

Soft Tissues Changes After Immediate and Delayed Single Implant Placement in Esthetic Area: A Systematic Review

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The aim of the present study was to conduct a systematic review of the literature to compare soft tissue aspects of immediate and delayed implant placement in esthetic areas. This review of literature was conducted in the following databases: MEDLINE (PubMed), Lilacs, Scielo, EMBASE, and Cochrane Central Register of Controlled Trials (CENTRAL). For those studies that met the inclusion/exclusion criteria, the results were analyzed and summarized according to the treatment protocol used for implant placement. The primary parameters taken into consideration were papilla level (PL) and marginal mucosa level (MML) around implants. Four randomized controlled trials (RCT) were selected for analysis, but all were deemed as being of poor quality according to quality assessment. No studies reported any statistically significant differences concerning the soft tissue esthetic parameters analyzed around immediate or delayed implants at any follow-up periods reported. However, PL results seemed to be more reliable than were MML results, due to the PL standardization of the method of analysis, which showed a tendency for poorer results around immediately placed implants. In conclusion, although the results are based on only a few poor quality RCTs, both treatment options for implant placement demonstrated similar outcomes in the esthetic area, especially when PL was considered.

Key Words: dental implant; immediate implant; delayed implant; esthetics; soft tissue

INTRODUCTION

To obtain optimal esthetics with single implants, the peri-implant soft tissue has to be in harmony not only with the subjacent prosthesis but also with adjacent teeth.¹ Several strategies have been proposed to preserve the remaining hard and soft tissues during the replacement of a condemned tooth, such as alveolar ridge preservation² and guided bone regeneration (GBR).³

Immediate implant placement presents some advantages when compared to delayed implant placement—such as reduction in the number of surgical interventions and decreased treatment time and cost^{4,5}—with satisfactory survival rates (2-year survival rate of 98.4%).⁶ However, immediate implant placement also involves some risks, such as the higher likelihood of site infection, flap dehiscence,^{4,8} and the occurrence of buccal bone remodeling⁹ that can lead to long-term marginal mucosa recession.⁸ There is also some evidence suggesting that immediate implant placement followed by immediate provisionalization can be a good option for papilla preservation in the esthetic zone, but the stability of

the facial marginal mucosa has been shown to be less than desirable.¹⁰ Delayed implant placement can also present problems such as marginal tissue alterations during the healing period,¹¹ and papilla alterations have also been observed.¹²

Therefore, tissue alterations have been reported with both immediate and delayed implant placement. Understanding the differences involved in those procedures is critical in the decision-making process during treatment planning. Nonetheless, there is scarce information in the literature comparing soft tissues outcomes with immediate and delayed implant placement. Hence, the present study was carried out to answer the following question: “Is there a difference in soft tissue outcomes around implants placed on fresh extraction sockets when compared to those placed in a healed socket?”

MATERIAL AND METHODS

Interventions and outcomes

Only randomized controlled trials (RCT) with the following criteria were included in this review: reporting soft tissue outcomes (papilla level and marginal mucosa level) around immediate and delayed implants placed in upper anterior and premolar areas (from #4 to #13) and with a follow-up of at least 6 months after implant placement.

Regarding implant placement time, 3 different protocols have been defined in the literature:¹³ (1) immediate placement (type 1), when implants are placed in the same surgical

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intervention as the dental extraction; (2) early implant placement (type 2), when implants are placed in the early stages of healing (from 4–8 weeks); and (3) delayed implant placement (types 3 and 4), when implants are placed once the alveolar ridge has completely healed (>12 weeks after extraction). In this systematic review, implants placed up to 15 days after tooth extraction were considered as immediate implants, while implants placed after at least 8 weeks after tooth extraction were regarded as delayed implants.

Outcomes measured

Soft tissue morphology around implants was evaluated based on papilla level (PL) and marginal mucosal level (MML).

Inclusion Criteria

This systematic review included only RCTs that fulfilled the following inclusion criteria: (1) human studies, (2) comparison of soft tissue alterations around immediate and delayed implants, (3) evaluation of the morphologic soft tissue alterations (at buccal and interproximal sites) after implant placement, (4) follow-up period of at least 6 months after implant placement, (5) single implants, and (6) presence of natural teeth adjacent to implants.

Exclusion criteria

Studies presenting any of following characteristics were excluded from the review: (1) patients with implants adjacent to implant sites; (2) implants placed in areas previously submitted to osteogenesis distraction, bone block grafting, or soft tissue grafting; (3) implants placed in the molar region; and (4) implants placed in patients with previous periodontal disease, uncontrolled systemic disorders, and smokers.

