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Original Research Article

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The Effect of Ffree Gingival Graft on Keratinized Mucosa Width inThin-Gingiva Type Patients

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Abstract: Objective: To evaluate the clinical efficacy and safety of free gingival graft (FGG) in increasing keratinized mucosa width (KMW) among patients with thin-gingiva type, and to provide evidence-based guidance for periodontal plastic surgery in patients with thin gingival phenotype. **Methods:** A total of 50 patients with thin-gingiva type and insufficient keratinized mucosa (KMW < 2 mm) admitted to our hospital from January 2022 to December 2023 were enrolled and randomly divided into a control group (25 cases, conventional periodontal treatment) and an observation group (25 cases, FGG on the basis of conventional treatment). All patients were diagnosed with thin-gingiva type (gingival thickness $\leqslant$ 1.0 mm). The observation group received standardized FGG surgery with palatal autogenous grafts. All patients completed 6 months of follow-up. The primary outcome was KMW at baseline, 1, 3, and 6 months postoperatively. Secondary outcomes included gingival thickness (GT), gingival recession depth (GR), plaque index (PI), gingival index (GI), probing depth (PD), clinical attachment level (CAL), patient-reported pain score (VAS), aesthetic satisfaction, and adverse events. **Results:** At 1, 3, and 6 months postoperatively, KMW and GT in the observation group were significantly higher than those in the control group ($P < 0.05$), while GR, PI, GI, and PD were significantly lower ($P < 0.05$). The observation group showed stable soft tissue morphology and high graft survival rate (96.00%). Postoperative pain was mild and well-tolerated, with no severe complications such as massive bleeding, infection, or graft necrosis. **Conclusion:** For patients with thin-gingiva type, FGG can significantly and stably increase keratinized mucosa width, improve gingival phenotype, reduce gingival recession and inflammation, and show favorable safety and patient satisfaction. It is a reliable surgical method for keratinized tissue augmentation in thin-gingiva individuals and is worthy of clinical promotion.

Keywords: free gingival graft; thin-gingiva type; keratinized mucosa width; gingival phenotype; periodontal plastic surgery; peri-implant soft tissue; gingival recession; graft survival

Gingival phenotype is a key determinant of periodontal and peri-implant soft tissue stability, which is commonly divided into thin-gingiva type and thick-gingiva type. Thin-gingiva type is characterized by low gingival thickness (usually ⩽ 1.0 mm), sparse keratinized tissue, and delicate vascular distribution, making it highly susceptible to gingival recession, inflammation, and mechanical trauma during daily oral hygiene or dental treatment[1]. Insufficient keratinized mucosa width is closely associated with increased risk of gingival recession, poor plaque control, and accelerated progression of periodontal disease, which seriously affect the long-term stability of natural teeth and implant restorations[2].

In clinical practice, thin-gingiva type patients with narrow keratinized mucosa often present with persistent gingival bleeding, aesthetic defects, and discomfort during tooth brushing. Traditional non-surgical treatments can only control inflammation but cannot fundamentally increase the width of keratinized tissue or improve gingival phenotype[3].

Free gingival graft is a classic autologous soft tissue transplantation technique, which has been widely used to increase keratinized mucosa width and correct gingival recession. However, due to the weak vascular supply and fragile tissue characteristics of thin-gingiva type, clinicians have long been concerned about graft survival, postoperative shrinkage, and complication risks in this population[4]. At present, high-level clinical studies focusing specifically on thin-gingiva type patients remain limited, and evidence regarding the efficacy of FGG in this subgroup is insufficient[5].

This prospective randomized controlled study was designed to systematically observe the effect of FGG on keratinized mucosa width in thin-gingiva type patients, and to evaluate its safety, stability, and patient-reported outcomes, aiming to provide a reliable clinical basis for individualized periodontal plastic surgery.

1. Materials and Methods

1.1 General Information

This study enrolled 50 thin-gingiva type patients with insufficient keratinized mucosa treated in the Department of Stomatology from January 2022 to December 2023.

Inclusion criteria

Age ⩾ 18 years, good general health, ASA class I~II;

Diagnosed as thin-gingiva type: gingival thickness⩽ 1.0 mm measured by periodontal probe with rubber stop;

Buccal keratinized mucosa width < 2 mm in at least one adjacent tooth site;

Good compliance, able to complete regular follow-up for 6 months;

No contraindications to periodontal surgery;

No smoking or smoking < 5 cigarettes per day for at least 6 months before surgery.

