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REIMPLANTATION OF TEETH: A REVIEW OF THE LITERATURE AND A CASE REPORT

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INTRODUCTION

A REIMPLANTED tooth is one which, having been removed from its socket, is repositioned in the same person (autograft), in a different person (allograft), or in a different species, for instance dogs (xenograft).

Tooth reimplantation is not a modern concept. Down the years various techniques were tried, most of them unsuccessfully. Among those who experimented were Albulcasis De Condue, 963 - 1013, and Ambroise Paré, 1510 - 1590 (Knight, Gans and Calandra 1964). In Elizabethan times it was fashionable for socialites to have the extracted teeth of paupers transplanted into their mouths. An increase in the incidence of tuberculosis and syphilis and other infectious diseases, however, brought this practice to an end.

The general viewpoint regarding tooth reimplantation between 1593 and 1917 can be summarised by a statement of John Hunter (Tompkins 1921): "There is a disposition of all living substances to unite when brought into contact with one another . . . while a tooth which has been extracted for some time so as to lose the whole of its life, will never become firm and fixed."

PRESENT CONCEPTS

A clinically stable reimplanted tooth is not sufficient evidence of a successfully treated case; this demands that the tooth show no signs of root resorption and has normal supporting structures (Knight *et al.* 1964). Some workers are opposed to reimplantations; they contend that the teeth and the surrounding bone always show some degree of resorption (Olech 1956).

The main causes of failure are resorption and/or infection.

(1) RESORPTION.

Sibley (1962) compiled a résumé of the findings of several authors regarding the causative factors in root resorption.

Gotlieb and Ordman: It occurs when cemental metabolism is impaired by tearing of the periodontal fibres.

Nygaard-Ostby: Localised haemorrhage in a confined space between bone and cementum causes granulation tissue which precipitates osteoclastic activity.

Simon: The pH of the chronic inflammatory process results in a local acidosis favouring the condition.

Henry and Weinmann: It is due to compression and crushing types of trauma and the necrosis of the periodontal membrane.

Boyle (1955) suggested that, whatever the cause, once initiated, the resorption of bone, cementum and dentine occurs along similar lines.

Andreasen and Hjorting-Hansen (1966) divided root resorption into three types:

(a) *Replacement resorption.* This takes place where there is contact between root surface and bone in the apical third of the root. It occurs three to four months after reimplantation and is preceded by ankylosis, after which the resorbed root is replaced by bone. The whole process resembles the resorption of a non-vital bone implant. A clinical feature is the absence of any observable radiolucency in the bone adjacent to the resorbing root.

(b) *Inflammatory Resorption.* This probably is caused by an inflammatory reaction within the periodontal space. There is an adjacent radiolucency in the bone and it may occur as early as three weeks after reimplantation: most commonly when the root filling is inadequate, and in young persons. To prevent progression an apicectomy may be performed (Andreasen 1967).

(c) *Surface Resorption.* These are microscopic areas of resorption of cementum only and seemingly is not related to either replacement or inflammatory re-

sorption. Such areas may show repair of cementum.

(2) INFECTION

This can result in failure in one of two ways:

Acute inflammation with pus formation causing the destruction of the supporting tissues with rapid exfoliation of the tooth.

Chronic inflammation following an attempt to treat the acute phase, or brought about by the passage of toxins from the root canal of an inadequate root filling to the periodontal space.

(3) FACTORS WHICH INFLUENCE RESORPTION AND INFECTION.

(i) *Age of Patient.* In a series of reimplantations carried out by Andreasen and Hjorting-Hansen (1966), they obtained the best results where the apices of the teeth were not yet fully calcified. The pulps of some of these teeth were left intact and they continued to show normal vital responses.

(ii) *Duration of the Extra-Oral Period.* When this is less than 30 minutes 100 per cent success can be expected, whereas a lapse of 120 minutes produces a half-life of the tooth: about three years. If a tooth is reimplanted within five minutes vitality may return in 50 per cent of cases, but only in 12 per cent following an extra-oral period of 120 minutes. This is because the pulp apparently is similar to embryonic connective tissue and can survive on its own substance for about 120 minutes (Massler 1970). Jonck (1966) prefers to delay the reimplantation for about 10 days. Normal periodontal re-attachment may then occur; at that time the bone of the socket is in its osteoblastic phase, thus causing less resorption.

(iii) *Fracture of the Alveolar Plate.* This seems to accelerate the resorption as the healing of the socket is delayed. If the fracture subsequently becomes infected it obviously will increase the chances of resorption.

