CLINICAL ORAL SCIENCE AND DENTISTRY ISSN 2688-7428

REVIEW ARTICLE Open Access

Patient Morbidity on the Donor Site after Harvesting the Palatal Graft: A Systematic Review

Merina Shakya[1]; Pujan Kranti Kayastha[2]; Kija Malale[3]; Ling Xu[4] and Huang Jiao[1]*

[1]Department of Periodontology, The affiliated hospital of Chongqing, Chongqing Medical University, People´s Republic of China

[2]Department of Conservative dentistry and Endodontics, College of Medical Sciences-Teaching Hospital, Bharatpur, Nepal

[3]Department of Hepatobiliary system, The Second affiliated hospital of Chongqing Medical University, People´s Republic of China

[4]Department of Prosthodontics, The affiliated hospital of Chongqing, Chongqing Medical University, People´s Republic of China

Received date: 14, July 2019, **Accepted date:** August 22, 2019, **Published date:** September 03, 2019

***Merina Shakya and Pujan Kranti kayastha contributed equally and therefore, both are considered as joint first author.**

***Corresponding Author:** Huang Jiao, Department of Periodontology, The Affiliated hospital of Chongqing, Chongqing Medical University, People´s Republic of China Tel: +86-13452319789; Email: huangjiao1201@163.com

Clinical Relevance

The palatal site used for the graft causes discomfort and pain on the donor site. Different technique and adjunct have been used to reduce the discomfort and pain on the palatal donor site.

Introduction

An adequate width of attached gingiva is essential for maintaining healthy periodontium and to create a seal against the contaminated environment of the oral cavity [1,2]. Gingival recession and mucogingival problems are the mostly encountered conditions in daily practice. Different treatment modalities are developed among which Free soft tissue graft is widely used and accepted treatment modality for the treatment of mucogingival defects [2,3]. A soft tissue graft is a withdrawal of soft tissue that is completely detached from its original donor site and placed in a prepared recipient bed.

The ideal characteristics for the graft should be user-friendly, quick, have an adequate size that to the patient and should create a wound in the donor area that heals rapidly with minimal postoperative problems [4,5].

Palatal area is found to be the most suitable area for the intra-oral autogenous graft due to a similar histological structure as with keratinized gingiva [6,7] and therefore, suitable for donor wound healing [8]. The donor site for the graft is primarily the hard-palatal mucosa, located between the canine and the second molar region [9,10]. The greater thickness of the palatal mucosa is found around the second premolar and thinnest around the second molar [11]. The palatal mucosa in the premolar region is the best area for obtaining graft due to its anatomic reason as a graft can be obtained without causing any

damage to the greater palatine artery [12-14].

The two most commonly used free soft tissue graft procedures are the Free Gingival Graft (FGG) and Connective Tissue Graft (CTG) [5]. In 1968, Sullivan & Atkins described the FGG technique, which was easy to perform and enables large quantities of graft tissue to be obtained [15]. FGG is obtained by removal of an epithelial layer of palatal mucosa that leads to the formation of the open wound which heals by secondary intention and found to be associated with high postoperative morbidity [5,15-19].

CTG is found to be the gold standard treatment modality for the gingival recession and other Mucogingival procedures. [3,5] CTG is obtained with a primary split-thickness access flap elevation and the donor site is completely closed with the access flap resulting in the formation of a closed wound that is thought to reduce postoperative patient discomfort. Originally CTG was designed by Langer and Calagna in 1980 [20] which was modified to parallel incision technique [4,21] that left a denuded wound area on donor site which increases patient morbidity. To reduce postoperative morbidity, more elaborate techniques such as a trap door with one releasing incision [22] with two releasing incisions [23], single incision technique [24,25] were performed. A single incision technique was described as more conservative and less traumatic for the patient, ensuring healing by primary intention and reducing palatal discomfort. [24,25]

The harvesting of autogenous grafts creates a second wound site, with a higher possibility of local morbidity and postoperative discomfort, which can result in lower patient acceptance. Excessive haemorrhage, postoperative bone exposure, prolonged pain/discomfort, necrosis of palatal tissue, unexpected postsurgical swelling and ecchymosis, infection, external root resorption, changes in sensitivity, open palatal wound [2,5,17,26-32], Cases of a mucocele [33] and an arteriovenous shunt [34] has been reported as complications after harvesting palatal graft. The main concern for the donor site is tissue necrosis when the palatal thickness is inadequate or primary closure is not achieved [23] along with post-operative pain and discomfort. Therefore, several techniques have been proposed and utilized to obtain a suitable palatal graft with minimal postoperative complications.

Along with various surgical procedure to obtain graft, various adjunct has been used to reduce the patient morbidity on the donor site such as a Low-level laser, Hyaluronic acid, Platelet-rich fibrin and so on. So, different graft harvesting technique with various agents have been used in the donor site to reduce the postoperative morbidity. All the cited techniques need an adequate thickness of palatal mucosa to avoid desquamation of the undermined superficial flap due to compromised vascularization.

Review

Rationale and focused question

To our knowledge from the literature, there is no absolute explanation for the graft harvesting technique with or without adjunct which has minimal postoperative morbidity in the donor site.

The addressed focused question is “What is the recommended graft harvesting technique with or without an adjunct to reduce postoperative complications on donor site?”

Materials and Methods

Search strategy

PubMed and Cochrane library database were used to search the relevant literature with the combination of following keywords from Jan 2000 to June 2018 performed in humans using the keywords (Connective tissue graft; Free gingival graft; Palatal donor site; Wound healing; Palatal healing) as shown in Table 1.

PubMed	Connective tissue graft OR free gingival graft AND palatal donor site AND palatal healing OR wound healing
Cochrane library	#1 Connective tissue graft #2 Free gingival graft #3 palatal donor site #4 Palatal healing #5 Wound healing #6 #1 OR #2 #7 #4 OR #5 #8 #6 AND #3 AND #7

Table 1: Search strategy.