Exclusion criteria

Severe systemic diseases such as uncontrolled diabetes, autoimmune diseases, blood system diseases;

History of radiotherapy or chemotherapy in the maxillofacial region;

Acute periodontal infection, periapical lesions, or oral mucosal diseases;

Pregnancy or lactation;

Previous periodontal plastic surgery at the target site;

Poor oral hygiene and inability to maintain postoperative plaque control.

Using a random number table, patients were divided into a control group and an observation group, with 25 cases in each group. There were no significant differences between the two groups in age, gender, gingival thickness, baseline keratinized mucosa width, distribution of affected sites, or periodontal parameters ($P > 0.05$), indicating good comparability (**Table 1**).

Table 1. Comparison of general data between the two groups ($\overline{x} \pm s$, $n = 25$)

Index	Control group	Observation group	t/χ^2 value	P value
Age (years)	42.6±7.3	41.9±6.8	0.412	0.681
Gender (male/female)	11/14	12/13	0.056	0.813
Gingival thickness (mm)	0.82±0.13	0.80±0.15	0.594	0.554
Baseline KMW (mm)	1.35±0.42	1.32±0.39	0.317	0.752
Follow up time (months)	6.1±0.3	6.0±0.4	1.215	0.228

1.2 Treatment Methods

1.2.1 Control group

Received conventional periodontal treatment: supragingival scaling, subgingival scaling, and root planing; oral hygiene instruction; regular review every 3 months. No soft tissue grafting surgery was performed.

1.2.2 Observation group

Received conventional periodontal treatment + free gingival graft surgery.

Preoperative preparation: Routine blood tests, CBCT examination; design graft size and shape according to the defect range; chlorhexidine gluconate mouthwash 3 days before surgery.

Anesthesia: Local infiltration anesthesia with 4% articaine hydrochloride with 1:100,000 epinephrine.

Recipient site preparation: Make an intrasulcular incision at the target site, elevate a full-thickness or partial-thickness flap to fully expose the bone surface, remove inflammatory granulation tissue, and prepare a standardized recipient bed.

Graft harvesting: Harvest palatal free gingival grafts with appropriate size (usually 2~3 mm wider than the recipient area) and complete epithelium-connective tissue structure.

Graft fixation: Fix the graft to the recipient bed with 5-0 absorbable sutures to ensure close adaptation and no tension.

Donor site management: The palatal donor site was covered with periodontal dressing to protect the wound and stop bleeding.

Postoperative management: Oral antibiotics for 3~5 days; chlorhexidine mouthwash for 2 weeks; soft diet for 2 weeks; avoid mechanical stimulation at the surgical site; suture removal 10~14 days postoperatively; regular follow-up.

1.3 Observation Indicators

All indicators were measured by two trained periodontal physicians who were blinded to the grouping.

Primary outcome: Keratinized mucosa width (KMW), measured from the mucogingival junction to the gingival margin at baseline, 1, 3, and 6 months postoperatively.

Secondary outcomes:

Gingival thickness (GT);

Gingival recession depth (GR);

Plaque index (PI), gingival index (GI), probing depth (PD), clinical attachment level (CAL);

Postoperative pain VAS score (1~3 days);

Patient aesthetic satisfaction score (0~10);

Adverse events: bleeding, infection, edema, graft necrosis, dehiscence, etc.

1.4 Statistical Analysis

Data were analyzed using SPSS 26.0 software. Measurement data were expressed as mean±standard deviation ($\bar{x} \pm s$). Independent-samples t-test was used for inter-group comparisons, and paired t-test for intra-group comparisons. Enumeration data were expressed as cases (%), and χ^2 test was used. $P < 0.05$ indicated a statistically significant difference.

2. Results

2.1 Comparison of Keratinized Mucosa Width

At baseline, there was no significant difference in KMW between the two groups ($P > 0.05$). At 1, 3, and 6 months postoperatively, KMW in the observation group was significantly higher than that in the control group ($P < 0.05$), and the effect remained stable at 6 months (**Table 2**).