Search strategy

An electronic search was conducted via MEDLINE (PubMed), Lilacs, Scielo, EMBASE, and Cochrane Central Register of Controlled Trials (CENTRAL). Randomized clinical trials, performed only in humans and published until December 2012, were selected. MeSH terms, key words and other free terms were used with Boolean operators (OR, AND) to combine searches. Studies published in any language and any journals were considered for analysis. The search terms used were:

- #1 ("implant" OR "implants" OR "dental implant" OR "implant placement" OR "delayed implantation" OR "delayed implant" OR "delayed implant placement" OR "delayed implant installation")
- #2 ("immediate implant" OR "immediate implant placement" OR "post-extraction implant placement" OR "immediate implant installation" OR "early implant placement" OR "early implant installation")
- #3 (#1) OR (#2)
- #4 ("papilla" OR "papillae" OR "marginal soft tissue" OR "mucosal level" OR "marginal mucosa" OR "soft tissue stability" OR "soft tissue")
- #5 ("aesthetic" OR "esthetic")
- #6 (#4) OR (#5)
- #7 (#3) AND (#6)

Study selection

Two independent reviewers (A.B., C.S.D.) screened the titles, abstracts, and finally the full texts of the articles identified in the search according to the inclusion and exclusion criteria. Reviewers then selected the abstracts and finally full texts of all eligible articles for possible inclusion. In case of disagreement, a joint decision was taken.

Other sources of data

A hand search was also carried out in the reference lists and journals that were considered relevant for implant dentistry. Unpublished data were searched listing unpublished studies, abstracts, and supplement editions of important journals.

Data extraction

Two reviewers (A.B., C.S.D.) independently recorded the data from the selected studies. The data were extracted and compiled, summarizing the main characteristics and results for comparisons. The following data were recorded: (1) total number of patients included; (2) patients' mean age and gender; (3) number of implants placed; (4) implant surface, design, length, and diameter; (5) healing protocol (submerged or non-submerged); and (6) follow-up period. Patients' treatment protocols were also recorded: (1) time of implant placement after tooth extraction (immediate or delayed); (2) loading protocol; and (3) when applicable, type of bone grafting or membrane used for ridge preservation or GBR.

Validity assessment and methodological quality

The methodological quality of the interventional studies selected was assessed using Cochrane's Collaboration quality measurement tool.¹⁴ The risk of bias was categorized according to the following classification: (1) low risk of bias (plausible bias that is unlikely to seriously change the results) when all criteria are met; (2) moderate risk of bias, when one or more criteria are partially met; and (3) high risk of bias, when one or more criteria are not met.

RESULTS

Search results

Using the search strategy aforementioned, 420 potential articles were found and separated for title and abstract analysis. A total of 12 full-text articles were selected for more detailed analysis. From these, 5 texts fulfilled all the inclusion/exclusion criteria,^{15–19} while the remaining 7 studies were excluded (Appendix A). However, the information contained in 2 of those 5 studies reported data from the same sample^{15,17} in two different follow-up periods. After contacting the authors, it was decided to include only the most recent article,¹⁷ which reported data from both follow-up periods (2 and 5 years). Thus, finally, a total of 4 studies were included and considered for this review. Figure 1 has a Flow Diagram illustrating the study selection process.

A total of 122 patients (ages 21–69 years) and 126 implants were included in the analysis. The follow-up period ranged

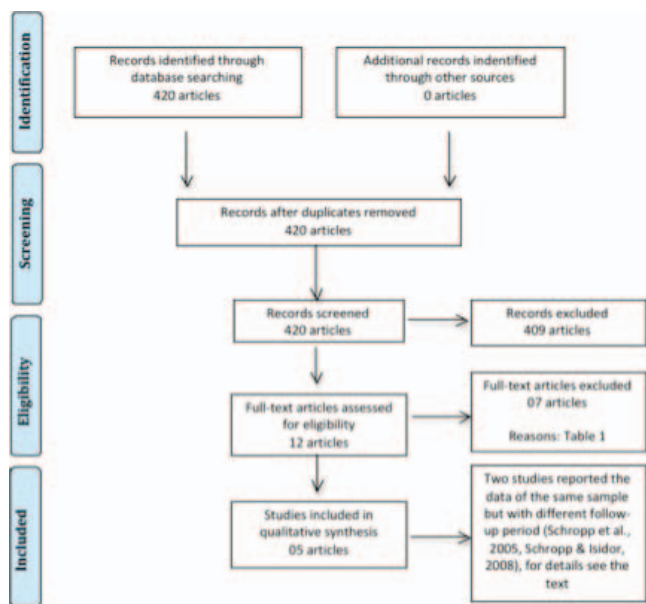


FIGURE 1. Flow diagram of the studies screened according to PRISMA method.

from 6–60 months (Table 1). The characteristics of the studies included in this review—such as the number of patients treated, gender, mean age, implant system, surface, length, diameter, healing time, and loading protocols—are shown in Table 1. Other characteristics—such as bone grafts, method of PL and MML analyses, and assessment time—are displayed in Table 2.