Eligibility criteria

The following eligibility criteria were applied for the literature search: 1. Original articles; 2. Experimental human studies; 3. Articles published only in the English language; 4. Reference list of pertinent original and review studies; 5. Intervention: various graft harvesting techniques with or without adjunct to reduce donor site morbidity; 6. Randomized controlled trials. Letters to the editors, historic reviews, abstract with no full-text articles and unpublished articles were excluded.

Data extraction

Two reviewers independently extracted data from the eligible studies. Name of the first author, Year of publication, Country, Study design, Number of patient [Male(m)/Female(f), mean age], Inclusion criteria, Loss of follow up, Postoperative medication, Post-operative donor site care with other material/Palatal stent, Graft size(GRT=Graft thickness; GRH=Graft height; GRW=Graft width) and Laser parameters (Ga-Al-As=Gallium Aluminum Arsenide) were extracted from the included studies as presented in Table. 2

Study selection

At each stage of the study screening, two reviewers independently reviewed the studies and made selections for inclusion (Figure 1).

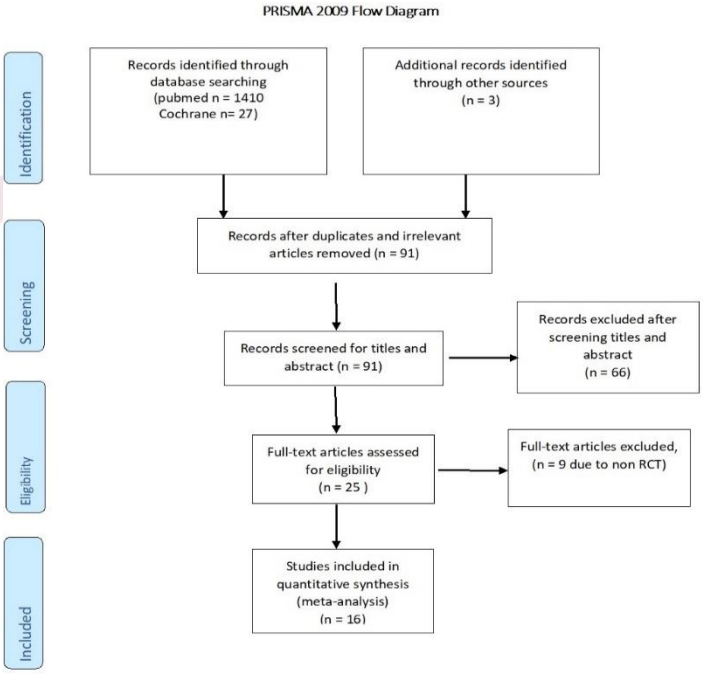

Figure 1: Flow diagram of an electronic search.

Study quality and risk of bias assessment

Two reviewers worked independently to search for and assess studies for their methodological quality applying the Cochrane collaboration's tool for assessing the risk of bias. (Cochrane handbook for systematic reviews of interventions; Higgins and Green 2011). This tool includes seven entries: random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data, selective reporting and other bias (Figure 2a and 2b). If more than two high-risk entries, it was considered of low quality; else it was considered to be of high quality.

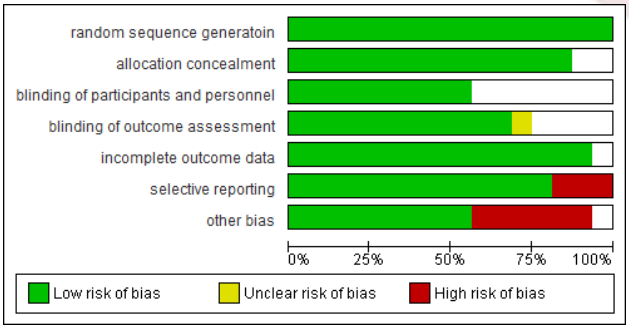

Figure 2a: Risk of bias graph.

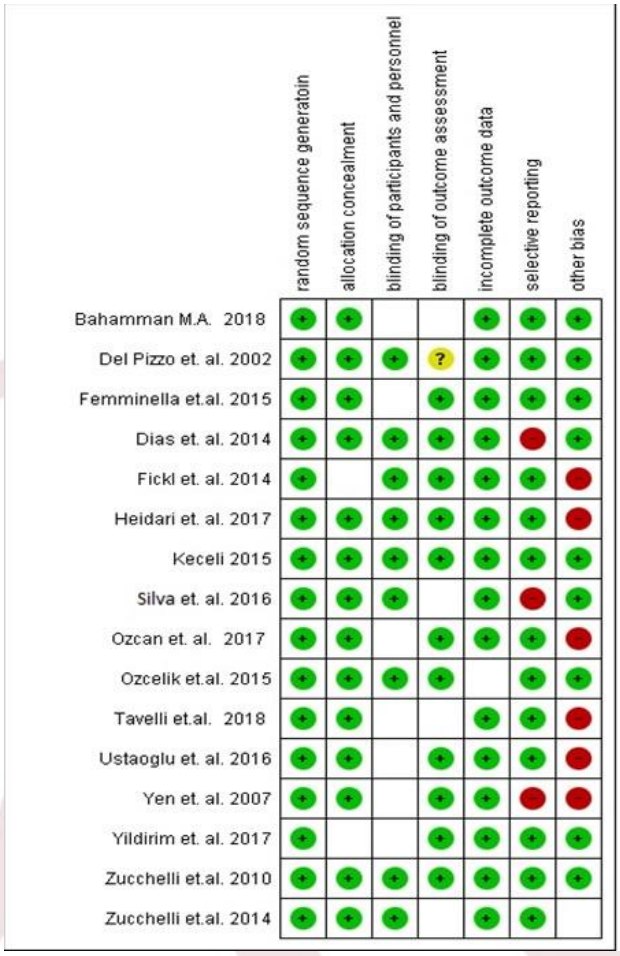

Figure 2b: Risk of bias summary: review authors' judgments about each risk of bias item for each included study.

