COMPARISON OF EXPANDED AND NON-EXPANDED FREE SOFT TISSUE AUTOGRAFTS: A CLINICAL COMPARISON

By

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A THESIS PRESENTED TO THE GRADUATE SCHOOL
OF THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
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TABLE OF CONTENTS

LIST OF FIGURES

Abstract of Thesis Presented to the Graduate School
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Background: Free gingival grafts (FGGs) have been used for over 40 years to create a widened zone of attached gingiva. They were initially described by Bjorn in 1963 and have been extensively investigated and used since. The traditional FGG technique extends the incisions to approximately twice the desired width to allow for 50% contraction when healing is complete. Expanding the donor tissue will allow for a more conservative donor site preparation and less post-operative pain experienced by the patient. Prior attempts to expand FGGs have had limited success. Medical techniques and instruments although, have been developed to accomplish skin graft expansion consistently. These techniques currently use dermatomes to harvest the skin grafts and tissue meshers to expand the grafts. The tissue expanders allow for expansion of donor tissue in an attempt to gain more coverage for burn patients and for patients that require extensive grafting procedures.

Methods: Fifteen patients with bilateral defects will be used for this study. The study design will be a split mouth design. One side will represent the experimental unit (FGG will be meshed) and the other side of the mouth will act as a control (a traditional FGG would be employed). The surgical technique would be identical for both sites, and would only differ by the mesh modification made in the donor tissue of the experimental unit.

Purpose: The purpose of this study is to investigate the healing effects of in vivo, free gingival grafts that have been modified by a tissue expander in patients with areas of inadequate attached gingiva. The FGG in order to see if less gingival donor tissue may be required to obtain satisfactory grafting results, and to observe the effects that expansion has on contraction after healing. Observations will also be made about aesthetics and color match. By perforating the FGGs we hope that the recipient tissue cells can profuse the donor tissue in order to help blend the borders of the graft.

CHAPTER 1
INTRODUCTION

Background

Skin grafts were utilized first by the ancient Egyptians. Some of the first documented reports were by Reverdin in 1869, when he successfully transplanted small thin epidermal grafts, but the foundation of modern skin grafting began when Thiersch and Wolfe developed the technique of split-thickness and full-thickness grafting in 1874. In 1894, the first intraoral skin grafting procedure was completed by Schnitzer and Bjorn; in 1963, was the first to demonstrate the value of autogenous free gingival grafts (FGGs) in periodontal therapy.

Gingival grafting was initially introduced into the United States in 1964 by King and Pennel. Subsequently, Nabers in 1966 reported gingival grafting as beneficial for vestibular extension and reported that grafting could achieve a gain in attached tissue along with root coverage of previously denuded roots.

With over 130 years of successful autogenous soft tissue grafting in the medical and dental fields, FGGs have become a routinely and successfully used procedure to: 1) create an adequate zone of attached gingiva in areas where periodontal probing depths are close to or extend apical to the mucogingival junction, 2) to eliminate frena and muscle attachments that encroach upon the periodontal apparatus, 3) to correct recession causing denudation of root surfaces, 4) to deepen the vestibule, and 5) to adequately deal with anatomic factors of thin alveolar housing, tooth position, prominent tooth roots, and other situations which predispose teeth to gingival recession.

Controversy exists as to the minimum width of attached tissue that is necessary for gingival health. Prior studies have suggested that a total of 2 mm of keratinized tissue is required for periodontal health with 1 mm of attached tissue and 1 mm of unattached tissue. [1] Other studies have shown that patients with excellent oral hygiene may maintain healthy areas with no attached tissue, while Bowers stated that for periodontal health a minimum amount of attached tissue is necessary but no exact dimension was given. [2, 3]

Anatomy

Gingival grafts are harvested from the patient's maxillary palate typically, but other possible donor sites may include keratinized tissue from the tuberosity region or an edentulous ridge. Acceptable donor tissue is characterized histologically by a keratinized or a parakeratinized epithelium and a dense lamina propria. Palatal tissue epithelium has been shown to range in thickness of 0.1 mm to 0.6 mm and is influenced by denture use, smoking or low grade inflammation .[4]