Implant restoration type and loading protocol

Implant restoration type and loading time varied among studies. One study¹⁸ used provisional restorations 2 days after implant placement, but neither centric relation occlusal contacts nor protrusive and lateral movements were reported. Two studies^{16,17} reported only the later placement of final restorations, 7 to 9 months and 6 months after implant placement, respectively. Finally, one study¹⁹ did not report any type of restoration (provisional or final).

PL analysis

In three studies,^{16–18} changes in PL were clinically evaluated using the Jemt Papilla Index.²⁰ The scores ranged from 0–4 (score 0 = no papilla; score 1 = less than half of space filled by proximal papilla; score 2 = at least half of space filled by proximal papilla; score 3 = all the space filled by proximal papilla; and score 4 = hyperplastic papilla). Figure 2 shows the results of these studies summarized for comparison (descriptive analysis only). In one study,¹⁹ however, PL was measured, in millimeters, from an imaginary line crossing the cemento-enamel junction (CEJ) of the adjacent teeth to the tip of the papilla.

In another study,¹⁶ although no statistical comparisons between groups were performed, similar PL values were found for both groups at follow-up. Yet another study¹⁷ showed that after 60 months, both groups presented statistically significant

improvements in PL, although no statistically significant differences between groups were observed at the end of the follow-up period ($P > .05$). Similarly, the study by Palattella¹⁸ also showed similar results for the immediate group (IG) and delayed group (DG) at the end of the follow-up period ($P > .05$). Finally, in the study of van Kesteren,¹⁹ (although the esthetic analysis performed was different), 6 months after implant placement, no statistically significant differences were found between IG and DG ($P = .713$) (for details, see Figure 2 and Table 2).

MML analysis

All studies selected presented different methods for MML analysis. The study by Lindeboom et al¹⁶ measured the difference of the buccal gingival outline of the adjacent teeth. The authors classified the marginal mucosa level ranging from 0–4 (score 0 = no difference in gingival level; score 1 = less than 1 mm difference; score 2 = less than 2 mm difference; score 3 = less than 3 mm difference; and 4 = differences greater than 3 mm). Another study¹⁸ clinically observed MML alterations at implants' buccal soft tissue evaluation, measuring the distance, in millimeters, from the most apical point of the mucosa margin to implant shoulder. Schropp and Isidor¹⁷ evaluated MML indirectly, measuring implant clinical crown height (CCH) in relation to the gingival level of adjacent teeth. Crowns were scored from 1–3 (score 1 = very high crown; score 2 = very short crown; and score 3 = appropriate crown). Finally, van Kesteren et al¹⁹ obtained MML by measuring the distance between the apical-coronal position of the midbuccal marginal mucosa and a reference line crossing the CEJ of adjacent teeth.

In the study by Schropp and Isidor,¹⁷ clinical crowns in IG at baseline was adequate (score 3) in 77% of the cases; in DG, clinical crowns were adequate in only 50% of the cases. At the 2-year follow-up, 82% of IG and 75% of DG were classified as adequate ($P > .05$). These values remained stable at the 60-month follow-up. It seems important to point out that all unsatisfactory crowns in IG and only half in DG occurred due to high crowns (score 1).¹⁷

In another trial,¹⁶ no statistical analysis was performed. However, the descriptive data showed that only 61% of immediate vs 84% of delayed implants presented ideal MML. In addition, IG presented 9% of at least 2-mm recession (score 2) compared to no cases in DG.¹⁶ In the study by Palattella et al,¹⁸ mean MML alteration from the beginning of the treatment to the 2-year follow-up was -0.8 ± 0.7 mm for IG and -0.6 ± 0.6 mm for DG, indicating a slightly displacement of mucosal margin to the apical position in both groups but with no significant differences between them ($P > .05$).¹⁸ Finally, in the study by van Kesteren et al,¹⁹ MML analysis was carried out before (baseline) and at 6 months after tooth extraction (follow-up). Before tooth extraction, mean MML for DG and IG were 0.49 ± 0.57 mm and -0.20 ± 1.04 mm coronally to the reference line, respectively. There was a loss of 0.13 mm and 0.26 mm for IG and DG at 3 months; between 3 and 6 months, DG lost only 0.01 mm while IG gained 0.08 mm, indicating that most of the recession occurred within the first 3 months. Nonetheless, no significant differences between groups were found at any timepoint ($P = .170$) (for details, see Table 2).¹⁹

