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Evaluating the clinical healing patterns of whale's tail technique by different healing indices- A clinical study

Corresponding Author and 1st author: Dr. Rudhra.K MDS*

Senior lecturer, Department of periodontics

Sree Balaji Dental College and Hospital

Pallikaranai, Chennai

Email ID: rudhrakannan97@gmail.com

Co-author 2:

Dr. Vennila K

Reader

Department of Periodontics

Vivekananda dental college for women

Elayampalayam, Namakkal

Gmail: vennilamds@gmail.com

Co-author 3:

Dr. SHIFA AFSHAN HASSAN BAKKEER

Post graduate student

Vivekananda dental college for women

Elayampalayam, Namakkal

Gmail: afshanshifs96@gmail.com

Co-author 4:

Dr. SHAKERON.S

Post graduate student

Vivekananda dental college for women

Elayampalayam, Namakkal

Gmail: shakeron.s@gmail.com

Co- author 5:

Dr.Yokataa Geetha Saravanan,

Lecturer,

Vinayaka Mission's Sankarachariyar Dental College,

Vinayaka Mission's Research Foundation [Deemed to be University].

Email id: yokataasaravanan@gmail.com

Co-author-6:

Dr Sajid Hussain

Reader

Sree Balaji dental college and hospital

Email id: sajid2000@gmail.com

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Abstract

Whale tail technique a type of papilla preservation surgery is used in wide interdental spaces involving semilunar incisions. Since it involves wider surgical zone, its healing pattern needs to be assessed. Hence for post-surgical wound monitoring two healing indices were analysed. Early healing changes were assessed by new index Early wound healing score (EHS) for monitoring the periodontal soft tissues 24 hours after surgical incision. Following this, healing changes at different time intervals were assessed by Landry healing index to derive the clinical patterns of healing in wide semilunar incisions. 20 patients indicated for whale's tail technique were included in the study, the postoperative monitoring done were at 24 hours to assess EHS to observe the re-epithelization, hemostasis and inflammation. Landry index was assessed at different time intervals at 1 week, 2 weeks and 1 month to derive the tissue changes in terms of color, incision margin, bleeding, and contours. With these indices, the clinical patterns of healing were documented in wide surgical areas.

Keywords: wound healing, soft tissue injuries, periodontal, inflammation

INTRODUCTION

Periodontal regeneration is the primary concept in restoring the lost periodontium by periodontal disease activity to its original tissue volume. For a successful periodontal regeneration primary closure of both hard and soft tissue defects are the essential component for a better clinical outcome. Lack of primary flap closure leads to clot dislodgement, delayed healing, and unpredictable graft outcomes.

Conventional surgical approaches make flap coverage difficult in interdental papillary areas when regenerative procedures are needed and it can also create "gingival craters" in the interproximal areas due to shrinkage during surgical healing. Hence for complete coverage papilla preservation techniques are indicated.[1,2]

Various surgical approaches are available in Papilla preservation technique to obtain primary closure of flap and to preserve interdental tissue. In these approaches Whales tail technique was first introduced by **Bianchi and Basseti in 2009**[3] to preserve interdental tissue and for primary closure in guided tissue regeneration Preserving papilla increases soft tissue healing and enhance the result of the periodontal reconstruction. The flap design with incision at the base of the papilla collapse the vascular network which may compromise the nutrition

to the overlaying soft tissue ultimately increase the risk of wound dehiscence during the early healing period. These circumstances of soft tissue collapse can be prevented by WHALES TAIL TECHNIQUE by improving the soft tissue integrity and vascularization eventually maintaining the esthetics and periodontal regeneration approach.[4,5,6]

It is important to understand that in the process of wound healing after periodontal therapy a complex set of biologic communications happens. If the sequence is altered, chronic disruption of the protective barrier may lead to various abnormalities. Wound healing basically intricate mechanisms at the ultracellular and cellular level that represents a dynamic process with several cell types and biologic mediators.

Full thickness mucoperiosteal flap heals by following histological events such as a fibrin clot first forms at the flap to bone interface and after 2 days inflammatory phase begins. At 4 days proliferative phase is evident by angioblasts and fibroblasts and continues to increase. The junctional epithelium will be completely renewed by the second week and at third week first histological evidence of new connective tissue attachment happens. Within three months, the healing will have dominant features of connective tissue maturation and osseous remodelling.[7,8,9]

This study helps to find out the surgical wound healing changes happening after wide area of incisions and early healing pattern were assessed by new healing index EHS description given by Marini L et al and further healing process were assessed by Landry healing score. These indices help to define the clinical aspects of primary healing at incisions and independently assess and integrate the different clinical aspects at surgical healing wounds. With these observational changes, clinical patterns of whale's tail technique have been described.

