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study

Effect of connective-tissue grafting on peri-implant tissues around immediately placed implants

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Background

The anterior maxilla poses unique challenges in achieving optimal aesthetics, particularly in cases that require the replacement of a tooth with an implant-supported restoration. Immediate single-implant placement and provisionalisation (IIPP) has emerged as a notably patient-friendly approach, streamlining treatment by minimising interventions and expediting the path to the final restoration.

However, the anatomically intricate nature of the anterior region underscores the significance of two critical elements for achieving seamless pink aesthetics: the buccal mucosa and the underlying bone structure.

The thickness of the supporting bone – primarily composed of bundle bone and typically measuring <1mm – exerts a direct influence on the positioning of the mucosal margin, predisposing it to post-extraction resorption. This resorption trajectory can culminate in mucosal recession, imperilling the aesthetic integrity of the eventual restoration, a phenomenon that cannot be prevented by implant placement alone.

While simultaneous bone grafting during placement is a viable option, the adjunctive use of a connective tissue graft (CTG) has emerged as a compelling strategy, demonstrating efficacy in averting recession during short-term follow-ups, even when paired with provisionalisation.

Nonetheless, preliminary long-term assessments cast doubt on the sufficiency of CTG in preserving soft-tissue levels, a view echoed by recent meta-analyses.

Aim

The aim of this study is to assess the long-term (five-year) influence of CTG placement on key parameters – the height of the mid-buccal mucosa (primary outcome), together with buccal-bone thickness and height, and patient-reported outcome measures (secondary outcomes) – to comprehensively gauge the efficacy and patient satisfaction associated with this intervention.

Materials & methods

- A five-year randomised controlled trial (RCT) based on a one-year study at the University Medical Centre Groningen (UMCG) in the Netherlands, involving patients (≥18 years) with a single non-restorable tooth in the maxillary aesthetic zone.
- Patients were included if they practised adequate oral hygiene, had mesial-distal width of ≥6 mm, up to 5mm vertical buccal distance between coronal bone level and marginal mucosa, no medical and general contraindications for implant surgery, no periodontal disease, and were non-smokers.
- After extraction, a tapered implant was placed and restored with a provisional crown, with (n=30, test group) or without a soft-tissue graft (n=30, control group) from the tuberosity region. Following a three-month provisional phase, a customised zirconia abutment was developed as final implant crown.
- The change in mid-buccal mucosa level (MBML) was evaluated as the primary outcome. Secondary outcomes were buccal bone thickness (BBT), marginal bone loss (MBL), soft-tissue peri-implant parameters, implant survival, aesthetics, and patient satisfaction.
- Using standardised photos, intra-oral radiographs, cone-beam computed tomography scans, self-completed questionnaires, and clinical examination, information was gathered before tooth extraction (T0) and at one (T1), 12 (T12), and 60 (T60) months after final crown installation.
- Independent t-test, Mann-Whitney U test, and Fisher's exact test were used respectively to compare normally distributed, non-normally distributed, and categorical data between groups.
- Linear mixed-effect models (LMMs) were used to assess the differences between groups in repeated measurements of MBML change, interproximal mucosa level change, and MBL change.

Figure: Changes in mid-buccal and interproximal mucosa levels at T1, T12, and T60 after implant crown placement

Variable	T_0–T_1 Mean (95% CI)		T_1–T_{12} Mean (95% CI)		T_{12}–T_{60} Mean (95% CI)		T_0–T_{60} Mean (95% CI)		Estimated difference at T_{60} minus baseline	*p*-Value
	Control group (*n* = 29)	Test group (*n* = 29)	Control group (*n* = 29)	Test group (*n* = 29)	Control group (*n* = 27)	Test group (*n* = 27)	Control group (*n* = 27)	Test group (*n* = 27)	Mean (95% CI)*	
Mid-buccal mucosa level change (MBML; mm)	-0.5 (-0.9 to -0.1)	0.1 (-0.3 to 0.4)	0.0 (-0.1 to 0.1)	0.0 (-0.1 to 0.1)	-0.2 (-0.4 to -0.1)	-0.2 (-0.3 to 0.0)	-0.6 (-1.1 to -0.1)	0.1 (-0.4 to 0.5)	0.8 (0.3 to 1.3)	0.008*

	T_1–T_{12} Mean (95% CI)		T_{12}–T_{60} Mean (95% CI)		T_1–T_{60} Mean (95% CI)		Estimated difference at T_{60} minus baseline	*p*-Value
Marginal bone level change								
Mesial of implant (mm)	-0.06 (-0.2 to 0.1)	-0.04 (-0.2 to 0.1)	0.05 (-0.3 to 0.4)	-0.5 (-0.7 to -0.2)	0.01 (-0.4 to 0.4)	-0.49 (-0.8 to -0.2)	-0.4 (-0.7 to -0.1)	0.014*
Distal of implant (mm)	0.03 (-0.1 to 0.2)	0.02 (-0.1 to 0.2)	0.03 (-0.3 to 0.3)	-0.1 (-0.3 to 0.1)	-0.02 (-0.3 to 0.3)	-0.1 (-0.3 to 0.1)	-0.1 (-0.4 to 0.1)	0.257*

* *p*-values were derived from the linear mixed effect models that incorporated all the repeated measurements into a single model for each outcome.

Results

- The five-year follow-up revealed an implant survival rate of 96.7% in both groups, with 27 patients remaining in each group.
- Inserting a connective tissue graft (CTG) during immediate implant placement improves mid-buccal mucosa levels (MBML) initially, which remain stable over five years. After five years, the mean change in MBML was -0.6mm in the control group and 0.1mm in the test group (p=.008).
- Gingival biotype adjustment does not alter these observed findings.
- No notable differences were observed in mucosa-level changes around the implant's mesial and distal sides.
- Marginal bone level (MBL) and buccal bone thickness remained stable over the five-year period and did not differ between groups, indicating similar outcomes in bone preservation.
- Only the mesial side for the control group showed a significant gain in MBL between the time of final implant crown placement (T1) and five years (T60) after implant placement.
- At the five-year follow-up, all patients showed no plaque or bleeding around the implant crown, with minimal gingival inflammation, and a slightly higher point bleeding in the test group.
- Both the control and test groups showed similarly good peri-implant mucosal and implant crown aesthetics and expressed a high level of satisfaction.

Limitations

- The different implant diameter and platforms used in control and test groups may influence the outcomes.
- A profilometric analysis could provide more specific data about soft-tissue changes.
- The risk factors for soft-tissue loss could not be identified, while more studies are required regarding the ideal time and grafting material for soft-tissue augmentation.

Conclusions & impact

- Immediate implant placement with immediate provisionalisation in the maxillary aesthetic zone presents favourable peri-implant tissues at the five-year follow-up.
- Grafting with a connective-tissue graft simultaneously with immediate implant placement limits the recession of the mid-buccal mucosa level.
- Soft-tissue grafting during immediate implant placement should be considered to achieve more stable soft-tissue levels and more favourable aesthetics.
- Connective-tissue grafting during immediate implant placement and provisionalisation in the aesthetic zone may constitute an effective approach for enhancing soft-tissue levels and aesthetics.
- Beneficial modifications in mid-buccal mucosa levels and peri-implant tissues highlight the relevance of conducting such a study soon.

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