TABLE 1

Main characteristics of the included studies*

Study	NP/NI	Men/ women	Mean age (range)	Number of implants	System	Surface	Length (mm)	Diameter (mm)	Healing protocol	Load (months)	Follow-up (months)†
Lindeboom et al ¹⁶	48/48	25/25	38.7 (19–69)	II = 23 DI = 25	Dentsply Friadent	SLA	NR	3.8–6.5	S	6	12
Schropp and Isidor ¹⁷	34/34	14/20	47 (20–69)	II = 18 DI = 16	3i	SLA	8.5–15	3.25–6.0	S	7–9	60
Palattella et al ¹⁸	16/18	6/10	35 (21–49)	II = 9 DI = 9	Straumann	SLA	10–12	4.8	T	Immediate‡	24
van Kesteren et al ¹⁹	24/26	NR	52 (28–76)	II = 13 DI = 13	Straumann	SLA	10–12	4.1	T	Not loaded	6

*RCT indicates randomized controlled trial; NP, number of patients; NI, number of implants; NR, not reported; II, immediate implant; DI, delayed implant; SLA, sandblasted acid-etched; S, submerged; T, transgingival.

†Follow-up period after implant placement.

‡No occlusal contact.

Quality assessment of included studies

None of the studies included in this review were considered as having low risk of bias.^{16–19} The reasons for the poor quality of the studies found were mainly due to unclear allocation and concealment, and lack of examiner blinding (for details, see Table 3).

DISCUSSION

Only four studies fulfilled the inclusion/exclusion criteria established by this review in contribution to answer the research question. In summary, the results indicated that no differences in the esthetic outcomes (PL and MML) were found when immediate and delayed implant placement were compared at any of the follow-up periods reported.^{16–19} However, the results obtained in this review have to be analyzed with caution for the following reasons: (1) very few studies were included in the review; (2) there were important methodological differences among the studies; (3) PL results seemed to be more consistent than the MML results due to a lack of standardized procedures and a slight tendency of immediate implants to present poorer MML outcomes.¹⁶

Recent systematic reviews have been conducted to compare peri-implant clinical parameters, success and survival rates among immediate, early, and delayed implants.^{21–25} In these studies, soft tissue modifications have also been evaluated but as a secondary outcome. In contrast, the present systematic review focused only in the comparison of soft tissues alterations around immediate and delayed implants.

A recent systematic review²⁵ reported that early implant placement, compared to delayed placement, may offer advantages in terms of soft tissue stability. However, the study focused on all peri-implant clinical aspects, and soft tissue was analyzed secondarily. Esposito et al²³ also reported lack of sufficient evidence for an unequivocal conclusion but suggested that esthetic outcomes might be better when implants are placed immediately after extraction. In another review,²² the results demonstrated that immediate placement of implants showed more recession in the buccal aspect and poorer

esthetic results when compared to early and delayed implant placement.

There are some clinical studies suggesting that immediate implant placement is the best approach to prevent papilla loss in single tooth replacement.^{26,27} This review found no differences between IG and DG in terms of PL (Figure 2). However, considering all individuals in both groups, different outcomes were found among the studies.^{16–18} The prostheses used may be a possible explanation for the different results obtained,^{20,28,29} as this variable may be difficult to control. The prosthesis is an important factor that can affect the soft tissue around implants,^{20,28,29} as the emergence profile may lead to soft tissue apical displacement.²⁹ The papilla will fill the interproximal areas according to the height of the contact point of the crown.²⁹ A distance of <5 mm from the contact point to the bone crest is crucial to obtain the interproximal area entirely filled by soft tissue.^{30,31} The results obtained in this review reinforce the hypothesis that interproximal papilla seems to be influenced by the prosthesis,²⁹ tooth-to-implant distance,³² and interproximal bone level of adjacent teeth.^{33,34}

Concerning MML, two studies included in this review^{18,19}

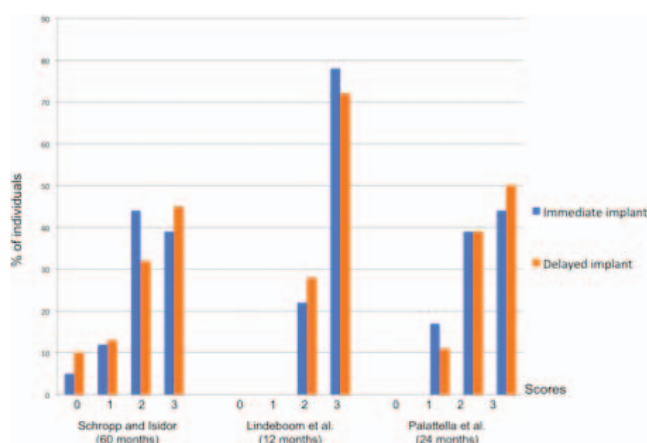


FIGURE 2. Graphic showing the individuals' distribution (percentage) of papilla level according to Jemt Papilla Index score²⁰ of immediate and delayed groups at follow-up period of three studies included.