Statistical analysis

A meta-analysis of the studies was not possible due to heterogeneity in trial design and outcomes reported. Therefore, the data related to included trial quality was subjected to narrative synthesis. Trial quality was assessed using the critical appraisal skills program and Prisma-2009 check-list.

Results

Search results

1407 articles were found in PubMed and 20 articles from the Cochrane library database. Bibliography of the selected articles was also screened and found 4 articles missed from the databases. Duplicates and irrelevant articles were removed using endnote x8.0.1.0 software. Finally, 25 articles were assessed for full-text review. 9 articles were excluded that does not fulfil the eligibility criteria. Finally, 16 studies were included in the studies.

14 studies were RCTs, 2 studies were performed in a split-mouth design [35,36]. 2 studies comparing FGG & CTG [19,37]; 1 study comparing different techniques of CTG [31]; 2 studies shows the effect of graft dimension [38,39]; 12 studies shows the Effect of different adjunct to graft harvesting procedure for reducing patient morbidity- 1 use Medicinal plant extract (MPE) [40],1 used Hyaluronic acid (HA) in two different concentration [41], 1 used Platelet concentrate (PC) [35], 4 used PRF [2,30,42,43], 1 used haemostatic agent for dressing palatal wound [39], 4 studies determine the effect of Photo biomodulation on palatal wound healing [36,44-46]

Outcome variables

Studies that determine the patient morbidity on palatal donor site as: (A) Pain according to VAS (B) Pain assessed according to number of analgesics pills taken (C) Discomfort as VAS (D) Altered in feeding habits as VAS recorded till (1day-3

weeks) after surgery with various graft technique and various measures implemented in palatal donor area to reduce morbidity.

Study populations

Systemically and periodontally healthy patient with no history of taking medication or surgery in the involved site was done in the past 6 months were included in selected final articles. Mean age available in 14 included studies while one used [35] age range and two studies [2,38] did not mention age and sex distribution. Other 13 included studies provided sex distribution.

The sample size ranged from 12 to 125 and the follow-up period for the post-operative morbidity from the day of surgery to 3 months. Postoperative morbidity was calculated from the questionnaires taken after the surgery. The loss to follow up was reported in all studies and 6 studies show the number of Patients lost in follow up [2,30,35,40,44,45].

14 of the studies included the non- smoker patients whereas 2 studies contain patient who smokes less than 10 cigarettes per day[37,38] and 1 study included 3 smokers in each group. 5 studies used an acrylic stent in the palatal donor site after the harvesting procedure [2,29,30,35,41]. Two studies [37,38] applied equine-derived collagen derivative in the palatal donor site. 3 studies did not provide medication after the surgery [30,41,46] and one study did not mention about any medication [40]while other 13 studies provided analgesics if necessary for at least 3 days. 8 of the studies used Full Mouth Bleeding Score (FMBS), and Full Mouth Plaque Score (FMPS) <20% before surgery [2, 19, 37-40, 42, 46]. 8 studies did not mention FMBS and FMPS [30,31,35,36, 41,43-45].

Interventions

2 studies compared free gingival graft with connective tissue graft [19,37]. 4 of the studies compared the effect of low-intensity laser treatment over the palatal wound. [36,44-46] in which One of the studies compared two power densities [45].9 studies used a different adjunct to the palatal donor site after harvesting the graft: 4 studies used PRF on the palatal wound [2,30,42,43]; 1 study used platelet concentrate [35]; 1 study used hyaluronic acid on the donor wound [41], and another used medicinal plant extract to compare the effect over postoperative complications [40], 1 used haemostatic agent for dressing palatal wound [39].

2 study was conducted to determine the effect of a different dimension of the graft on the morbidity [38, 39]; 1 study compared three graft harvesting technique (SI, Modified SI, and TD) of CTG [31].

Reported outcome variables

Since pain is the perception of the patient which is recorded either VAS score or amount of analgesics taken by the patient. Patient morbidity on the donor site was reported as the subjective perception of pain, discomfort, feeding habit according to the VAS. The pain was also monitored according to the mean amount of pain killer assumptions. 10 studies described pain in relation to VAS score [2,29-31,35,36,39,41,43,46], 11 studies described pain in relation to analgesics pills taken [2,31,36-40,42-45], 6 studies measured pain as discomfort in VAS score [19,37,38,42,44, 45], and , 6 studies measure VAS Inability to chew: [19,30,37,38,42,46]

Pain as vas score was taken one- week postoperatively in 8 studies; two studies recorded VAS from day 1 to day 7[30, 46]. All provided VAS score in mean ± SD with one study presented in avg. Pain as a painkiller assumption was determined by mean ± SD, number of pills in mg. Feeding habit was measured as altered to feeding habit or inability to chew.

Description of eligible studies (shown in Table 3)

One study compared FGG, single incision and trap door method [19]. Single Incision (SI) and Trap Door [47] method result in less postoperative pain, discomfort and inability to chew. Another study compared Single incision, Modified- single incision and Trap door method [31] and found less morbidity with Single incision techniques although the VAS score for pain was insignificant. Another study shows a similar result in relation to discomfort, inability to chew [37]. The study shows discomfort with CTG with Trap Door less than FGG but non-significant, whereas inability to chew was statistically significant and less in CTG with Trap Door group. However, pain in relation to pain killer consumption was found more in CTG with Trap door compared to FGG. TD shows necrosis on donor site which may be the reason for high pills intake in the TD group.

