Case Report

Spontaneous Pigmentation of Non-Pigmented Palatal Tissue After Periodontal Surgery

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Background: *A 22-year-old African American female was referred for augmentation of keratinized gingiva around implants at the right and left maxillary second premolar sites. Presurgical evaluation revealed generalized melanosis of the buccal gingiva and a lack of keratinized tissue around implants at sites #4 and #13. No pigmentation was noted on the palatal tissues.*

Methods: *Thick free gingival grafts were harvested bilaterally from the non-pigmented palate and secured to the recipient sites with bioabsorbable sutures. Hemostasis was achieved at the palatal donor sites with moistened gauze, and an acrylic stent was delivered for patient comfort.*

Results: *Both palatal donor sites healed with spontaneous pigmentation. The pigmentation intensified with time but resulted in no adverse outcome.*

Conclusions: *Post-surgical healing in patients with gingival pigmentation is not entirely predictable, as multiple studies have demonstrated widely inconsistent results in regards to gingival pigmentation upon healing. When performing periodontal plastic surgery in patients with pigmented oral tissues, it is important to discuss all possible outcomes, including spontaneous pigmentation.* J Periodontol 2010;81: 172-176.

KEY WORDS

Case report; gingiva; pigmentation; wound healing.

The normal color of the oral mucosa is determined by many factors, the most important of which are the number and size of blood vessels, oxygenation of blood, epithelial thickness, degree of keratinization, and the amount of pigments in the tissue.[1] A few pigments, such as melanin, carotene, reduced hemoglobin, and oxyhemoglobin, contribute to its normal color,[2,3] with melanin pigmentation having the greatest significance.[4-6] Although pigmentation may be observed in any location, the gingiva is the most commonly affected site followed by the buccal mucosa, lips, palate, and tongue.[2,4-6]

Melanocytes residing in the epithelial basal cell layer convert tyrosine to melanin via the enzyme tyrosinase, which is then stored in the basal cells in the form of melanosomes. It can also be found in the keratinocytes of gingival epithelium.[2] Both light- and dark-pigmented individuals possess melanocytes in the oral epithelium, and it has been microscopically demonstrated that melanocytes are present in oral mucous membranes even when no clinical evidence of pigmentation exists.[7] The normal variations of physiologic pigmentation relate not to the quantity of melanocytes but, rather, to their activity in each individual.[8,9] The tendency to develop pigmentation is genetically acquired, but the intensity of the pigmentation is frequently influenced by physical, chemical, and hormonal factors.[10] High levels of oral melanin pigmentation are quite normal in African, East Asian, Mediterranean, and Hispanic populations. Persons of other nationalities (e.g., French, Filipino, Arab, Chinese, Indian, German, Italian, Jewish, Greek, and Romanian) also present melanin gingival hyperpigmentation.[11]

Although melanin hyperpigmentation is not a medical problem, "black gums" are a common complaint, and people with moderate or severe gingival pigmentation frequently request cosmetic therapy.[11,12] Successful treatment of gingival hyperpigmentation for esthetic purposes has been previously reported using surgical, chemical, cryosurgical, electrosurgical, and

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laser techniques with different degree of success.[13-22] Repigmentation after treatment has been reported with most techniques, although the timeframe in which this happens varies considerably (1 to 20 months).[20-24]

Although post-surgical repigmentation has been extensively covered in the dental literature,[20-24] there are no reports, to our knowledge, of spontaneous pigmentation of previously non-pigmented oral tissue after surgical treatment. This report describes a case in which non-pigmented free gingival graft donor sites healed with spontaneous pigmentation in an African American female patient.

CASE REPORT

In November 2008, a 22-year-old African American female was referred to the Department of Periodontics, Naval Hospital Pensacola, for augmentation of keratinized gingiva around implants at the right and left maxillary second premolar sites. Presurgical evaluation revealed generalized melanosis of the buccal gingiva (Fig. 1) and a lack of keratinized tissue around implants at sites #4 (Fig. 2) and #13. No pigmentation was noted on the palatal tissues.

The patient was anesthetized with bilateral anterior middle superior alveolar injections,[25] and recipient sites were deepithelialized in preparation to receive free gingival grafts. Upon preparation of the implant at site #4, a dehiscence exposure of buccal threads was noted. The decision was made to treat the site with guided bone regeneration (GBR) upon healing of the free gingival graft. Thick free gingival grafts were harvested bilaterally from the non-pigmented palate (Fig. 3) and secured to the recipient sites with a combination of tacking and compression sutures. Hemostasis was achieved at the palatal donor sites with moistened gauze, and an acrylic stent was delivered for patient comfort.