TABLE 2

Characteristics and comparison of the results of immediate (IG) and delayed (DG) groups of included articles*

Study	Bone graft	Method of analysis	Time of evaluation
Lindeboom et al ¹⁶	Particulate AB in the buccal aspect of all implants	PL: Jemt Papilla Index MML: difference with the buccal gingival outline of the adjacent teeth (scores)	PL and MML: 12 mo after implant placement
Schropp and Isidor ¹⁷	Particulate AB: only with delayed implants in case of fenestrations or dehiscence	PL: Jemt Index, by clinical photography MML: by CCH in relation to adjacent teeth gingival level (scores)	PL and CCH: One wk after restoration, 24 mo and 60 mo of follow-up
Palattella et al ¹⁸	NR	PL: Jemt Papilla Index MML: The distance from the most apical point of the gingival margin to the implant shoulder measured (in mm)	NP: 24 mo (follow-up) MML: at the moment of the provisional restoration delivery (baseline) and 24 mo (follow-up)
van Kesteren et al ¹⁹	DG: Ridge preservation with FDDBA + collagen membrane IG: FDDBA filling the gap between the buccal bone and the implant surface when the HDD ≥ 2 mm without membrane	PL: Distance between the level of CEJ of adjacent teeth and the most coronal point of the papilla MML: Distance between the apical position of the midbuccal mucosa and the adjacent teeth marginal gingiva	PL and MML: before tooth extraction (baseline), 3 and 6 mo after implant placement

*AB indicates autogenous bone; FDDBA, freeze-dried bone allograft; HDD, horizontal dimension defect; CEJ, cement-enamel junction; Sco., score; PR, papilla recession; MR, mucosa recession; CCH, clinical crown height; NR, not reported.

reported no difference in MML between groups (for details, see Table 2). Moreover, one study did not report the use of bone graft in any of the groups.¹⁸ Considering the inability of immediate implants to preserve buccal bone,⁴ a possible explanation for MML stability in this case is soft tissue gain (2.1 mm), which would replace the hard tissue modeling after tooth extraction.³⁵ However, MML stability around implants with no buccal bone is controversial, once more recession has been observed⁹ in the long-term (7 years).

In the study by Lindeboom,¹⁶ delayed implants presented more ideal MML when compared to immediate implants (9% with ≥ 2 mm of recession). These results are in agreement with other studies that evaluated MML around immediate implants after 1³⁶ and 3 years.³⁷ The authors observed >1 mm of mucosal recession in 8.3% and 8% of the patients, respectively.^{36,37} Thus, MML stability seems to be related to factors such as thin, damaged, or absent buccal bone,^{9,22} position of implant placement,^{22,38} and gingival biotype.^{10,22,34}

This review of the literature found only a few randomized

controlled studies. Furthermore, there was a lack of standardization in the procedures, type of esthetic analysis, characteristics of implant supported crowns, use of bone grafts, and description of gingival biotype. However, despite these limitations, the data assessed from the literature suggested that no differences in esthetic outcomes between immediate and delayed implants exist, with more consistent outcomes observed for PL than for MML.

Implications for practice

Although no differences in soft tissue esthetic outcomes were found between immediate and delayed implant protocols, clinicians should expect that soft tissue esthetic alterations will occur to some extent after tooth extraction and the subsequent implant placement. Hence, prior identification of individual risk factors that may lead to negative results could help the clinician choose the most adequate technique for implant placement,