One study determines the influence of the dimension of graft in patient morbidity. Bigger graft shows significantly high VAS score in terms of post-operative discomfort and inability to chew [38]. Another study determines no effect of thickness and height of graft in pain. But with an increase in 14mm width, pain on the donor site increases significantly [39].

Study (Year)	Country	Study Design	Number of patients (m/f, mean age)	Inclusion Criteria	Loss of follow up	Postoperative medication	Post-operative donor site care with other material /Palatal stent	Graft size (GRT/GRH/GRW) in mm	Laser parameter
Zucchelli et.al. (2010) 37	Italy	RCT	50 (22/28, 34.7)	miller's class I and II recession defects >=2mm in depth, periodontally and systemically healthy, no medications taken for at least 6 months that interfere with tissue healing, no periodontal surgery on involved site smokes<10 cigs /day, FMPS <20%, FMBS<15%	0	Ibuprofen 600 mg	Equine-derived collagen (GABA VEBAS, San Giuliano Milanese, MI, Italy) used in the test group to protect donor site	Test 1.32±0.16/ 6.28±0.97/ 10.96±0.37 Control 1.34±0.26/ 6.16±0.89/ 10.72±0.84	…
Del Pizzo et.al. (2002) 19	Italy	RCT (Pilot Study)	36 (9/27, 31.7)	Miller's class I, II and III recession defect > 3mm, nonsmoker, systematically healthy, FMPS <20% FMBS <20%	0	Azithromycin 500 mg	Not used	1-1.5/ 8 /12	
Keceli et.al. (2014) 29	Turkey	RCT	40 (5/28, 30.82)	systemically healthy, nonsmoker, no history of periodontal surgery FMPS<20% FMBS<20%	7	not mentioned	The palatal stent used to protect donor site	test group (1.07±0.12 / 8.23±2.06/ 12.06±2.52) Control group (1.09±0.12 /	

								7.75±1.06/ 11.76±3.30)	
Yildirim et.al. (2017) 41	Turkey	RCT	36(9/27, 32.58)	>18 years, with ≤1mm width of gingiva, systemically healthy, no history of periodontal surgery, no medications or antibiotics in past 6 months, non-smoker, no pregnancy or lactating	0	no medication	The acrylic stent used to guide harvesting the graft but not to protect donor site	Test group 1 (1.13±0.18) test group 2 (1.18±0.16) Control group (1.17±0.15)	
Yen et.al. (2007) 35	Boston	RCT (split-mouth)	20(7/13, 30-70: age has been given in range)	At least 4 sites of gingival recession bilaterally, non-smokers and systematically healthy	1	Ibuprofen 800mg and Hydrocodone 5.0 mg	Surgical stent guide holes used to measure palatal donor thickness but not to protect donor site	control GRT (5.0±0.9) Test GRT (5.0±0.6)	
Ustaoglu et.al. (2016) 2	Turkey	RCT	40	systemically healthy, non -smoker, no periodontal surgery at experimental site FMPS<20% FMBS<20%	6	500mg paracetamol	An acrylic stent was to prepare to protect palatal donor site after surgery and non-eugenol pack	1.5/ 7/ 12mm	
Femminella et.al. (2015) 42	Italy	RCT	40(15/25, 32.4)	systemically healthy, no medications taken past 6 months, no pregnancy or lactation, non-smoker, no periodontal surgery on experimental site FMPS &FMBS <20%	0	2g/day amoxicillin plus clavulanic acid and oral ketoprofen	Not used	test (2.11±0.81 / 8.11±1.55/ 14.89±2.22) control (1.89±0.76 / 7.93±1.67/ 15.02±3.01)	
Zucche	It	R	60	>=18yrs, Miller	0	600mg	Equine-derived	test	

lli et.al. (2014) 38	aly	CT		Class I&II defect with ≥3mm depth systemically and periodontally healthy,smoke <10 cigs per day, no medications or previous periodontal surgery on the experimental site, FMPS &FMBS<15%,		Ibuprofen	collagen was used to palatal wound in both group	(1.12±0.14 / 3.80±0.40/ 11.13±0.82) Control (2.14±0.16 / 6.43±1.16/ 10.9±0.72)	
Dias et.al. (2014) 44	Brazil	RCT	40(15/17, 41.87)	Miller's I or II, systemically healthy, non-smoker, non-pregnancy or lactating, no medication or previous history of periodontal surgery	8	500mg sodium dipyrone	Not used	test (11.3±1.9) control (10.9±2)	Ga-Al-As diode laser 660nm,30 mw ,20s ,15j/cm2 (3j/cm2 per point;4s per point) after surgery and 7 more applications performed every other day
Heidari et.al. (2017) 36	Iran	RCT (split mouth)	12 (4/8, 40.2)	systemically and periodontally healthy, non-smokers, non-pregnant or lactating, no past history of surgery, lack of pain and infection at the time of surgery	0	NSAIDS Gelofen 400mg,	Not used	1/10/2020	Diode laser 660nm;200mW; continuous;32j/cm2 (4j/cm2 per point ;4s/point) 32s for after surgery day1,2,4 and 7
Silva et.al. (2016) 45	Brazil	RCT	54 (23/28, 43.4)	Miller's I or ii recession, 20-70yrs, systemically healthy, nonsmoker, non-pregnant or lactating, no past	3	500 mg sodium dipyrone	Not used	G60 length (12.17±2.0) G30 length	Ga-Al-As diode laser One group 60j=