The first post-surgical appointment was conducted 10 days after surgery, and healing appeared uneventful. At a subsequent 6-week post-surgical appointment, the free gingival graft recipient site was well healed and contiguous with the adjacent gingival tissue (Fig. 4), whereas the palatal donor sites began to exhibit unanticipated changes. Bilaterally, the mesial, distal, and inferior aspects of the palatal donor sites displayed diffuse areas of pigmentation (Fig. 5). The patient subjectively noted no pain, paresthesia, or any other negative outcome associated with the palatal donor sites. Clinical palpation revealed no tactile abnormalities. During this visit, a GBR procedure was performed to cover the exposed buccal threads on the implant at site #4. At the 12-week post-surgical visit, the free gingival graft recipient sites still exhibited no signs of pigmentation, whereas both palatal donor sites displayed an increased intensity of the

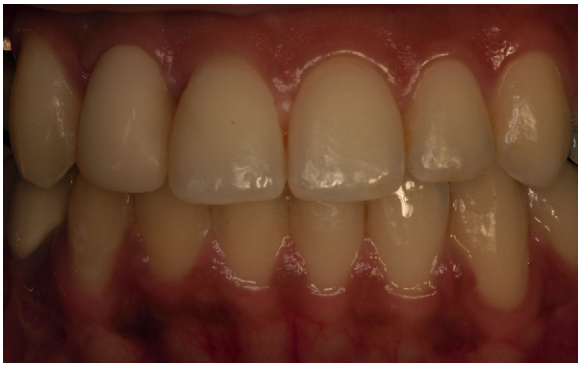

Figure 1.
Racial gingival pigmentation.

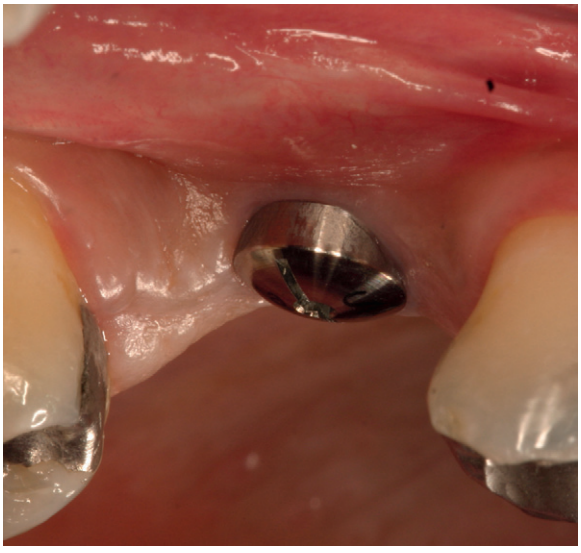

Figure 2.
Initial presentation of implant at site #4. Note the lack of keratinized gingiva.

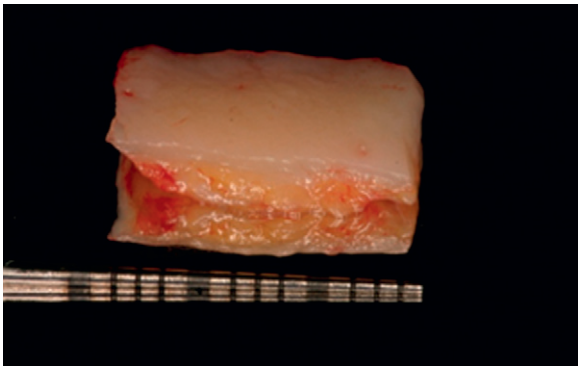

Figure 3.
Thick free gingival graft. Note the lack of pigmentation.

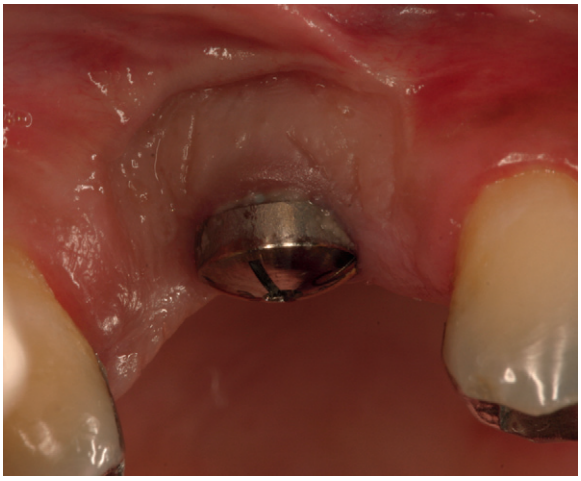

Figure 4.
Healing at 6 weeks. Note the plaque accumulation. The patient was instructed to improve home care.