(iv) *Care of the Root Surface.* Heiss (1944) showed healing to occur more readily along a root from which the periodontal fibres were removed, whilst the cementum is treated with respect. Contact with bone, however, produces ankylosis which, as already pointed out, influences resorption. Discretion must be exercised as to whether or not to remove the periodontal fibres. If the tooth has been out of the mouth for some time it is advisable to do so.

(v) *Filling the Root Canal.* Knight *et al* (1964) obtained better results in the reimplanted teeth of dogs in which the root canals had been filled. The filling material should be softer than that ordinarily used, in case it has to be removed at a later date. The canal must be perfectly clean to prevent seepage of toxins through the dentinal tubules causing a chronic inflammatory process in the periodontal space.

(vi) *Types and Duration of Splintage.* During the initial stages complete immobilisation is essential: best achieved by full arch coverage and opening the bite 2 to 4 mm. This allows for maximum stability and adequate function. The splint should be removed after about 30 days and the teeth tested for mobility.

If immobilisation is too long, ankylosis will result; if it is too short, the tooth will accidentally exfoliate (Dreyer 1967).

If mobility persists after 30 days, interdental wiring can be used; the Essig or Modified Essig method is recommended (Finn 1962). After removal of the splint the occlusion must be checked for trauma. Hydrostatic pressure may cause extrusion of the tooth if all the blood clot in the socket is not removed prior to reimplantation. A slow, steady pressure should be used to replace the tooth in the socket. If there is extrusion and the tooth is splinted, resorption may result.

(vii) *General Health.* Reimplantation is contra-indicated in persons with a history of congenital heart disease, rheumatic heart disease, diabetes mellitus or any active infective process.

(viii) *The Use of Drugs.* Andreasen *et al* state there is no increase in the success rate when reimplanted teeth are treated prophylactically with antibiotics. The possibility of tetanus must be borne in mind, however, when the avulsed teeth have been contaminated. Experiments recently were carried out on rats to determine the effects of stannous fluoride,

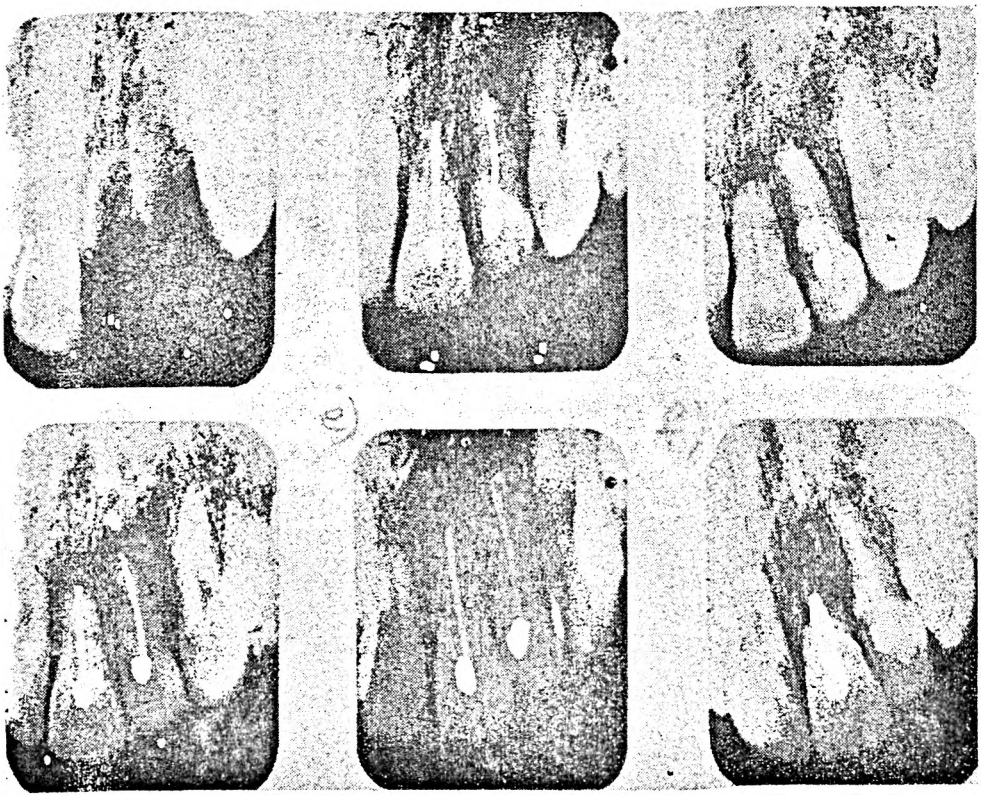


FIGURE 1. Serial radiographs of reimplanted teeth.
a.—prior to reimplantation.
b.—6 weeks after reimplantation.
c.—14 weeks after reimplantation.
d.—17 weeks after reimplantation.
e.—6 months after reimplantation.
f.—1 year after reimplantation.

oxytetracycline hydrochloride and prednisolone sodium succinate on the resorptive process of cementum and bone. The results obtained by Bjorvatn and Weiss (Massler 1970) demonstrate that: if, prior to reimplantation, the teeth are soaked in the fluoride solution for 15 minutes, there is a marked decrease in root resorpfion; oxytetracycline stimulates osteogenesis and leads to the roots being completely ankylosed to the alveolar bone; the prednisilone solution causes massive areas of bone and root resorption.

