Healing following full thickness excision of human palatal mucosa

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Summary—Healing was observed for 6 months following excision of full thickness normal adult human palatal mucosa (approx 12 mm × 10 mm) to measure the degree of wound contraction and determine if rugae would regenerate. Measurements of plaster models showed stretching and displacement of soft tissue not involved in the original wound toward the centre of the wound from 6 weeks postoperatively. The distance between the incisive papilla and the most posterior ruga on the side of operation reduced by 2.2 mm and the first ruga on the opposite side was stretched in length by 0.9 mm. A fragment of superficial bone (approx 10 mm × 7 mm) sequestrated at 5 weeks, epithelialisation was complete by 8 weeks but the rugae did not reform at all.

Introduction

The mucosa covering the palate is firm, resilient and attached closely via periosteum to bone. Anteriorly there is a variable number of transverse ridges, named rugae, on either side of the midline which probably aid in the manipulation of food. Surgical closure of palatal clefts creates an area of palate denuded of mucosa which is allowed to heal by secondary intention; this practice has been incriminated in animal experiments in the postsurgical reduction of maxillary growth (Kremenak and Searls, 1971). Palatal wound healing has been extensively studied in animals because of this. Considerable wound contraction takes place following excisional wounds of the palate in beagle pups (Searls et al., 1979; Jonsson and Hallmans, 1980) despite the firm texture of the tissue and its close adherence to bone. Indeed Searls et al. (1979) demonstrated that contraction was reduced by lifting periosteum from bone around the wound. In Jonsson and Hallmans’ (1980) experiment which involved excision of bone as well as mucosa, contraction was eliminated by skin grafting the excision site. In addition, skeletal growth was normal following skin grafting but reduced if the wound was left to granulate. The only reference to palatal rugae in healing appears to be that of Kahnberg and Thilander (1982) who noted failure of their reappearance in rats by 21 days after excision of a 3 mm diameter circle of mucosa.

None of the above mentioned experiments was continued for more than 7 weeks and there is no literature concerning experimental wounds in the human palate, so when for the purpose of another study I required a substantial piece of normal adult human palatal mucosa and volunteered to undergo biopsy myself, the opportunity was taken to observe the healing process.

Methods

At the age of 34 when I was in good health a full thickness portion of mucosa was excised under local anaesthesia from the left side of my palate anteriorly (Fig. 1). It measured 12 mm anteroposteriorly and 10 mm across. The majority of the rugae were included in the specimen but the wound stopped short of the midline and the gingival margin. The bone was covered initially with a periodontal dressing (Coe-pak, Coe Laboratories Inc., Chicago, IL, 60658 USA) held in place with an acrylic plate.

The wound was inspected and models were made from alginate impressions periodically during healing. Measurements (4 replicate) were made with vernier calipers between readily identifiable points on each of these models and analysed statistically by F test and students’ t test.

Results

The wound margin became increasingly swollen and tender over the first 36 hours and at this stage
Fig. 1
Figure 1—Author's palate immediately after excision of mucosa measuring 12 mm × 10 mm.

Fig. 2
Figure 2—Wound 9 days postoperatively showing swollen wound margin, and slough and exposed bone at base.
the protective acrylic plate and pack were discarded. The incisor and canine teeth on that side also became tender during this period.

The first 8 postoperative days were marked by severe pain which started before the local anaesthetic wore off and which was barely controlled by paracetamol 1 g 6-hourly.

At 9 days (Fig. 2) the pain was reducing and the wound, although initially covered by blood clot was now covered by slough with some bare bone visible. The wound margin, although more swollen than at 5 days was less tender. Granulation tissue proliferated toward the wound centre over the bare bone until 35 days when a superficial sequestrum (Fig. 3) measuring approx 10 mm \( \times \) 7 mm \( \times \) 1.5 mm separated from the wound. By 63 days (Fig. 4) the wound was covered by epithelium, all pain had gone and the teeth were much less tender. The wound still looked dark red and was tender and paraesthetic to touch.

Over the following 4 months there was gradual

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Figure 3—Sequestrum (oral aspect) which separated at 35 days.

Figure 4—Wound 63 days postoperatively showing partial filling of the defect with tissue readily distinguished from surrounding normal tissue.
partial filling of the residual depression in the mucosa, a return to normal colour and a reduction in abnormal sensation. There was no evidence of regrowth of rugae.

The measurements taken from the models are shown in Figure 5. No significant (by F test) variation with time of the control measurement between the canine cusps was detected (Fig. 6A). The posterior tip of the incisive papilla was deviated significantly to the left by 6 weeks and continued to move further in that direction during the remainder of the observation period (Fig. 6B, C). The first ruga on the right side was increased in length by 0.9 mm (Fig. 6D) and the tip of the incisive papilla and the remaining left ruga became closer by 2.2 mm also over this period (Fig. 6E). Two measurements (the length of the first right ruga and the papilla to left ruga length (Fig. 6D, E) showed significant displacement of tissue away from the wound centre at 9 days only.

Discussion
The reaction of bone in this case is of interest. That intense pain should occur so early and persist for so long is more consistent with an osteitis than mucosal inflammation. The early tenderness of the teeth would support this. The area of bone sequestrated would suggest that most of the bone exposed at operation and quite a depth below became necrotic but it is not known whether this was because of deprivation of its mucosal blood supply or some local toxic reaction. Necrosis and sequestration of bone does occur in similar but smaller wounds in young rats (Butcher and Klingsberg, 1963; Kahnberg and Thilander, 1982) and should therefore not be considered directly related to the age of the subject, the size of the wound or the mode of anaesthesia.

The time taken for full epithelialisation, 2 months, was considerably in excess of the 3 weeks
required in Jonsson and Hallmans' beagle model for a similar sized defect. It is possible that age or species differences or the presence of a sequestrum in the present case may have been responsible.

The tissue which now occupies the original wound is firm, pink and resilient: very similar to normal palatal mucosa. However the failure of regeneration of the rugae points to the specialised nature of these structures and indicates that a return to normality does not occur.

The work of Jonsson and Hallmans (1980) has implied a relationship between reduced postsurgical maxillary growth and wound contraction in the palate. I have demonstrated that reduction in wound size does occur in the human palate following an excisional wound though it occurred later and over a longer period than in the beagle pup model. It is probably better described as cicatrisation than wound contraction. The wound “spreading” noted here at 9 days does not appear to have been described previously and may represent “frustrated” wound contraction.

In any scientific endeavour, especially those involving animals, it is desirable to measure a number of subjects; this study has looked at one only but it has offered a rare opportunity to study healing in a normal human.

References


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