				history of periodontal surgery				(11.24±2.1) G sham (12.91±3.6)	660nm;30 mW=60j/cm2;60s (30j/cm2/point)30s/point Other group 30j=660nm; 30mW=30j/cm2;30s (15j/cm2/point) 15s/point
Ozcelik et.al. (2015) 46	Turkey	RCT	52(26/26, 27.4)	systemically and periodontally healthy, no medications, no past history of surgery, nonsmokers, non-pregnant, FMPS<10%, FMBS<15%,	0	no medications	Not used	Test; GRT (1.24±0.12) Control; GRT (1.26±0.13)	Ga-Al-As 810nm 1W used to remove FGG and irradiated after surgery with total dose 4j/cm2 in test group
Ozcan et.al (2017) 30	Turkey	RCT	141(36.42)	systemically and periodontally healthy; no medication or past surgery; nonsmokers, FMPS <10%, FMBS <15%,	16	no medications	Not used	PRF group; GRT = (1.41±0.13) BC group; GRT (1.42±0.19) WG group; GRT (1.36±0.14)	Excision performed by Ga-Al-As at 45 degree taking care not to severe bone or periosteum
Bahaman (2018) 43	Sau	RCT	24 (14/10, 28.1	Periodontally and systematically healthy, non-smokers		1000 mg acetaminophen	Not used	1-1.5/12/7	

	diArabia		5)						
Tavelli et.al. (2018) 39	USA	RCT	44(15/29, 51.7)	>18yrs. Millers I II III, systemically and periodontally healthy, non - pregnant, no history of previous palatal harvesting, smokers who smoked≥10 cigarettes/day, FMBS and FMPS <15%,	0	600mg ibuprofen	Not used	Test (1.70±0.33 /4.68±0.84 / 13.87±4.12) control (1.59±0.33 /4.63±1.22 /13.32±4.32)	
Fickl et.al (2014) 31	Germany	RCT(Pilot Study)	36(5/31, 42.7)	Systemically healthy, non-smokers, probing depth≤3 mm, FMBS <10%	0	Ibuprofen 600 mg	Not used	1.5-2/ (15 / 8	

RCT= Randomised Control Trial; FMPS= Full Mouth Plaque Score; FMBS= Full Mouth Bleeding Score; GRT= Graft thickness; GRW= graft width; GRH= graft height

Table 2: Characteristics of included studies

				The significance of post-operative morbidity			
Study (year)	Country	Test	Control	PAIN			FEEDING HABIT (inability to chew)
				VAS score	Pain- killer assumption in mg	Discomfort as VAS score	VAS score
Zucchelli et. al. (2010) [37]	Italy	DGG	TD		NS #	NS #	SIG #
Del pizzo et.al. (2002)[19]	Italy	TD/SI	FGG			SIG #	NS #
Keceli et.al. (2014)[29]	Turkey	FGG+MPE	FGG+ WG	SIG*	NS #		
Yildirim et.al. (2017)[41]	Turkey	0.20% HA + FGG 0.8% HA + FGG	Placebo +FGG	SIG#			
Yen et.al. (2007)[35]	Boston	CTG+PC	Placebo + CTG	NS#			
Ustaoglu et.al. (2016)[2]	Turkey	FGG + T-PRF	FGG	NS#	NS#		
Femminella et.al. (2015)[42]	Italy	FGG + PRF	FGG		NS #	sig #@ $	sig @#$
Zucchelli et.al. (2014)[38]	Italy	SMALL graft group	BIG graft group		SIG #	SIG #	SIG #
Dias et.al. (2014)[44]	Brazil	CTG+ Diode (LLLT)	CTG+ Sham		NS #	NS #@	
Heidari et.al. (2017)[36]	Iran	FGG+ Diode laser	FGG+ Sham	NS#	NS #		
Silva et.al. (2016)[45]	Brazil	CTG+ PBM 60 J/cm2	CTG + Sham		NS #	NS#	

		CTG+ PBM 30 J/ cm2					
Ozcelik et.al. (2015)[46]	Turkey	DGG-L+ FGG	DGG-B+FGG	SIG*			SIG #
Ozcan et.al. (2017)[30]	Turkey	FGG+ PRF+ BC	FGG+ WG	SIG*@			SIG @#
		FGG+BC	FGG+ WG	SIG*@			
Bahamman (2018)[43]	Saudi Arabia	FGG+ PRF	FGG	SIG%*	SIG %		
Taveli et.al. (2018)[39]	USA	FGG+ Hemostatic collagen+ Cyanoacrylate	FGG+ Hemostatic collagen	Sig*@	Sig*		
Fickl et.al. (2014)[31]	Germany	SI + Modified SI	TD	NG*	SIG*		

VAS score taken after 1 week postoperatively * VAS score taken from day 1 to 7 postoperatively;@ VAS score taken 2 week postoperatively;$ VAS score taken 3 week postoperatively;% VAS score taken till day 3 postoperatively; DGG= De-epithelialized gingival graft; TD= Trap door; SI= Single incision; MPE= Medicinal plant extract; WG= Wet guaze; HA= Hyaluronic acid; PC= Platelet concentrate; PRF= Platelet rich fibrin; T-PRF= Titanium prepared PRF;LLLT= Low level laser therapy; PBM= Photo biomodulation; BC= Butyl cyanoacrylate; DGG-L= De-epithelialized gingival graft using Laser; DGG-B= De-epithelialized gingival graft using Blade

Table 3: Results of included studies

Four studies compared the effect of low power laser in the palatal wound healing. These studies utilized different laser parameters for the Photo biomodulation on the donor site. One study used a diode laser (wavelength 810nm and power 1W) (Picasso 7watt, AMD LASER, Indianapolis, USA) for the excision of the graft [46]. VAS score for pain was recorded from the first day to day 7 postoperatively which shows significantly less pain in the test group. Functional limitations, physical disability, physical pain was recorded as the quality of life assessed using the Turkish version of OHIP-14 which shows significantly less morbidity effect on the test group.