TABLE 2					
Extended					
Papilla level (PL)		Marginal mucosa level (MML)		Main results	
After 12 mo:		After 12 mo:		PL: In both groups, 72% full regeneration of the papilla was observed MML: Ideal level = 61% for IG versus 84% for DG group (no statistical analysis reported) PL: No difference between groups after 24 and 60 mo ($P > .05$). CCH: No significant difference between the groups was found at follow-up ($P > .05$). MML: Comparing the baseline to the follow-up period of each group independently, there was a statistically significant difference for both groups ($P < .05$). PL and MML: No statistically significant difference between groups after 24 mo ($P > .05$). PL: Statistically significant difference from baseline to 6 mo ($P < .01$). No difference between immediate and delayed implants ($P = .713$). MML: No statistically significant difference between groups ($P = .170$)	
IG	DG	IG	DG		
Sco. 0 = 0%	Sco. 0 = 0%	Sco. 0 = 61%	Sco. 0 = 84%		
Sco. 1 = 0%	Sco. 1 = 0%	Sco. 1 = 30%	Sco. 1 = 16%		
Sco. 2 = 22%	Sco. 2 = 28%	Sco. 2 = 9%	Sco. 2 = 0%		
Sco. 3 = 78%	Sco. 3 = 72%	Sco. 3 = 0%	Sco. 3 = 0%		
		Sco. 4 = 0%	Sco. 4 = 0%		
Baseline:	60 mo:	Evaluated by CCH compared to adjacent teeth:			
IG	IG	Baseline:	60 mo:		
Sco. 0 = 9%	Sco. 0 = 5%	IG	IG		
Sco. 1 = 38%	Sco. 1 = 12%	Sco. 1/2 = 23%	Sco. 1/2 = 18%		
Sco. 2 = 41%	Sco. 2 = 44%	Sco. 3 = 77%	Sco. 3 = 82%		
Sco. 3 = 12%	Sco. 3 = 39%	DG	DG		
DG	DG	Sco. 1/2 = 50%	Sco. 1/2 = 25%		
Sco. 0 = 19%	Sco. 0 = 10%	Sco. 3 = 50%	Sco. 3 = 75%		
Sco. 1 = 23%	Sco. 1 = 13%				
Sco. 2 = 42%	Sco. 2 = 32%				
Sco. 3 = 15%	Sco. 3 = 45%				
After 24 mo:		Difference from baseline to follow-up (MR):			
IG	DG	IG			
Sco. 0 = 0%	Sco. 0 = 0%	-0.8 ± 0.7 mm			
Sco. 1 = 17%	Sco. 1 = 11%	DG			
Sco. 2 = 44%	Sco. 2 = 39%	-0.6 ± 0.6 mm			
Sco. 3 = 39%	Sco. 3 = 50%				
IG and DG		Baseline:			
Difference between baseline to 6 mo (PR):		IG = 0.20 ± 1.04 mm			
Mesial = 1.73 ± 0.71 mm Distal = 1.48 ± 0.80 mm		DG = 0.49 ± 0.57 mm			
Difference between 3 to 6 mo (PR):		3 mo:			
Mesial = 0.38 ± 0.41 mm Distal = 0.21 ± 0.48 mm		IG = 0.33 ± 0.99 mm			
		DG = 0.22 ± 0.76 mm			
		6 mo:			
		IG = 0.25 ± 0.69 mm			
		DG = 0.21 ± 0.69 mm			
		Difference from baseline to 6 mo (MR):			
		IG = 0.05 mm			
		DG = 0.28 mm			

once no evidence was found suggesting any advantage of one procedure over another.

Implications for research

In future studies, it would be important to focus on high quality, well-designed RCTs with larger samples, long-term follow-up periods, and standardization in the methods of analyses. The identification of causal factors of negative results

would also be important, especially when MML is evaluated. Additional information—such as horizontal defect size in immediately placed implants, type of bone grafts used, prostheses (contact point height), gingival biotype, and tomographic analysis for the presence or absence of adjacent buccal bone—adds some variables to be evaluated. Other patient-centered variables could also be analyzed and associ-

TABLE 3					
Assessment of quality and risk of bias of the included studies					
Study	Method of randomization	Allocation concealment	Completeness of follow-up period	Examiner blinding	Risk of bias
Lindeboom et al ¹⁶	Adequate	Adequate	Yes	No	Moderate
Schropp and Isidor ¹⁷	Adequate	Unclear	Yes	Yes	Moderate
Palattella et al ¹⁸	Adequate	Unclear	Yes	No	High
van Kesteren et al ¹⁹	Adequate	Unclear	Yes	No	High

ated to soft-tissue alterations, such as oral hygiene, trauma due to brushing, and tooth-brushing instruction.

ABBREVIATIONS

CCH: clinical crown height
CEJ: cementoenamel junction
DG: delayed group
GBR: guided bone regeneration
IG: immediate group
MML: marginal mucosa level
PL: papilla level
RCT: randomized controlled trials