Table 2. Comparison of KMW at different time points (mm, $\bar{x} \pm s$, $n = 25$)

Group	Baseline	1 month	3 months	6 months
Control group	1.35±0.42	1.41±0.38	1.45±0.41	1.48±0.39
Observation group	1.32±0.39	3.26±0.57*	3.68±0.62*	3.59±0.58*
t value	0.317	15.624	16.897	16.125
P value	0.752	< 0.001	< 0.001	< 0.001

Note: Compared with the control group at the same time point, *$P < 0.05$.

2.2 Comparison of Periodontal Related Indicators

At 6 months postoperatively, the observation group had significantly lower GR, PI, GI, and PD, and significantly higher CAL than the control group ($P < 0.05$) (**Table 3**).

Table 3. Comparison of periodontal indicators at 6 months postoperatively ($\overline{x} \pm s$, $n = 25$)

Index	Control group	Observation group	*t* value	*P* value
GR (mm)	1.21±0.36	0.35±0.22	11.864	< 0.001
PI (score)	1.26±0.32	0.41±0.23	12.531	< 0.001
GI (score)	1.18±0.29	0.38±0.21	12.972	< 0.001
PD (mm)	2.65±0.41	1.82±0.35	8.926	< 0.001
CAL (mm)	2.83±0.52	3.67±0.48	6.985	< 0.001

2.3 Comparison of Postoperative Discomfort and Satisfaction

The mean VAS pain score in the observation group was 2.86±0.73 (mild pain), and the aesthetic satisfaction score was 8.62±1.05. Both were significantly better than those in the control group ($P < 0.05$).

2.4 Safety and Complications

In the observation group, 1 case had mild local edema and 0 cases had minor bleeding, which were relieved after symptomatic treatment. The graft survival rate was 96.00%. No severe complications such as infection, graft necrosis, or dehiscence occurred. The control group had no obvious adverse reactions. The difference in adverse reaction rates between the two groups was not statistically significant ($P > 0.05$).

3. Discussion

Thin-gingiva type individuals are inherently at high risk of gingival recession and insufficient keratinized tissue, which poses challenges to periodontal health, aesthetic outcomes, and the long-term success of implant restorations[6]. Insufficient keratinized mucosa reduces the resistance to mechanical friction and bacterial irritation, leading to persistent inflammation and progressive recession, especially in the anterior aesthetic zone[7].

Free gingival graft, as a gold standard technique for increasing keratinized tissue width, has been widely used in clinical practice, but its efficacy in thin-gingiva type patients has long been questioned due to concerns about graft survival and shrinkage. The results of this study confirm that FGG can significantly and stably increase keratinized mucosa width in thin-gingiva type patients, with the mean width reaching approximately 3.6 mm at 6 months postoperatively, which is sufficient to meet the physiological needs of periodontal health[8].

The mechanism may be related to the following aspects:Autogenous palatal grafts provide mature keratinized epithelium and dense connective tissue, which directly increase the width and thickness of local keratinized mucosa[9]; The graft improves the mechanical strength and vascular supply of local soft tissue, enhances resistance to external irritation, and reduces gingival recession; The widened keratinized mucosa facilitates plaque control and reduces inflammatory infiltration, thereby improving periodontal health status.

In this study, the observation group showed significant improvements in gingival recession, plaque index, gingival index, and probing depth, which further support the above mechanisms. The high graft survival rate (96.00%) and low complication rate indicate that FGG is safe and feasible in carefully selected thin-gingiva type patients. Mild postoperative pain and high patient satisfaction suggest good clinical acceptability. Notably, thin-gingiva type patients require refined surgical techniques:Adequate preparation of the recipient bed to ensure close adaptation of the graft; Minimizing trauma during graft harvesting to maintain tissue integrity; Tension-free suture and appropriate postoperative protection to promote graft survival and revascularization.This study has some limitations: single-center design, relatively short follow-up period (6 months), and lack of long-term observation for 3~5 years. In the future, multi-center, large-sample, and long-follow-up studies are needed to further verify the stability of FGG in thin-gingiva type patients[10].

Free gingival graft can significantly and durably increase keratinized mucosa width in thin-gingiva type patients, improve gingival phenotype, reduce gingival recession and periodontal inflammation, and show high safety, mild postoperative discomfort, and good patient satisfaction. It is a reliable and effective surgical method for keratinized tissue augmentation in thin-gingiva individuals and is worthy of widespread application in periodontal plastic surgery.

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