Other three studies using low-level laser treatment for Photo biomodulation shows the nonsignificant difference in relation to pain, discomfort [36, 44, 45]. One study used a diode laser (THOR laser, London, UK). Postoperative pain was measured on the day of surgery for the first 8 hours. First 3 hours after surgery, the test group presented significantly more vas score for pain than the control group. However, the pain was more with control for a second to 12 days but was not statistically significant. The number of NSAIDs intake was more in the test group in the first two days than the control group but not significantly [36]. One study used a Ga-AI-As low laser [44] whereas another study compared the effect of two power densities (60 & 30) on the healing of the palatal wound [45] and found no significant difference in relation to postoperative pain and discomfort.

9 studies used different adjunct over the palatal wound. 3 studies used PRF over the palatal wound and found a significant reduction in pain, discomfort in the test group and increased feeding habit. [30, 42, 43]. One study shows a significant reduction in pain from the day of surgery to day7 and day 14 postoperative [30].

One study used titanium prepared PRF [2] and another study used platelet concentrate [35] over the palatal wound and found no significant difference in terms of pain.

One study used hyaluronic acid of two different concentration (0.2% and 0.8%) and found significantly less pain than the control group. 0.2% hyaluronic acid shows quick pain relief than 0.8% HA [41]. Another study used a haemostatic agent and found a significant difference for 7,10 and 14day post surgically. It also found that pain was not associated with the depth of the graft but depends on the width of the graft. Graft width > 14mm shows significantly more pain as vas score for 3,4,6,7,10 and 14th day post-surgically [39]. One study used medicinal plant extract and found less vas score for the first 6 days after surgery. There was no significant difference after day 7 [29].

Discussion

FGG shows to be less favourable with postoperative morbidity in donor site compared to CTG which is thought to be due to the secondary intention of healing in FGG [16-19,28]. The postoperative pain and discomfort associated with FGG was not only due to the type of palatal wound healing but also associated with the height and depth of the wound on donor palatal site [32, 38] probably associated with injury to a large-sized nerve/vessel, causing greater pain [39]. When a CTG harvesting technique is performed, some connective tissue must be left to maintain the vitality of the primary flap, and due to the closed wound, CTG shows less postoperative morbidity [4,27]. Single-incision technique is found to be the most acceptable for the donor site as it is safer than TD in terms of pain and necrosis [18,23,31,37]. SI is less invasive with the improved blood supply of the flap favouring primary wound closure. [4,25,31].

Selection of the graft harvesting technique depends upon the amount of palatal mucosa. The primary access flap must include both epithelium and connective tissue that is critical for its viability. It can be suggested that when 2 mm or more of soft tissue thickness can be left to cover the palatal bone, donor site shows less postoperative morbidity. CTG harvesting techniques are preferred because primary intention wound healing results in very limited pain and a better postoperative course in terms of patient stress and ability to chew. If the palatal soft tissue is not thick enough, it consists only or prevalently of epithelium and might result in necrosis/dehiscence during the first healing phase. As a result, the palatal wound heals by secondary intention due to primary flap dehiscence/necrosis caused by sloughing of the primary flap which is the main cause of marked post-operative discomfort [4,5,18,19,23,31,37]. It can be speculated that the more painful postoperative course due to secondary intention wound healing might be due to some infection of the wound favoured by tissue necrosis and/or from the greater depth reached during the harvesting technique [37]. In this situation, the ambition is to harvest a partly de-epithelialized free gingival graft [37,48,49]. Postoperative pain and discomfort was mainly associated with the dimensions of the graft extracted from the donor site and the remaining tissue on the donor wound [32,38]. With each millimetre increase in the thickness of the graft, pain value increases and found an inverse relation with palatal mucosal thickness for the first week. But one study found no difference in VAS score in relation to the height and thickness of the graft. Vas was found significantly affected by the width which was more in graft width > 14mm [39]. Larger the dimensions of the palatal wound, result in larger wound area which increases the discomfort and that too alters the feeding habit. Soft tissue thickness remaining on the palatal bone affect the discomfort for the patient. The thickness of the remaining soft tissues covering the palatal bone is found to be associated with the patients' post-operative discomfort, therefore 2 mm or more of soft tissue should be left to cover the bone [37]. Bigger and thicker CTG results in the thin tissue covering the palatal wound that increases the risk of covering flap dehiscence and consequently graft exposure that increases discomfort [38]. It could be speculated that various adjunct material applied over the palatal wound may have produced the same protective effects as a thick residual layer of connective tissue.

Inflammation and cellular migration, proliferation and differentiation are crucial processes for successful healing [50,51]. The highest pain was perceived on the first post-surgical day and then gradually decreases in the subsequent healing period [32]. Duration of the procedure also shows the effect on postoperative morbidity. Lengthy surgical procedures

may create extensive tissue injury, prolong vasodilation that permits more fluid to accumulate in the interstitial spaces, and results in a higher level of biologic mediators released by inflammatory and resident cells. [28]

Protection of the palatal wound with soft tissue or adjunct closing the donor site has a positive effect on wound healing and reduce associated pain that minimizes patient discomfort [16, 52]. If the palatal wound is maintained and protected during the healing period, no differences could be found between CTG and FGG groups in terms of pain and morbidity. Hence, the utilization of the adjunctive agent seems to be critical for minimization of postoperative pain. [39]

Various adjunct like Platelet concentrate, platelet-rich fibrin (PRF), titanium- based platelet rich fibrin, hyaluronic acid (HA), haemostatic agent and medicinal plant extract (MPE) has been used in the donor site which is found to reduce postoperative pain and discomfort significantly. One of the most important advantages of using adjunct over the palatal donor site is wound protection from surrounding external irritants, reducing postoperative pain and discomfort with acceleration in wound healing. [30,43]. It is thought that MPE, HA, a haemostatic agent, PRF provide the complete seal and protection of the wound via cellular proliferation, vascular dynamics, antimicrobial activity, and provide an extracellular matrix for the earlier connective tissue healing that reduces postoperative morbidity on the donor site [53-55].