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REFERENCES

- Meijer HJ, Stellingsma K, Meijndert L, Raghoobar G. A new index for rating aesthetics of implant-supported single crowns and adjacent soft tissues – the implant crown aesthetic index. *Clin Oral Implants Res.* 2005;16:645–649.
- Araújo MG, Lindhe J. Ridge preservation with the use of Bio-Oss collagen: a 6-month study in the dog. *Clin Oral Impl Res.* 2009;20:433–440.
- Buser D, Hart C, Bornstein M, Grütter L, Chappuis V, Belser UC. Early implant placement with simultaneous GBR following single-tooth extraction in the esthetic zone: 12-month results of a prospective study with 20 consecutive patients. *J Periodontol.* 2009;80:152–162.
- Esposito MA, Koukouloupoulou A, Coulthard P, Worthington HV. Interventions for replacing missing teeth: dental implants in fresh extraction sockets (immediate, immediate-delayed, and delayed implants). *Cochrane Database Syst Rev.* 2006;CD005968.
- Glauser R, Zembic A, Hammerle CH. A systematic review of marginal soft tissue at implants subjected to immediate loading or immediate restoration. *Clin Oral Implants Res.* 2006;17(suppl.):82–92.
- Lang NP, Lui P, Lau KY, Li KY, Wong MCM. A systematic review on survival and success rates of implants placed immediately into fresh extraction sockets after at least 1 year. *Clin Oral Impl Res.* 2012;23(suppl. 5):39–66.
- Gapski R, Wang HL, Mascarenhas P, Lang NP. Critical review of immediate implant loading. *Clin Oral Implants Res.* 2003;14:515–527.
- Benic GI, Mokti M, Chen C-J, Weber H-P, Hämmerle CHF, Gallucci GO. Dimensions of buccal bone and mucosa at immediately placed implants after 7 years: a clinical and cone beam computed tomography study. *Clin Oral Implants Res.* 2012;23:560–566.
- Araújo MG, Sukekava F, Wennström JL, Lindhe J. Ridge alterations following implant placement in fresh extraction sockets: an experimental study in the dog. *J Clin Periodontol.* 2005;32:645–652.
- Kan JY, Rungcharassaeng K, Lozada JL, Zimmerman G. Facial gingival tissue stability following immediate placement and provisionalization of maxillary anterior single implants: a 2- to 8-year follow-up. *Int J Oral Maxillofac Implants.* 2011;26:179–187.
- Oates TW, West J, Jones J, Kaiser D, Cochran DL. Long-term changes in soft tissue height on the facial surface of dental implants. *Implant Dent.* 2002;11:272–279.
- Cardaropoli G, Lekholm U, Wennström JL. Tissue alterations at implant-supported single-tooth replacements: a 1-year prospective clinical study. *Clin Oral Implants Res.* 2006;17:165–171.
- Hämmerle CHF, Chen ST, Wilson Jr TG. Consensus statements and recommended clinical procedures regarding the placement of implants in extraction sockets. *Int J Oral Maxillofac Implants.* 2004; 19(suppl):26–28.
- Higgins JPT, Green S. *Cochrane Handbook for Systematic Review of*

Interventions, Version 5.1.0. London: The Cochrane Collaboration; 2011. <http://www.cochrane-handbook.org>. Accessed May 31, 2010.

- Schropp L, Isidor F, Kostopoulos L, Wenzel A. Interproximal papilla levels following early versus delayed placement of single-tooth implants: a controlled clinical trial. *Int J Oral Maxillofac Implants.* 2005;20:75361.
- Lindeboom JAH, Tjiook Y, Kroon FHM. Immediate placement of implants in periapical infected sites: a prospective randomized study in 50 patients. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2006;101:705–710.
- Schropp L, Isidor F. Clinical outcome and patient satisfaction following full-flap elevation for early and delayed placement of single-tooth implants: a 5-year randomized study. *Int J Oral Maxillofac Implants.* 2008;23:733–743.
- Palattella P, Torsello F, Cordaro L. Two-year prospective clinical comparison of immediate replacement vs immediate restoration of single tooth in the esthetic zone. *Clin Oral Implants Res.* 2008;19:1148–1153.
- van Kesteren CJ, Schoolfield J, West J, Oates T. A prospective randomized clinical study of changes in soft tissue position following immediate and delayed implant placement. *Int J Oral Maxillofac Implants.* 2010;25:562–570.
- Jemt T. Regeneration of gingival papillae after single-implant treatment. *Int J Periodontics Restorative Dent.* 1997;17:326–333.
- den Hartog L, Slater JJ, Vissink A, Meijer HJ, Raghoobar GM. Treatment outcome of immediate, early, and conventional single-tooth implants in the aesthetic zone: a systematic review to survival, bone level, soft-tissue, aesthetics, and patient satisfaction. *J Clin Periodontol.* 2008;35:1073–86.
- Chen ST, Buser D. Clinical and esthetic outcomes of implants placed in postextraction sites. *Int J Oral Maxillofac Implants.* 2009;24(suppl):186–217.
- Esposito M, Grusovin MG, Polyzos IP, Felice P, Worthington HV. Timing of implant placement after tooth extraction: immediate, immediate-delayed or delayed implants? A Cochrane systematic review. *Eur J Oral Implantol.* 2010;3:189–205.
- Ortega-Martínez J, Pérez-Pascual T, Mareque-Bueno S, Hernández-Alfaro F, Ferrés-Padró E. Immediate implants following tooth extraction. A systematic review. *Med Oral Patol Oral Cir Bucal.* 2012;17:251–261.
- Sanz I, García-Gargallo M, Herrera D, Martín C, Figuero E, Sanz M. Surgical protocols for early implant placement in post-extraction sockets. A systematic review. *Clin Oral Impl Res.* 2012;23(suppl 5):67–79.
- Kan JYK, Rungcharassaeng K, Umezaki K, Kois J. Dimensions of peri-implant mucosa: An evaluation of maxillary anterior single implants in humans. *J Periodontol.* 2003;74:557–562.
- Kan JY, Rungcharassaeng K. Interimplant papilla preservation in the esthetic zone: a report of six consecutive cases. *Int J Periodontics Restorative Dent.* 2003;23:249–259.
- Chang M, Wennström JL, Ödman P, Andersson B. Implant supported single-tooth replacements compared to contralateral natural teeth. Crown and soft tissue dimensions. *Clin Oral Implants Res.* 1999;10:185–194.
- Gallucci GO, Grutter L, Chuang SK, Belser UC. Dimensional changes of peri-implant soft tissue over 2 years with single-implant crowns in the anterior maxilla. *J Clin Periodontol.* 2011;38:293–299.
- Grunder U, Polizzi G, Goené R, et al. A 3-year prospective multicenter follow-up report on the immediate and delayed-immediate placement of implants. *Int J Oral Maxillofac Implants.* 1999;14:210–216.
- Choquet V, Hermans M, Adriaenssens P, Daelemans P, Tarnow DP, Malevez C. Clinical and radiographic evaluation of the papilla level adjacent to single-tooth dental implants. A retrospective study in the maxillary anterior region. *J Periodontol.* 2001;72:1364–1371.
- Tarnow DP, Cho SC, Wallace SS. The effect of inter-implant distance on the height of the inter-implant bone crest. *J Periodontol.* 2000;71:546–549.
- Esposito M, Ekstubbé A, Grondahl K. Radiological evaluation of marginal bone loss at tooth surfaces facing single Brånemark implants. *Clin Oral Implants Res.* 1993;4:151–157.
- Nisapakulorn K, Suphanantachai S, Silkosessak O, Rattanamongkolgul S. Factors affecting soft tissue level around anterior maxillary single-tooth implants. *Clin Oral Implants Res.* 2010;21:662–670.
- Tan WL, Wong TLT, Wong MCM, Lang NP. A systematic review of post-extraction alveolar hard and soft tissue dimensional changes in humans. *Clin Oral Impl Res.* 2012;23(suppl 5):1–21.
- Kan JYK, Rungcharassaeng K, Sclar A, Lozada J. Effects of the facial osseous defect morphology on gingival dynamics after immediate tooth