While palatal tissue is the most commonly used donor tissue for the harvesting of a FGG, it has anatomical limitations. The posterior palate is the location of the Greater Palatine artery, nerve, and accompanying vessels. The foramen is typically located in the vicinity of the third molar 15 mm from the midline and 4.8 mm from the most lateral point of the posterior border of the hard palate. The Greater Palatine Nerve and vessels emerge through this foramen and run anteriorly in the submucosa of the palate between the palatal and alveolar processes. The location of these vital structures may limit the surgical access for harvesting donor tissue. The submucosa of the palate posterior to the first molars contains the majority of the minor salivary glands, which are more compact in the soft palate and extend anteriorly into the hard palate where they decrease in

quantity. These glands occur between the mucosal connective tissue and the periosteum protecting the underlying vessels and nerves.

Palatal tissue harvested from the tuberosity region yields significantly thicker grafts averaging over 5.4 mm. The thickness of tissue in the first molar vicinity is usually 1.8 mm and increases as the first premolar is approached. The tissue thickness in the first premolar area averages 3.9 mm, and the tissue will also increase in thickness as grafts are harvested, further away from the margins of the crowns of the teeth, thus thicker grafts can be harvested if grafts are obtained several millimeters away from the gingival margin of teeth. The thinnest tissue occurs 1–8 mm from the gingival margin of the first molar, hence the palatal root of the first molar represents an anatomical barrier. [5]

The palate has other limitations, including palatal rugae that begins around the mesial of the first pre-molar. Studies have shown that the underlying lamina propria contains genetic pre-determinants for the specific character of the overlying epithelium and its structure. [6] Hence, incorporating donor tissue that includes these rugae will result in the transfer of the tissue topography to the recipient site. Attempts to surgically remove rugae by blades and burs are usually not successful, and aesthetics can be compromised when the rugae return. Another limitation of palatal donor tissue is the underlying submucosa which can have a variable amount of adipose tissue. Adipose tissue can act as a diffusion and vascularization barrier if it is included in the palatal graft, and care must be taken to remove it with a surgical blade before the graft is stabilized onto the recipient site. Adipose tissue in the hard palate increases in quantity anterior to the first premolar, limiting the extent of available donor tissue, in this area.

Graft Harvesting and Wound Healing

Harvested grafts are classified into full or split-thickness grafts. A full-thickness graft refers to the inclusion of all of the lamina propria, while the split-thickness graft includes only a partial amount. FGGs that are harvested can be either thickness because of the challenges of tissue contour, poor access due to curvature of the palate, proximity of the teeth, and instrument design. The proper thickness of the graft can be important for graft survival. The graft should be thin enough to permit diffusion of nutritive fluid from the recipient site; but if it is too thin, it may necrose and expose the recipient site. [7] The ideal thickness of a graft has been shown to be 1.0–1.5 mm. [8]

Epithelial tissue lacks the presence of blood vessels and it must derive its vascularization and exchange of metabolites and waste solely by diffusion. When grafts are transplanted, its epithelium and lamina propria will maintain its viability through diffusion from the recipient bed in the initial stages of healing. The lamina propria of the graft hinders diffusion; hence, the thinner the graft the more easily it can be maintained by diffusion and can be revascularized. Thinner grafts (0.75 mm) have been shown to heal more rapidly than thicker grafts (>1.75 mm). Microscopically, thin grafts complete their healing at 10.5 weeks and thicker grafts require 16 weeks or longer. [9]

The process of graft healing occurs in three stages: plasmatic circulation stage, capillary circulation stage, and the organization stage. Fluorescein angiography studies have shown blood recirculation in grafts to be first established through capillary "budding" and are maintained for the first 2–3 days by plasmatic circulation which provides graft sustenance. A formation of a regular pattern of capillary loops will begin on the seventh day and is followed by complete revascularization on the ninth to fourteenth day. [10]

The thickness of the graft can influence its behavior during the healing process and the final results. Thicker grafts, because they contain more elastin, will undergo more immediate contracture when the graft is removed from the donor site. This shrinkage is termed primary shrinkage since it occurs before the healing process. This higher amount of elastin in thick grafts has shown that contracture of as much as 43% can occur. Thinner grafts with less connective tissue will have less primary shrinkage but will experience more secondary contracture termed "cicatrization". [11] Secondary contracture is caused by the scarring or fibrosis of the tissue that unites the graft with its recipient base. The effect of this cicatrization on the graft is dependant upon the rigidity of the recipient bed and the thickness of the lamina propria of the graft.