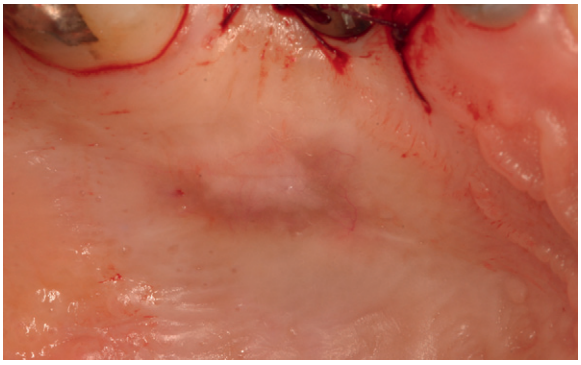

Figure 5.
Palatal donor site 6 weeks after initial surgery. A secondary GBR procedure was performed at this appointment.

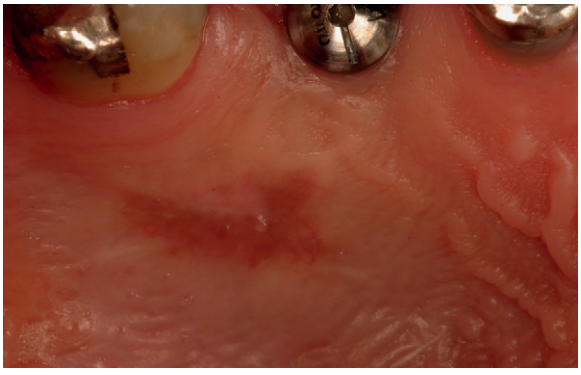

Figure 6.
Palatal donor site 6 months after the initial procedure. Note increased intensity of pigmentation.

pigmentation noted at the 6-week follow-up visit. Additional post-surgical appointments at 4 and 6 months revealed further enhancement of pigmentation intensity at the palatal donor sites (Fig. 6).

DISCUSSION

Although dental literature is replete with oral depigmentation/repigmentation studies,[13-24] there are no reports on non-pathologic spontaneous pigmentation of previously non-pigmented oral tissues. Although the classic 1963 study by Dummett and Bolden[20] described post-surgical healing with pigmentation as "spontaneous," the areas in question were previously pigmented prior to surgery. As such, the healing is more accurately described as repigmentation: "the clinical reappearance of melanin pigment after a period of clinical depigmentation."[26]

In this case report, free gingival grafts harvested from non-pigmented palatal donor sites were used in diffusely pigmented recipient sites. Ideally, pigmented keratinized attached gingiva would have been the donor site for the grafts. However, donor sites with adequate tissue quantity, thickness, and color match were non-existent and, therefore, the palate, though non-pigmented, was used. According to a wound-healing study,[27] pigmentation of the recipient sites in this case may be expected over time. However, one would not expect spontaneous pigmentation of the non-pigmented palatal donor sites. Excluding commonly found racial gingival pigmentation, a number of factors may contribute to oral melanin pigmentation, including Albright syndrome, Peutz-Jeghers syndrome, Addison's disease, von Recklinghausen's disease, hemachromatosis, malignant melanoma, smoking, pregnancy, metal poisoning, and minocycline use.[28-30] As none of these factors applied to the patient in this report, and because the post-surgical pigmentation developed bilaterally along the margins of the palatal donor sites, the most likely explanation for this anomalous finding is a variation of normal healing.

In general, persons from all racial backgrounds have comparable numbers of melanocytes in their gingival epithelium.[31] However, the determination of expressed pigmentation is determined by the activity level of these melanocytes rather than their density in the epithelial basal-cell layer.[32] Within individuals, melanocyte activity may vary in different locations of gingival tissue leading to the variable pattern of pigmentation commonly seen in racial gingival pigmentation. The fact that an area of gingiva does not express pigmentation does not render it devoid of melanocytes; the melanocytes in these areas are simply not as active as those in more deeply pigmented areas.[7] During wound healing, a variety of factors may upregulate melanocyte activity leading to

increased pigmentation. Upon excisional gingival wounding, as seen with the harvesting of a free gingival graft, mitotic activity of the epithelial basal layer increases up to 12-fold.[33] This increased activity typically initiates at the wound margins and progresses centripetally.[33,34] Accordingly, in this case report, spontaneous pigmentation upon healing was initially noted along the wound margins of the palatal harvest sites. During healing, activation of hypoactive melanocytes secondary to hypermitotic activity of the melanocyte-housing basal layer may explain the donor-site pigmentation pattern observed.