replacement and guided bone regeneration: 1-year results. *J Oral Maxillofac Surg.* 2007;65(suppl 1):13-19.

37. Cosyn J, Eghbali A, De Bruyn H, Collys K, Cleymaet R, De Rouck T. Immediate single-tooth implants in the anterior maxilla: 3-year results of a case series on hard and soft tissue response and aesthetics. *J Clin Periodontol.* 2011;38:746-753.

38. Evans CDJ, Chen ST. Esthetics outcomes of immediate implant placements. *Clin Oral Implants Res.* 2008;19:73-80.

APPENDIX A: LIST OF EXCLUDED STUDIES. MAIN REASON FOR EXCLUSION IS SHOWN IN PARENTHESES

- Grunder U, Polizzi G, Goené R, et al. A 3-year prospective multicenter follow-up report on the immediate and delayed-immediate placement of implants. *Int J Oral Maxillofac Implants.* 1999;14:210-216. (Focused question not answered.)
- Schropp L, Kostopoulos L, Wenzel A. Bone healing following immediate versus delayed placement of titanium implants into extraction sockets: a prospective clinical study. *Int J Oral Maxillofac Implants.* 2003;18:189-199. (Focused question not answered.)
- Covani U, Bortolaia C, Barone A, Sbordone L. Bucco-lingual crestal bone changes after immediate and delayed implant

placement. *J Periodontol.* 2004;5:1605-1612. (Study did not evaluate soft tissues.)

- Gotfredsen K. A 5-year prospective study of single-tooth replacements supported by the astra tech implant: a pilot study. *Clin Implant Dent Relat Res.* 2004;6:1-8. (Focused question not answered.)
- Block MS, Mercante DE, Lirette D, Mohamed W, Ryser M, Castellon P. Prospective evaluation of immediate and delayed provisional single tooth restorations. *J Oral Maxillofac Surg.* 2009;67:89-107. (Esthetic analysis was not clear.)
- Juodzbaly G, Wang HL. Socket morphology-based treatment for implant esthetics: a pilot study. *Int J Oral Maxillofac Implants.* 2010;25:970-978. (Soft tissue graft and/or block graft were used.)
- Felice P, Soardi E, Piattelli M, Pistilli R, Jacotti M, Esposito M. Immediate non-occlusal loading of immediate post-extractive versus delayed placement of single implants in preserved sockets of the anterior maxilla: 4-month post-loading results from a pragmatic multicentre randomised controlled trial. *Eur J Oral Implantol.* 2011;4:329-344. (Study did not complete the minimal follow-up period.)

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