The traditional FGG technique extends incisions for the donor harvest site to approximately twice the desired width allowing for initial shrinkage after harvesting allowing for a 50% graft contraction with final healing. Grafts can either be placed on denuded bone or on periosteum. Grafts when placed on denuded bone have shown to have less post-operative mobility, less swelling, and better hemostasis. [12] Several biometric studies analyzed that grafts placed on denuded bone shrink 25% versus grafts placed on a periosteal bed shrink 50% after a 24-week healing period. The greatest amount of shrinkage typically occurs during the first 6 weeks, however a healing lag of 2 weeks is observed when grafts are placed on denuded bone. [13, 14]

Purpose of the Study

Disadvantages of FGGs not only include shrinkage but also present a potential challenge. FGGs have been known to heal in a "postage stamp" fashion since the donor tissue color may not match the recipient tissue. This color disparity leads to an obvious

demarcation of where the FGG was placed and a potentially unaesthetic result. No prior attempts to date have been made to improve the aesthetics of FGGs.

Pervious attempts have been made to expand FGGs, but none have been truly successful. Rateitschak created a technique that was termed the "accordion technique". [15] This technique involves trying to gain expansion by making incisions by hand in alternate sides of the graft using a scalpel blade. These alternating incisions attempted to gain expansion, but limited expansion is actually achieved. The accuracy and reproducibility of these incisions is suspected to be the limitation to expansion.

This study hopes to determine a true and predictable expansion ratio that a tissue expander may achieve with donor tissue. The ability to expand FGGs would allow for smaller donor tissue to be harvested, less post-operative pain for the patient, and increased coverage from the donor tissue. We also expect that the perforations made in our donor tissue will allow for recipient tissue to perfuse the FGG, allowing for better aesthetics and eliminating the "postage" like appearance.

This study applies the techniques already used in modern medical grafting to dental procedures in order to improve surgical treatment for dental patients. The medical profession has been using devices to mesh skin grafts since the 1960s in order to expand donor grafts for large surgical skin defects as those associated with burn patients. Their investigations have proven that meshed grafts are both safe and effective. Medical research has shown that the minimal thickness for a skin graft to remain viable and grow is 1.02 mm. [6] Our research utilized grafts between 1.0– 2.0 mm in thickness. Zimmer, Padgett, and Brennen are medical corporations marketing skin graft meshers that have the ability of producing expansion ratios of up to 4:1. The grafts used in this study were

thicker in nature and required less expansion than what is required in medical applications; hence, the meshing of our grafts were done in a more conservative nature. The medical specialties have demonstrated that perforating a graft improves the graft's viability. Regardless, if a skin graft is intended to be expanded the medical protocol still requires perforation of the graft by this meshing process. This perforation is completed on every graft in order to prevent hematomas or seromas, and ultimately graft acceptance.

The purpose of our study was to employ the standard surgical technique used for dental grafting procedures, but to incorporate some of the principles of perforation and expansion as utilized with skin grafting in order to determine an expansion ratio, aesthetic improvements, and to determine the amount of gain in keratinized tissue. Expansion of the graft was attempted with a custom device that is not yet available commercially. The device was designed to bring the benefits of skin grafting to intraoral tissue grafting.

CHAPTER 2
MATERIALS AND METHODS

Inclusion Exclusion Criteria

Patients from the University Of Florida College Of Dentistry in Gainesville, Florida will be recruited for this study and will be examined for their levels of periodontitis, recession and amounts of keratinized tissue. The inclusion criteria are medically healthy patients between the ages of 16–65 with a diagnosis of insufficient width of keratinized gingiva or other mucogingival defects that would benefit from an increase in keratinized or attached tissue. Patients were excluded from the study if they had spontaneous bleeding upon probing, suppuration, active infection**,** were pregnant, or had any other severe concurrent systemic diseases that may impact on the periodontal condition and wound healing.