An additional explanation for this pigmentation healing pattern may be endothelin-1 (ET-1)-induced hyperpigmentation. ET-1 is a 21-amino-acid peptide with a number of functions, among which is the constriction of blood vessels. Upon blood vessel damage, intense ET-1 expression from endothelial cells, in addition to the release of a cornucopia of other factors such as thromboxane, bradykinin, and serotonin, produces vessel constriction in an attempt to gain hemostasis.[35] ET-1 is also produced by keratinocytes,[36] and its level of expression in gingival epithelial cells is increased during inflammation.[37] After the excision of gingival tissue, healing of the wounded area occurs via initial hemostasis and subsequent formation of inflammatory granulation tissue over which epithelial cells migrate from surrounding wound margins.[38] The harvesting of free gingival grafts from palatal tissues results in a significant amount of microscopic vascular damage[39] and inflammatory healing,[40] which may upregulate ET-1. Such an upregulation may lead to hyperpigmentation, as ET-1 is a proven stimulator of melanocyte proliferation.[41,42]

CONCLUSIONS

Post-surgical healing in patients with gingival pigmentation is not entirely predictable, as multiple studies[13-24] demonstrated widely inconsistent results in regards to gingival pigmentation upon healing. This case report describes spontaneous pigmentation of previously non-pigmented palatal tissues after a periodontal plastic surgery procedure. To our knowledge, this unexpected post-surgical outcome, although logically explainable via documented physiologic processes, has not been reported in dental literature and further reinforces the relative unpredictability of gingival pigmentation healing. When performing periodontal plastic surgery in patients with pigmented oral tissues, it is important to discuss all possible outcomes, including spontaneous pigmentation.

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REFERENCES

1. McCarthy P, Shklar G. *Diseases of the Oral Mucosa*, 2nd ed. Philadelphia: Lea & Febiger; 1980:27.
2. Dummett CO. Oral pigmentation. First symposium on oral pigmentation. *J Periodontol* 1960;31:356-360.
3. Goldzieher J, Roberts J, Rawls W, Goldzieher M. Chemical analysis of the intact skin by reflectance spectrophotometry. *Arch Dermatol Syph* 1951;64: 533-537.
4. Dummett CO. Normal and abnormal pigmentation of the oral mucosa. *Dermatol Digest*; 1966:541-549.
5. Dummett CO, Barnes G. Pigmentation of the oral tissue: A review of the literature. *J Periodontol* 1967;38: 360-377.
6. Monash S. Normal pigmentation of the oral mucosa. *Arch Dermatol Syph* 1932;261:139-147.
7. Becker S. Melanin pigmentation. *Arch Derm Syphilol* 1927;16:259-290.
8. Dummett CO, Barens G. Oromucosal pigmentation: An updated literary review. *J Periodontol* 1971;42: 726-736.
9. van Wyk CW. Mouth pigmentation patterns in a group of healthy South African Bantu. *S Afr Med J* 1970;44: 177-180.
10. Dummett CO. Clinical observation on pigment variations in healthy oral tissues in the Negro. *J Dent Res* 1945;24:7-13.
11. Tal H, Oegiesser D, Tal M. Gingival depigmentation by erbium: YAG laser: Clinical observations and patient responses. *J Periodontol* 2003;74:1660-1667.
12. Fowler EB, Breault L, Galvin B. Enhancing physiologic pigmentation utilizing a free gingival graft. *Pract Periodontics Aesthet Dent* 2000;12:193-196.
13. Gilckman I, Smulow J. *Periodontal Disease: Clinical Radiographic and Histopathologic Features*. Philadelphia: W.B Saunders; 1974:3-5.
14. Tal H. A novel cryosurgical technique for gingival depigmentation. *J Am Acad Dermatol* 1991;24:292-293.
15. Yeh CJ. Cryosurgical treatment of melanin pigmented gingival. *Oral Surg Oral Med Oral Pathol* 1998;86: 660-663.
16. Trelles MA, Vekruysse W, Segui JM, Udaeta A. Treatment of melanotic spots in the gingival by Argon laser. *J Oral Maxillofac Surg* 1993;51:759-761.
17. Ozbayrak S, Dumlu A, Ercalik-Yalcinkaya S. Treatment of melanin-pigmented gingival and oral mucosa by CO_2 laser. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2000;90:14-15.
18. Sharon E, Azaz B, Ulmansky M. Vaporization of melanin in oral tissues and skin with a carbon dioxide laser. A canine study. *J Oral Maxillofac Surg* 2000;58: 1387-1393.
19. Atsawasuwan P, Greethong K, Nimmanon V. Treatment of gingival hyperpigmentation for esthetic purposes by Nd:YAG laser: Report of 4 cases. *J Periodontol* 2000;71:315-321.
20. Dummett CO, Bolden TE. Postsurgical clinical repigmentation of the gingiva. *Oral Surg Oral Med Oral Pathol* 1963;16:353-365.
21. Perlmutter S, Tal H. Repigmentation of the gingival following surgical injury. *J Periodontol* 1986;57:48-50.