CASE REPORT

A 14-year-old Caucasian male presented for treatment in June 1967, two hours after receiving a blow to the face which resulted in the upper left central incisor being avulsed. Intra-oral examination showed the adjacent lateral incisor to be completely luxated but still attached to the gingivae. Neither tooth was fractured and a radiograph revealed no abnormality of the empty sockets (Fig. 1a). As the patient was healthy, it was decided to reimplant the teeth.

The lateral incisor was detached from the gingivae, the roots were cleaned in saline, and the sockets were syringed to remove the blood clots. The teeth were inserted into their respective sockets and alginate impressions were taken of the arches. They were then removed and 1 mm. of the apices cut off to facilitate the reimplantation. The pulp chambers and root canals were reamed, cleaned

and filled with tightly-fitting gutta-percha points which extended through the apices. Each apex was sealed by applying a heated instrument to the gutta-percha point.

The teeth were regularly moistened with saline to prevent dehydration and so ensure that the root structures retained whatever vitality they still had. The sockets were again syringed with saline and the teeth reimplanted. The central incisor fitted snugly, the lateral incisor less so. A quick-setting acrylic was used to construct a splint on the plaster model of the upper arch: as a temporary measure until a permanent splint could be completed. All the undercuts in the region of the anterior teeth were removed and the splint fixed in position with a zinc oxide-eugenol cement. Care was taken to avoid any cement getting in the area of the anterior teeth; this could cause dislodgment of the reimplanted ones on removal of the splint. The patient was given an injection of a long-acting penicillin preparation ("Triplopen"—Glaxo-Allenbury) and instructed how to maintain good oral hygiene.

An accurate heat-cured acrylic splint was then constructed with a bite-opening of 2 to 4 mm; and after a week the temporary one was discarded and this one cemented in place with oxyphosphate cement. Again the area surrounding the anterior teeth was kept free of cement. Progress was regularly checked radiographically.

Six weeks after reimplantation there was resorption about the apices; and a week later it occurred along the sides of the root of the lateral incisor (Fig. 1b). The splint was removed, but as the lateral incisor was clinically mobile, it was returned for a further 10 days. Both teeth were then firm but in traumatic occlusion. This was relieved and periodically checked.

Fourteen weeks after the reimplantation the resorption along the side of the lateral incisor appeared to have ceased, but the apical resorption continued on the central incisor (Fig. 1c).

Three weeks later resorption began along the side of the central incisor (Fig. 1d). This together with the apical resorption, continued until half of the root was resorbed after about six months (Fig. 1e). Resorption about the root of the lateral incisor appeared to have ceased.

Apical radiolucencies were apparent 10 months after reimplantation and root canal therapy was re-done. The canals were slightly overfilled with Kri Paste and sealed with gutta-percha points. Subsequent radiographs showed a considerable slowing down of the resorptive process. The paste disappeared from the radiolucent areas in which new bone had formed (Fig. 1f). Now, almost four years after reimplantation, there is no longer resorption of the root of the lateral incisor, but in the central incisor there is a slow continuation of the process.

DISCUSSION

Resorption is the main reason for exfoliation of reimplanted teeth. In the case here described several factors may have contributed to the condition: the central incisor was completely avulsed and there was an extra-oral period of at least 120 minutes; the lateral incisor was attached to the gingivae and was kept moist by the saliva; while treating the apical areas when the root canals were re-filled, the patient became unco-operative during the treatment of the central incisor, which led to an acute inflammation developing in the periapical region and this may have aggravated the resorption; when the teeth were initially replaced the central incisor fitted very tightly but not the lateral incisor, and this may have produced some degree of ankylosis.

SUMMARY

The literature on tooth reimplantation is reviewed. The prime factors to bear in mind when faced with this type of treatment are: other related injuries, the duration of the extra-oral period, the administration of drugs, the type and duration of splinting and correction of any traumatic occlusion.

A case is reported in which two teeth were successfully reimplanted.

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