Low-level laser treatment has been thought to bio stimulate and accelerate wound healing, stimulating the process of regeneration and epithelialization [56], promote provisional matrix and wound reorganization [57] resulting in less postoperative pain [58]. But no significant difference was recorded in terms of discomfort and analgesic intake, after the photo biomodulation of the donor site after excision of the graft whereas one study shows a significant reduction in postoperative discomfort in laser therapy group. This can be due to the mode of excision performed by laser whereas in the other two study excision was performed by knife and photo biomodulation was performed in the palatal wound. [46]. It can be assumed that during blade excision periosteum was injured whereas during laser excision care was taken not to injure the periosteum resulting in a minimal depth of excision than the blade and result in less discomfort.

Conclusion

It is common to have post-operative discomfort on the palatal donor site after harvesting the graft with any techniques but can be minimized to some extent. The closed wound on donor site is found to be less associated with the postoperative morbidity. In CTG or with adjunct, the palatal wound is protected from external irritant reducing postoperative pain and discomfort. Further research should be carried out with the most reliable graft harvesting technique with minimal postoperative morbidity on the palatal donor site.

References

Bednarz W (2016) Augmentation of the hard palate thin masticatory mucosa in the potential connective tissue donor sites using two collagen materials-Clinical and histological comparison. Ann Anat 208: 78-84.

Ustaoglu G, Ercan E, Tunali M (2016) The role of titanium-prepared platelet-rich fibrin in palatal mucosal wound healing and histoconduction. Acta Odontol Scand 74(7): 558-564.

Bertl K, et al., (2015) Relative Composition of Fibrous Connective and Fatty/Glandular Tissue in Connective Tissue Grafts Depends on the Harvesting Technique but not the Donor Site of the Hard Palate. J Periodontol 86(12): 1331-1339.

Harris RJ (1997) A comparison of two techniques for obtaining a connective tissue graft from the palate. Int J Periodontics Restorative Dent 17(3): 260-71.

Aguirre-Zorzano LA, et al., (2017) Complications of harvesting a connective tissue graft from the palate. A retrospective study and description of a new technique. J Clin Exp Dent 9(12): e1439-e1445.

Hsieh PC, et al., (2010) Elastin in oral connective tissue modulates the keratinization of overlying epithelium. J Clin Periodontol 37(8): 705-711.

Okazaki M, et al., (2003) Effects of subepithelial fibroblasts on epithelial differentiation in human skin and oral mucosa: heterotypically recombined organotypic culture model. Plast Reconstr Surg 112(3): 784-792.

Muller HP, et al., (2000) Thickness of masticatory mucosa. J Clin Periodontol 27(6): 431-436.

Monnet-Corti V, et al., (2006) Connective tissue graft for gingival recession treatment: assessment of the maximum graft dimensions at the palatal vault as a donor site. J Periodontol 77(5): 899-902.

Benninger B, Andrews K, Carter W (2012) Clinical measurements of hard palate and implications for subepithelial connective tissue grafts with suggestions for palatal nomenclature. J Oral Maxillofac Surg 70(1): 149-153.

Song JE, et al., (2008) Thickness of posterior palatal masticatory mucosa: the use of computerized tomography. J Periodontol 79(3): 406-412.

Reiser GM, et al., (1996) The subepithelial connective tissue graft palatal donor site: anatomic considerations for surgeons. Int J Periodontics Restorative Dent 16(2): 130-137.

Schacher B, et al., (2010) Direct thickness measurements of the hard palate mucosa. Quintessence Int 41(8): e149-e156.

Studer SP, et al., (1997) The thickness of masticatory mucosa in the human hard palate and tuberosity as potential donor sites for ridge augmentation procedures. J Periodontol 68(2): 145-151.

Sullivan HC, Atkins JH (1968) Free autogenous gingival grafts. I. Principles of successful grafting. Periodontics 6(3): 121-129.

Farnoush A (198) Techniques for the protection and coverage of the donor sites in free soft tissue grafts. J Periodontol 49(8): 403-405.

Wessel J, Tatakis D (2008) Patient outcomes following subepithelial connective tissue graft and

free gingival graft procedures. Journal of periodontology 79: 425-430.

Jahnke PV, et al., (1993) Thick free gingival and connective tissue autografts for root coverage. J Periodontol 64(4): 315-322.

Del Pizzo M, et al., (2002) The connective tissue graft: a comparative clinical evaluation of wound healing at the palatal donor site. A preliminary study. J Clin Periodontol 29(9): 848-854.

Langer B, Calagna L (1980) The subepithelial connective tissue graft. J Prosthet Dent, 1980. 44(4): 363-367.

Raetzke PB (1985) Covering localized areas of root exposure employing the "envelope" technique. J Periodontol 56(7): 397-402.

Liu CL, Weisgold A (2002) Connective tissue graft: a classification for incision design from the palatal site and clinical case reports. Int J Periodontics Restorative Dent 22(4): 373-379.

Edel A (1974) Clinical evaluation of free connective tissue grafts used to increase the width of keratinised gingiva. J Clin Periodontol 1(4): 185-196.

Hurzeler MB, Weng D (1999) A single-incision technique to harvest subepithelial connective tissue grafts from the palate. Int J Periodontics Restorative Dent 19(3): 279-287.

Lorenzana ER, Allen EP(2000) The single-incision palatal harvest technique: a strategy for esthetics and patient comfort. Int J Periodontics Restorative Dent 20(3): 297-305.

Brasher WJ, Rees TD, Boyce WA (1975) Complications of free grafts of masticatory mucosa. J Periodontol 46(3): 133-138.

Roman A, et al., (2012) Patient-centered outcomes after subepithelial connective tissue grafts and coronally advanced flaps. Quintessence Int 43(10): 841-851.