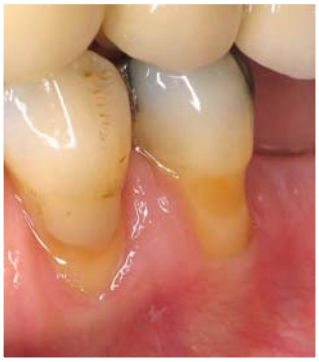

Figure 2-1. Patients with bilateral mucogingival defects were accepted into the study if they met the inclusion criteria.

Investigational Device

The prototype instrument was manufactured by Champagne designs in West Palm Beach, Florida. The instrument was modeled after the medical meshers that are currently

available for skin graft meshing. The instrument has a rolling drum with cylindrical cones as the perforation mechanism. The cones are symmetrically spaced 1.0 mm apart with the base of the cones measuring 2 mms in diameter. The instrument was designed to be rolled over the free gingival graft (FGG) graft in a length wise direction on the outer epithelial side. The graft is held on a polycarboxylte cutting board with the edge of a periosteal elevator. The rolling action of the mesher is meant to perforate and mesh the graft symmetrically.

Figure 2-2. Investigational meshing device was used to perforate and mesh the grafts.

Study Protocol

Thirteen healthy patients with bilateral mucogingival defects were used for this study. The study design was a split mouth design. One side chosen at random represented the experimental unit and the FGG on that side was meshed. The contra-lateral side acted as the control unit with a traditional FGG technique employed and the graft was not meshed. The surgical technique would be identical for both sites and would only differ by the mesh modification made in the donor tissue on the experimental side. The instrument would be rolled across the outer epithelial surface of the experimental graft in a mesial-distal direction and all other procedures would be identical.

Patients included in this study were required to have five visits. The initial visit included an explanation of the purpose of the study and the signing of informed consent forms. Initial measurements of the mucogingival defects were recorded to include: length

and width in millimeters, and the amount keratinized gingival tissue. A Miller Classification was determined for each site, probing depths, bleeding on probing, mobility, and furcation involvement was also noted. The second surgical visit consisted of pre-operative photographs to document the patient's mucogingival defect before the surgery. Patients rinsed with a 60-second pre-operative chlorhexidine 0.12% rinse. The recipient bed was created in the standard split-thickness method, and the involved root surface was prepared with hand instrumentation and Pref Gel was applied to the root surface for a minimum of 3 minutes. Pref Gel is a neutral acid that is safe on the tissues. The purpose of this acid is to expose collagen fibers to allow for attachment of the soft tissue grafts to the surfaces of the roots. The donor tissue was then harvested from the patient's palate and the thickness ranged 0.75–2.00 mm. Grafts were considered "thin" if they were less than 1.0mm, "average" if they were 1.0–1.5 mm, and "thick" if they exceeded 1.5mm.

The sizes of the harvested grafts were documented in length and width in millimeters and the expanded grafts were also measured post-expansion for length and width in millimeters. The harvested graft for both the control and experimental unit was affixed to recipient site with 5.0 vicryl suture using a p-3 needle. Surgical photos were taken documenting each step of the procedure.

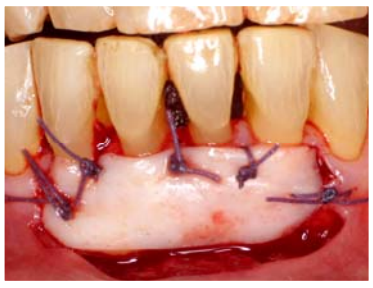

Figure 2-3. The grafts were affixed to the recipient bed with vicryl suture.

One graft that was harvested and expanded had a 3 x 4 mm sample removed for histological analysis. Statistical analysis was completed by using both a t-test and a signed ranked t-test, since our population sample was small (n=13). *P* values < 0.05 were considered significant.

The subsequent post-operative visits occurred 10 days and 4 weeks post-operatively to document the healing stages and to enforce oral hygiene. Patients were placed on a chlorhexidine rinse 0.12% to aid in soft tissue healing and inflammation reduction for duration of 4 weeks from the day of surgery. Motrin 800mg was prescribed and patients were instructed to take 3200 mgs per day for control of discomfort.