MATERIALS & METHODS

20 patients with wide interdental spaces >2 mm with infrabony defect and probing depth >6 mm indicated for whale's tail technique were included for the study to analyse the clinical healing pattern.

Surgical protocol

Local anesthesia with adrenaline (1:1,00,000) was administered by supraperiosteal infiltration and bleeding points were marked. Two semilunar incisions were made on either side of maxillary labial frenum resembling whale tail shape. Intrasulcular incisions were given on the buccal, interdental, and palatal aspects of the central incisors as a continuing

incision from the distal aspect. Full thickness mucoperiosteal flap was separated from the buccal aspect as a thick, broad papilla-preserving flap. The tail flap was elevated from the buccal to the palatal aspect and osseous morphology was evident with a depth of 7 mm. Flap debridement and trimming using scissors was performed along with osteoplasty. Regenerative procedure was done with a xenograft (fixoss) along with platelet rich fibrin as a barrier membrane. Flap was approximated to its original position firmly and perimeter sutures were placed using non -resorbable 4-0 sutures followed by periodontal dressing.

Patients healing pattern were analysed at different time intervals at 24 hours, 1 week, 2 weeks, 1 month. (Figure 1-4)

Early healing scoring system gives the description of immediate post operative healing changes of the wide semilunar incisions in the anterior zone

Landry et al index which grades the wound on a scale of 1–5, where 1 indicates very poor healing and 5 indicates excellent healing is used to derive the wound changes (Table 1)

Table 1: LANDRY HEALING INDEX

SCORING	CRITERIAS
very poor	Tissue color: ≥50% of gingiva red Response to palpation: Bleeding Granulation tissue: Present Incision margin: Not epithelialized, with loss of epithelium beyond incision margin.
Poor	Tissue color: ≥50% of gingiva red Response to palpation: Bleeding Granulation tissue: Present Incision margin: Not epithelialized, with con nective tissue exposed
Good	Tissue color: ≥25% and < 50% of gingiva red Response to palpation: No bleeding Granulation tissue: None Incision margin: No connective tissue exposed
Very good	Tissue color: <25% of gingiva red Response to palpation: No bleeding Granulation tissue: None Incision margin:

	No connective tissue exposed
Excellent	Tissue color: All tissues pink Response to palpation: No bleeding Granulation tissue: None Incision margin: No connective tissue exposed

Clinical patterns of healing were noted according to Landry criteria evaluating the color change, contour, consistency, inflammatory signs, and probing depth. (Figure 1-4)

TABLE 2: CLINICAL ASSESSEMENT OF HEALING BY EHS DESCRIPTION (Marini L et al index[10])

SEMILUNAR INCISIONS	**CSI**	**CSH**	**CSR**	**TOTAL EHS**
1	0	2	6	8
2	2	0	3	5
3	1	0	6	7
4	0	0	0	0
5	0	1	3	4
6	2	2	0	4
7	1	1	3	5
8	1	1	6	8
9	0	1	6	7
10	0	2	6	8
11	2	1	3	6
12	1	1	3	5
13	2	1	3	6
14	1	0	0	1
15	1	2	3	6
16	2	1	6	9
17	1	1	3	5
18	1	1	6	8
19	1	1	3	5
20	0	1	0	1

EHS: Early Wound Healing Score, CSR: clinical signs of re-epithelialization, CSH: clinical signs of haemostasis, CSI: clinical signs of inflammation.

Dark Red color- Inflammatory phase associated with haemostasis, inflammation, and early phase of epithelisation.

Dull red color- initiation of proliferative phase with increased re-epithelization and reduced inflammation

Green color- Complete re-epithelialization and haemostasis.