22. Tal H, Landsberg J, Kozlovsky A. Cryosurgical depigmentation of the gingiva: A case report. *J Clin Periodontol* 1987;14:614-617.
23. Pontes AE, Pontes C, Souza S, Novaes A, Grisi M, Tara M. Evaluation of the efficacy of the acellular dermal matrix allograft with partial thickness flap in the elimination of gingival melanin pigmentation. A comparative clinical study with 12 months of follow-up. *J Esthet Restor Dent* 2006;18:135-143.
24. Novaes AB Jr., Pontes C, Souza S, Grisi M, Taba M. The use of acellular dermal matrix allograft for the elimination of gingival melanin pigmentation: Case presentation with 2 years of follow-up. *Pract Proced Aesthet Dent* 2002;14:619-623.
25. Holtzclaw D, Toscano N. Alternative anesthetic technique for maxillary periodontal surgery. *J Periodontol* 2008;79:1769-1772.
26. Dummett CO. The oral tissues in vitiligo. *Oral Surg Oral Med Oral Pathol* 1959;12:1073-1079.
27. Tamizi M, Taheri M. Treatment of severe physiologic gingival pigmentation with free gingival autograft. *Quintessence Int* 1996;27:555-558.
28. Coleton S. Laser treatment of atypical oral pigmentation. *N Y State Dent J* 2006;72:22-23.
29. Hedin CA, Pindborg J, Axell T. Disappearance of smoker's melanosis after reducing smoking. *J Oral Pathol Med* 1993;22:228-230.
30. Esen E, Haytac C, Oz A, Erdoğan O, Karsli D. Gingival melanin pigmentation and its treatment with the CO2 laser. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2004;98:522-527.
31. Arikan F, Gurkan A. Cryosurgical treatment of gingival melanin pigmentation with tetrafluoroethane (in French). *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2007;103:452-457.
32. Mobio S, Noujeim Z, Boutigny H, Jensen M, Cassia A, Soueidan A. Pigmentation and pigmented lesions of the gingival mucosa. *Rev Belge Med Dent* 2008;63:15-28.
33. Engler WO, Ramfjord SP, Hiniker JJ. Healing following simple gingivectomy. A tritiated thymidine radioautographic study. I. Epithelialization. *J Periodontol* 1966;37:298-308.
34. Bergamaschi O, Kon S, Doine A, Ruben M. Melanin repigmentation after gingivectomy: A 5-year clinical and transmission electron microscopic study in humans. *Int J Periodontics Restorative Dent.* 1993;13:85-92.
35. Papalambros KE, Sigala F, Georgopoulos S, et al. The relationship of endothelin-1 and inducible nitric oxide synthase at several stages of the anastomotic healing process. *Int Angiol* 2008;27:302-306.
36. Yohn JJ, Morelli J, Walchak S, Rundell K, Norris D, Zamora M. Cultured human keratinocytes synthesize and secrete endothelin-1. *J Invest Dermatol* 1993;100:23-26.
37. Yamamoto E, Awano S, Koseki T, Ansai T, Takehara T. Expression of endothelin-1 in gingival epithelial cells. *J Periodontal Res* 2003;38:417-421.
38. Wennström J. Regeneration of gingiva following surgical excision. A clinical study. *J Clin Periodontol* 1983;10:287-297.
39. Del Pizzo M, Modica F, Bethaz N, Priotto P, Romagnoli R. The connective tissue graft: A comparative clinical evaluation of wound healing at the palatal donor site. A preliminary study. *J Clin Periodontol* 2002;29:848-854.
40. Yen CA, Griffin TJ, Cheung WS, Chen J. Effects of platelet concentrate on palatal wound healing after connective tissue graft harvesting. *J Periodontol* 2007;78:601-610.
41. Imokawa G, Kobayashi T, Miyagishi M, Higashi K, Yada Y. The role of endothelin-1 in epidermal hyperpigmentation and signaling mechanisms of mitogenesis and melanogenesis. *Pigment Cell Res* 1997;10:218-228.
42. Hara M, Yaar M, Gilchrest B. Endothelin-1 of keratinocyte origin is a mediator of melanocyte dendricity. *J Invest Dermatol* 1995;105:744-748.

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