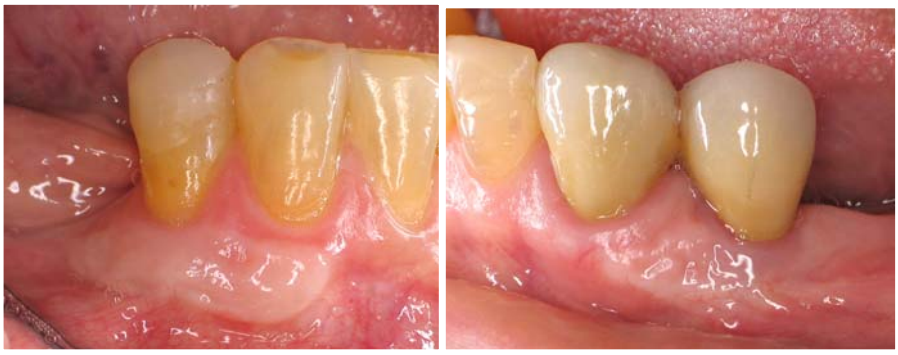

Figure 2-4. Side-by-side comparison of the non-meshed graft on the left versus the meshed graft on the right. Evaluators were asked to make comparisons of the 6-month post-operative results.

The final visit occurred at 6 months post surgery and final photographs were taken in order to determine the final aesthetic result. The aesthetic comparisons were completed by three board certified periodontists, 3 periodontal residents, and 3 dental students. A computer presentation was created with before and after photographs of each case. The evaluators were given a questionnaire and were instructed on how to complete the comparison (Appendix A). The presentation of the cases included side by side comparisons of the experimental graft next to the control. The two treatments were randomly assigned a letter A or B and the evaluators were asked to judge each graft for 1)

graft detectibility 2) graft color match to surrounding tissue and 3) aesthetics of the graft being superior for A or B or if they are similar.

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CHAPTER 3
RESULTS

Statistical Analysis

Of the 13 patients recruited, all completed the study. Healing was uneventful for all patients. The study population consisted of nine females and three males with the mean age of 52. A total number of 17 mucogingival defects were located in the mandibular premolar region, 3 in the mandibular canine region, and 6 in the mandibular anterior region. The data collection sheets were reviewed and statistical analysis was completed by the University Of Florida Biostatistics Department.

Both a t-test and a signed t-test were conducted (n=13) for length, width, gender, and thickness of the grafts to determine statistical significance ($p<0.05$) related to expansion. No difference in gender was found in the study. Pre-meshing and post-meshing measurements were rounded to the nearest 0.5mm to determine if there was any statically significant difference in length and width after the meshing was completed. The mean change in length was calculated at 0.65mm and a standard deviation of 0.66mm. The t-test for length expansion was statistically significant ($p=0.0038$) and the signed-rank test was also statistically significant ($p=0.0078$). The mean change in width was calculated at 0.04 mm and a standard deviation of 0.14mm. No statistical significance was found with either the t-test or the signed-ranked t-test for a change in expansion of width pre-meshing and post-meshing. When considering the thickness of the grafts harvested, no statistical difference was calculated between thin, average, or thick grafts.

Table 3-1. Statistical analysis parameters.

Subject	Length Before	Length After	Width Before	Width After	Graft Thickness	*M/F*
1	13.5	13.5	8.0	8.0	1.5 thick	*F*
2	10.5	11.5	7.0	7.0	1.5 thick	*M*
3	11.5	11.5	7.5	7.5	1.5 thick	*F*
4	25.5	27.0	8.0	8.0	1.5 thick	*M*
5	12.0	12.0	9.5	9.5	1.5 thick	*F*
6	15.0	15.0	7.0	7.0	1.5 thick	*M*
7	15.0	15.5	5.0	5.0	0.75 thin	*F*
8	18.0	20.0	4.0	4.0	0.75 thin	*F*
9	21.0	22.0	7.5	7.5	1.0 average	*F*
10	30.0	30.0	5.0	5.0	0.75 thin	*M*
11	17.0	17.5	10.0	10.0	1.5 thick	*F*
12	17.0	18.0	10.0	10.5	1.5 thick	*F*
13	13.0	14.0	8.5	8.5	1.0 average	*F*

Histological Analysis

A histology sample was sent to the University Of Florida Department Of Pathology. The tissue sample was first fixed in 10% neutral buffered formalin. The tissue was processed on Leica ® tissue processor followed by dehydration with serial alcohol intervals at 80%, 90%, 100% concentrated alcohol and followed by xylene to clear the sample. The samples were placed in paraffin and the sample was embedded top down in order to visualize the surface penetrations from the mesher. The paraffin block was cut into 5 μm sections with a Micron ® machine. Leica ® Auto Stainer XL was used to complete the Hemolysin & Eosin stain.