Griffin TJ, et al., (2006) Postoperative complications following gingival augmentation procedures. J Periodontol 77(12): 2070-2079.

Keceli H, et al. Evaluation of palatal donor site haemostasis and wound healing after free gingival graft surgery. Journal of clinical periodontology 42: 582-589.

Ozcan M, et al., (2017) Effects of Platelet-Rich Fibrin on Palatal Wound Healing After Free Gingival Graft Harvesting: A Comparative Randomized Controlled Clinical Trial. Int J Periodontics Restorative Dent 37(5): e270-e278.

Fickl S, et al., (2014) Early wound healing and patient morbidity after single-incision vs. trap-door graft harvesting from the palate--a clinical study. Clin Oral Investig 18(9): 2213-2219.

Burkhardt R, Hammerle CH, Lang NP (2015) Self-reported pain perception of patients after mucosal graft harvesting in the palatal area. J Clin Periodontol 42(3): 281-287.

Curtis JW, Hutchinson RA (1981) Mucous extravasation phenomenon of the hard palate following periodontal surgery. J Periodontol 52(12): 750-752.

Adcock JE, Spence D (1984) Unusual wound healing following removal of donor tissue for soft tissue graft. J Periodontol 55(10): 589-591.

Yen CA, et al., (2007) Effects of platelet concentrate on palatal wound healing after connective tissue graft harvesting. J Periodontol 78(4): 601-610.

Heidari M, et al., (2017) Effect of laser photobiomodulation on wound healing and postoperative pain following free gingival graft: a split-mouth triple-blind randomized controlled clinical trial. Journal of photochemistry and photobiology. B, biology 172: 109-114.

Zucchelli G, et al., (2010) Patient morbidity and root coverage outcome after subepithelial connective tissue and de-epithelialized grafts: a comparative randomized-controlled clinical trial. J Clin Periodontol 37(8): 728-738.

Zucchelli G, et al., (2014) Does the dimension of the graft influence patient morbidity and root coverage outcomes? A randomized controlled clinical trial. J Clin Periodontol 41(7): 708-716.

Tavelli L, et al., (2018) Pain perception following epithelialized gingival graft harvesting: a randomized clinical trial. Clin Oral Investig.

Keceli HG, et al., (2015) Evaluation of palatal donor site haemostasis and wound healing after free gingival graft surgery. J Clin Periodontol 42(6): 582-589.

Yildirim S, et al., (2017) Effect of Topically-Applied Hyaluronic-Acid on Pain and Palatal Epithelial Wound Healing: An Examiner-Blind, Randomized, Controlled Clinical Trial. J Periodontol pp: 1-14.

Femminella B, et al. (2016) Clinical Comparison of Platelet-Rich Fibrin and a Gelatin Sponge in the Management of Palatal Wounds After Epithelialized Free Gingival Graft Harvest: a Randomized Clinical Trial. Journal of periodontology 87: 103-113.

Bahammam MA (2018) Effect of platelet-rich fibrin palatal bandage on pain scores and wound healing after free gingival graft: a randomized controlled clinical trial. Clin Oral Investig.

Dias SB, et al., (2015) Effect of GaAIAs low-level laser therapy on the healing of human palate mucosa after connective tissue graft harvesting: randomized clinical trial. Lasers Med Sci 30(6): 1695-1702.

Silva NF, et al. (2016) Comparison of two power densities on the healing of palatal wounds after connective tissue graft removal: randomized clinical trial. Lasers in medical science 31: 1371-1378.

Ozcelik O, Seydaoglu G, Haytac CM (2016) Diode laser for harvesting de-epithelialized palatal graft in the treatment of gingival recession defects: a randomized clinical trial. J Clin Periodontol 43(1): 63-71.

Batdorf NJ, et al., (2015) Enhanced recovery after surgery in microvascular breast reconstruction. J Plast Reconstr Aesthet Surg 68(3): 395-402.

Bosco AF, Bosco JM (2007) An alternative technique to the harvesting of a connective tissue graft from a thin palate: enhanced wound healing. Int J Periodontics Restorative Dent 27(2): 133-139.

McLeod DE, Reyes E, Branch-Mays G (2009) Treatment of multiple areas of gingival recession using a simple harvesting technique for autogenous connective tissue graft. J Periodontol 80(10): 1680-1687.

Grzesik WJ, Narayanan A (2002) Cementum and periodontal wound healing and regeneration. Crit Rev Oral Biol Med 13(6): 474-484.

Pitaru S, McCulloch CA, Narayanan A (1994) Cellular origins and differentiation control mechanisms during periodontal development and wound healing. J Periodontal Res 29(2): 81-94.

Rossmann JA, Rees TD (1999) A comparative evaluation of hemostatic agents in the management of soft tissue graft donor site bleeding. J Periodontol 70(11): 1369-1375.

Dohan Ehrenfest DM (2010) How to optimize the preparation of leukocyte- and platelet-rich fibrin (L-PRF, Choukroun's technique) clots and membranes: introducing the PRF Box. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 110(3): 275-278.

Dohan Ehrenfest DM, et al., (2009) Slow release of growth factors and thrombospondin-1 in Choukroun's platelet-rich fibrin (PRF): a gold standard to achieve for all surgical platelet concentrates technologies. Growth Factors 27(1): 63-69.

Naik B, et al., (2013) Role of Platelet rich fibrin in wound healing: A critical review. J Conserv Dent 16(4): 284-293.

Dawood MS, Salman D (2013) Low level diode laser accelerates wound healing. Lasers Med Sci 28(3): 941-945.

Wang CY, et al., (2015) Light-emitting diode irradiation promotes donor site wound healing of the free gingival graft. J Periodontol 86(5): 674-681.

Almeida AL et al., (2009) Utilization of low-intensity laser during healing of free gingival grafts. Photomed Laser Surg 27(4): 561-564.