetic region: a randomized controlled clinical trial. BioMed Research International. 2021;20(1):1-9.
31. Slagter KW, Meijer HJ, Hentenaar DF, Vissink A, Raghoebar GM. Immediate single.tooth implant placement with simultaneous bone augmentation versus delayed implant placement after alveolar ridge preservation in bony defect sites in the esthetic region: A 5.year randomized controlled trial. J Periodontol. 2021;92(12):1738-48.
32. Puisys A, Auzbikaviciute V, Vindasiute.Narbute E, Pranskunas M, Razukevicus D, Linkevicius T. Immediate implant placement vs. early implant treatment in the esthetic area. A 1.year randomized clinical trial. Clinical Oral Implants Research. 2022;33(6): 634-55.
33. Yan Q, Xiao LQ, Su MY, Mei Y, Shi B. Soft and Hard Tissue Changes Following Immediate Placement or Immediate Restoration of Single-Tooth Implants in the Esthetic Zone: A Systematic Review and Meta-Analysis. International Journal of Oral & Maxillofacial Implants. 2016;31(6):76-82.
34. Cosyn J, De Lat L, Seyssens L, Doornewaard R, Deschepper E, Vervaeke S. The effectiveness of immediate implant placement for single tooth replacement compared to delayed implant placement: A systematic review and meta.analysis. Journal of Clinical Periodontology. 2019;46(4):224-41.
35. Garcia.Sanchez R, Dopico J, Kalemaj Z, Buti J, Pardo Zamora G, Mardas N. Comparison of clinical outcomes of immediate versus delayed placement of dental implants: A systematic review and meta.analysis. Clinical Oral Implants Research. 2022;33(3):231-77.