Histologic analysis was completed by light microscopy using a Leica microscope at 40 magnification. Photomicrographs were captured using the Q capture Pro program. Histological analysis revealed intact parakeratinized epithelium with alternating perforations equally distanced from each other. The perforations were seen in cross-

section and they completely incised through the epithelium and partially through the connective tissue.

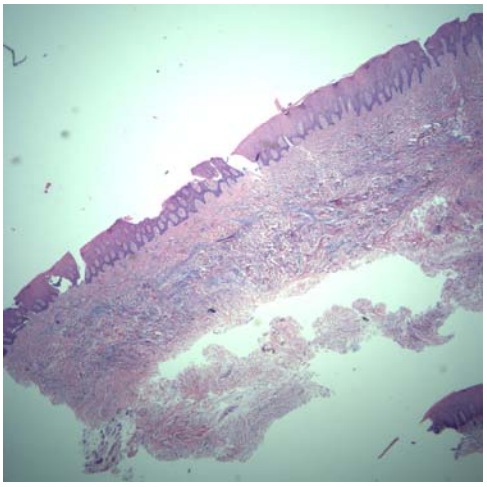

Figure 3-1. Equally spaced perforations are evident in this H&E stain with the perforation extending into the connective tissue.

Determination of whether the incisions transversed completely through the entire thickness of the graft could not be completed through histology since the sample was in cross-section, the entire perforation from epithelium through connective tissue may not have been captured in the 5μm slice. Alternate transverse sections were completed and histology revealed consistently spaced perforations through the connective tissue. No signs of incisions or tearing could be noted from the rolling of the drum over the graft, only perforations were detected.

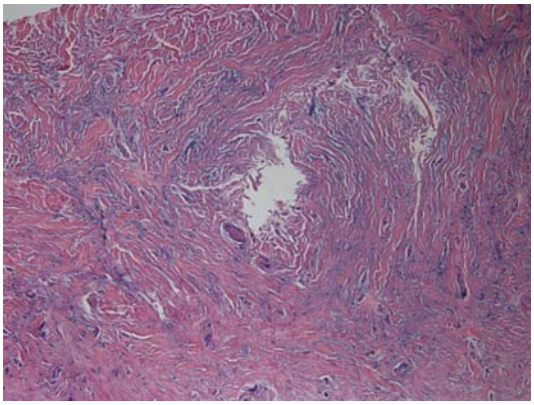

Figure 3-2. Transverse section of a H&E slide of the perforation made by the device.

Aesthetic Analysis

The aesthetic evaluation was completed by a panel of evaluators. As previously described for graft detectibility, the meshed graft was chosen 23.1% of the time as being "non-detectible", 53.8% for "above average" blend, 23.1% of the time as having "average" blend, and 0% as having "poor" blend. The control was chosen 15.4% as "non-detectible", 30.8% "above average" blend, 53.8% "average" blend, and 0% chosen as having "poor" blend. Evaluators were also asked to examine the photos for color march to the surrounding tissues. The meshed graft was chosen 46.1% as an "excellent" match, 38.5% "above average", 15.4% "average", and 0% as "poor" color match to the surrounding tissues. The control graft was chosen 15.4% as "excellent", 53.8% as "above average", 30.8% as "average", and 0% as a "poor". Evaluators were also asked to choose which graft appeared more aesthetic when the experimental unit was compared side-by-side to the control. The meshed graft was chosen as being superior in 46.1% of the cases, and no difference in aesthetics was determined in 38.5% of the photos when the meshed side was compared to the non-meshed side. The control, non-meshed side was chosen as being superior than the meshed side in 15.4% of the cases.