Table 3: WOUND MONITORING BY LANDRY HEALING INDEX

Time intervals	Mean values	SD
1 week	1.75	0.7864
2 weeks	3.25	0.4443
1 month	3.65	0.4894

P-value <0.0001. The result is significant at p <0.05

TABLE 4: CLINICAL PATTERNS OBSERVED ACCORDING TO LANDRY CRITERIA WERE AS FOLLOWS

TIME INTERVAL	PATTERNS OBSERVED
1 WEEK	After suture removal, Patient has reddish pink margin around incised areas, whale tail area demonstrated whitish zone with red striae, margins were attenuated not blended with the adjacent mucosa, with soft and oedematous consistency, rolled out marginal gingiva with blunt interdental papilla still evident, she had tenderness on palpation
2 WEEKS	Entire surgical area has turned to reddish pink in color, margins started blending with adjacent mucosa, with soft in consistency, it is demarcated from the adjacent mucosa by reddish line. No tenderness was reported
1 month	color changes to normal pink in color, with firm consistency, no demarcated margins evident from adjacent mucosa and probing depth reduced to 3 mm

Results

Early healing changes for all the patients were documented in table 2 indicating points for re-epithelization, hemostasis, and inflammation

One-way Anova analysis were used for finding the statistical significance at different time intervals for Landry wound healing index. Table 3 demonstrated the mean values of 1.75,3.25,3.65 at 1 week, 2 weeks and 1 month with statistically significant results with p value <0.0001

DISCUSSION

The important aspect of periodontal therapy is maintenance of esthetic area after pocket elimination therapy. In maxillary anterior region, papilla preservation technique is essential to maintain the papillary height and for maximizing postoperative esthetics.

The papilla plays an essential role in esthetic functionalities and serves as a biological barrier to protect the periodontal attachment apparatus. Papilla preservation flap was introduced by Takei et al 1985 had a detailed description of the surgical approach reported earlier by Genon allows for maintenance of intact interdental papilla in contrast to papilla splitting techniques. This procedure gave an optimal interproximal coverage and facilitated retention of bone graft material.[11,12,13]

After several modifications in this approach, Bianchi and Basseti in 2009 again gave a modification called “whale’s tail” technique to preserve interdental tissue in guided tissue regeneration for the treatment of wide intrabony defects in case of wide interdental spaces to allow accessibility as well as visibility of the defect. Recent studies have suggested that flap design have an impact on periodontal treatment outcomes in regenerative procedures.[14]

The study results were concordance with Vijay DM et al 2019, Mrunal DM et al 2016, with reduction of probing depth and complete radiographic fill. Patil et al 2019 used amnion membrane along with whale’s tail technique and reported complete bone fill in accordance with its radiographic bone fill which was demonstrated in these cases. [15,16,17]

The advantage of this technique is the pattern incision design distant from the defects resembling tail of the whale and biomaterial margins has reduced the percentage of flap dehiscence with uneventful healing pattern in terms of color, consistency, contour, and probing depth which has been recorded in this study. Furthermore, suturing technique indicated for this procedure distant from the regenerated defects has decreased the chances of

bacterial colonization which prevents from graft infection and rejection which also decreased patient postoperative discomfort.[18,19]

Retzepi *et al* compared simplified papilla preservation flap and modified Widman flap healing pattern which showed that gingival blood flow by simplified papilla preservation technique was higher to different parts of the periodontium that can have a positive effect on quality of the healing process. Similarly, whales tail technique although initial inflammatory phase associated with redness extends upto 2 weeks but at 1 month healing were improved by re-epithelisation and reduced inflammatory zones.[20,21]

Wound closure remains crucial for periodontal wound healing especially in regeneration. Hence it should be monitored to identify the early signs related to healing patterns. Such findings are to be addressed in different surgical procedures and surgeons should be aware of these changes to avoid further complications[22,23,24]

The early wound healing changes were assessed by EHS description scoring system[10] which helps to analyse clinical signs of re-epithelialization, haemostasis and inflammation at different time intervals which gives an idea of visual patterns of early healing changes happening at 24 hours interval (Table 2)

Post surgical monitoring after 1 week assessed by Landry index showed significant values with $P<0.001$ at different time intervals indicating favorable healing patterns for these techniques. This was in concordance with the wound healing assessment score given by Lingamaneni S et 2019 who suggested that the outcomes of gingival wound healing may be improved using LLLT after gingivectomy and gingivoplasty operations proved Landrey et al wound healing index.[25] (Table 3 &4)

Marini et al has concluded that in a vertical releasing incision case, EHS system proves to be a useful tool for assessing early wound healing by primary intention after surgery, similarly this study also addressed about the wound healing pattern using this index which was helpful in describing the clinical changes of wound healing in whales' tail technique[10] Hence the clinical changes happening at different time intervals were evaluated using two different healing indices to derive the patterns happening at early time intervals.

FIGURES

FIGURE 1- 24 hours post op



FIGURE 2 – 1 WEEK POST OP



FIGURE 3- 2 WEEKS POSTOP



FIGURE 4 – 1 MONTH POST OP



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