CHAPTER 4
DISCUSSION

Discussion of Statistical Results

Evaluation of the statistical results yielded a mean expansion in length of 0.63mm. The mean expansion of width was calculated only at 0.14mm**.** When considering the statistical significance versus the clinical significance, 0.63mm of expansion is clinically insignificant. One must also take into consideration the error in measurements. The harvested grafts were not perfectly rectangular and sometimes had irregular proportions due to the difficulty in harvesting. The measurements were made as accurate as possible with a ruler and a probe to the nearest .05mm, but inherent error in measurements could have occurred.

Discussion of Histological Results

A review of the histologic sample did reveal successful perforation of the device though the epithelium and into the underlying connective tissue (Fig. 3-1). The perforations were equally spaced, but the sample was taken in cross-section, and it could not be determined if the perforation extended through the entire width of the graft. It is possible that the cross-sectional 5μm cut did not include the entire incision made by the instrument and only the surface perforation was included in the slice. A transverse sample was then analyzed and equally spaced perforations were detected in the deeper layers of the graft (Fig. 3-1). Visual examination during the meshing of the grafts did reveal that complete perforation was achieved by the instrument, since the cones were able to be seen entering and exiting the graft.

Modification of Device

Since histological evaluation only revealed a perforating effect from our instrument, it is believed that modifications to the instrument could improve the possible expansion achieved in free gingival grafts (FGGs). Dr. Neel Bhatavadekar was consulted regarding making modifications to the prototype in order to improve expansion ratios. Dr. Bhatavadekar has recently just completed some research regarding the development of a newly designed dermatome and improved skin meshing device. His work was completed at the University of Florida in the Department of Biomedical Engineering. Consultation with him suggested that a redesign of the device to incorporate a motorized or hand-crank mechanism in order to provide positive pressure to the graft during the meshing process. This positive pressure would allow for an even and controlled meshing to occur. A suggestion was also made to modify the perforating cones. The layout of the cones was determined to be appropriate but a suggestion to modify the cones into surgical cutting blades. These alternating blades would provide a cutting effect instead of a perforating effect. The cutting effect of the blades would allow for better expansion to be achieved.

Conclusions

Aesthetic results of the meshed versus the traditional non-meshed graft were compared by a panel of evaluators. Overall, the meshed graft was chosen 46.1% of the time to be superior in overall aesthetics, but 38.5% of the time no difference in aesthetics could be determined between the two sites. The control was actually chosen to more aesthetic than the meshed site in 15.4% of the cases.

Alternative uses for this device were considered, since it is successful at perforation of the grafts consistently. The perforations could be used as a carrier for either proteins

or amelogins. Combing these healing enhancing mediators within the grafts perforations could act as a carrier for these substances. Since root coverage with FGGs is not as predictable as connective tissue grafts, the addition of these substances may allow for better root coverage by increasing attachment to the root surface. It would then be possible to gain both keratinized tissue and root coverage by a single surgical procedure.

In conclusion, the device seemed to have improved the aesthetic appearance of the graft in 46.1% of the cases, but clinically the expansion was non-significant. Future research could be conducted by modifying the mesher in order to improve the expansion ratio, or keeping the current design and using the perforations as a carrier for proteins to improve soft-tissue procedures.

APPENDIX
DATA COLLECTION SHEET

Please Circle or Highlight one of the Choices Below for Comparison of Photo A to B
Please Fill in the Case Number #1-12

Case# _____

Graft Detectibility:

Graft A:

- Graft is not Detectible (excellent blend)
- Above Average Blend of Graft
- Average Blend of Graft
- Poor Blend of Graft

Graft B:

- Graft is not Detectible (excellent blend)
- Above Average Blend of Graft
- Average Blend of Graft
- Poor Blend of Graft

Graft Color Match to Surrounding Tissue:

Graft A: Excellent Above Average Average Poor

Graft B: Excellent Above Average Average Poor

Aesthetics of The Graft is Superior For:

Graft A Graft B Neither, Grafts have similar Aesthetic Appearance

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BIOGRAPHICAL SKETCH

Michele P. Beaty was born and raised in Boca Raton, FL. She graduated with a Bachelor in Science in 1999 from the University of Florida. She continued her post-graduate education at the University Of Florida College Of Dentistry. In 2003 she earned her Doctorate of Dental Medicine and began a residency in the Graduate Periodontics Department at the University Of Florida. She currently is in private practice specializing in Periodontics and Implant Dentistry.