

EXPERIMENTAL STUDIES ON THE TREATMENT OF TRAUMATIC DENTAL AVULSION IN DOGS

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Summary

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The aim of the present study was to evaluate a method for treatment of traumatic dental avulsion in dogs.

The experiments were performed on 7 dogs aged between 2 and 4 years weighing 12-16 kg in the period October 1998–January 2000. After anaesthesia, the following dental procedures were accomplished: performance of a dental avulsion, endodontic treatment, apical dentotomy, tooth replantation and fixation with an orthodontic splint, figure-of-eight wire ligature and photopolymer.

The treatment was effective in 71.4% of experimental replantations of incisors and the replanted teeth persisted for more than 8-9 months.

The radiological survey showed that the regeneration began as early as the first post replantation days. In the period between days 30 and 45, a bone bridging was observed and the regeneration was complete by the end of the second month.

Key words: dental avulsion, tooth replantation, veterinary dentistry

INTRODUCTION

Recent studies show that traumatic dental diseases (luxations and avulsions) in pets (dogs and cats) become more and more important (Emily, 1991; Hennes, 1991). The commonest causes for the occurrence of traumas are fights with other animals, road accidents, falls and playing with hard objects (Jacobs, 1989; Harvey and Emily, 1993).

Spodnick (1992) and Wiggs and Lobrise (1997) reported that traumatic dental diseases in dogs affect most frequently the maxillary incisors and canine teeth. According to Emily (1991), the dental avulsion is a knock-out and partial or complete separation of the tooth from its alveolus. The inspection of such patients usually reveals a recent wound, the alveolus of separated teeth is empty,

bleeding or filled with blood coagulum, sometimes the tooth is attached only to soft tissues.

The dental replantations are known since the ancient times (Karchemski, 1960). Neuwirt (1925) described experimental replantations of 108 teeth in 17 dogs emphasizing upon the primary importance of preserving the entity of periodontium and the good fixation that determined to a considerable extent the success of replantation. Similar data are communicated by Kozlov (1964) for experimental replantation of 32 teeth in dogs and in our country – by Kadankov (1976) in humans.

Literature sources evidence that the success of replantation and the durability of replanted teeth are different – 2–4

years (Heiss, 1944). The longest period of durability is reported following replantation of traumatically dislocated human teeth – from 5 to 10 years.

The indications for replantation are determined by the anamnesis, the status of the masticatory apparatus, the dental status, the character of tooth pathology as well as the status of the surrounding periapical tissues.

The duration of the period of separation of the tooth from its alveolus has a primary role for the survival of cells of periodontal ligaments and is an important factor for the success of the treatment. The probability of successful replantation decreases with increase in the forementioned period (Cohen and Burns, 1991; Dumsha, 1992; Gracis and Orsini, 1998). Other factors important for the issue of treatment of dental luxations and avulsions, are the extent of dentoalveolar injury, the age of the animals, the periodontal status of dislocated and undislocated teeth, the status of dental roots, the presence and degree of jaw fracture as well as soft tissue damage (Crona et al., 1991).

Studies on dental replantation in veterinary medicine are occasional and incomplete (Boudrieau and Kudisch, 1996; Gracis and Orsini, 1998). Thus, the aim of the present study was to evaluate a method for treatment of dental avulsion in dogs in conditions of favourable combination of forementioned factors and to follow out the efficacy of the treatment by replantation.

MATERIALS AND METHODS

The experiments were performed during the period October 1998-January 2000 on 7 dogs aged 2-4 years and weighing 12-16 kg. The phases of the trial were as

followed:

1. Anaesthesia with xylazine (Rometar, Spofa, Prague, Czech Republic) and ketamine hydrochloride (Imalgène, Rhône Mérieux, France);

2. Performance of dental avulsion of the second left upper incisor;

3. Placing of a gauze drainage soaked with saline in the freed alveolus;

4. Endodontic treatment including pulpotomy, nervectomy, apical dentotomy (apexectomy) and obturation of the pulp cavity with canal-filling substance (Forident, Spofa, Prague, Czech Republic);

5. Placing of the tooth into its alveolus following a 15 min stay outside it;

6. Fixation of the replant by a splint made of orthodontic wire (thickness 0.4 mm) and photopolymer to the adjacent incisors. The procedure aimed not only to fix the replant but to ensure a close contact of the dental root to the alveolus thus excluding the possibility for formation of pathological pockets.

Following this intervention, the dogs were treated with doxycycline hydrochloride (Supracyclin, Grünenthal, Austria) at a dose of 4 mg/kg once daily for 7-10 days.

At the end of the fourth week, the orthodontic splint was removed and after the sixth week - the photopolymer from the adjacent teeth.

Dental radiography was performed prior to the replantation and periodically up to the 6th post replantation month using an intraoral oblique view. The serial radiography helped us to evaluate the status of the alveolar wall, the extent and character of changes in alveolar septa, the status of dental roots and canals as well as the occurring

Table 1. Individual records of dogs with experimental dental avulsion cured by tooth replantation

No	Gender	Age (years)	Date replantation of	Observed until	Complications
1	female	4	16.10.1998	16.07.1999	None
2	male	2	21.11.1998	30.07.1999	Local purulent process at day 10
3	male	3	04.12.1998	04.08.1999	None
4	male	4	11.01.1999	13.10.1999	None
5	female	2	10.02.1999	15.11.1999	None
6	male	4	22.02.1999	18.12.1999	Fracture of dental crown at day 67
7	female	3	15.03.1999	19.12.1999	None

regeneration. Thus we obtained the most precise information for the bone structure of replanted tooth and the surrounding bone and soft dental tissues. The dental status of patients was followed out for 8-9 months. The individual records of the patients are listed in Table 1.



RESULTS

Fig. 1 illustrates the general view of the tooth 14 days after the replantation and the fixation with wire splint, figure-of-weight ligature and photopolymer.

At the end of the 3-4th week, the dogs

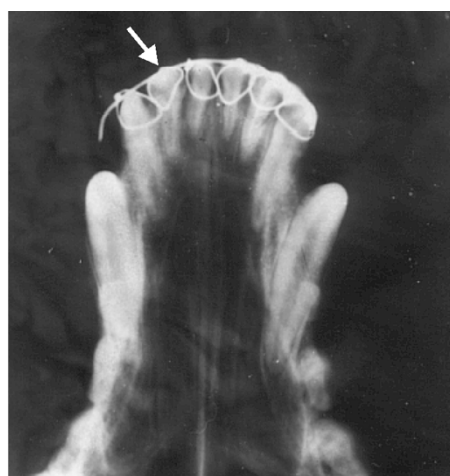


Fig. 1. General view of the tooth 14 days after the replantation. Fixation of incisors by wire cerclage and

Fig. 2. Radiograph of replanted second left maxillary incisor (arrow) 30 days after the replantation.



used normally the teeth and accepted food with harder consistency.

After the 4th week, when the splint and the wire ligatures were removed, the replanted tooth was considerably stable with no mobility. The radiograph (Fig. 2) shows the filled pulpar channel of replanted tooth 30 days following the replantation. The periodontium is visualized as a band of radiolucidity with irregular margins. Around the dental root and in close proximity to the alveolar septum, a dense shadow is visible.

At the end of the sixth week, when the photopolimer fixation was removed, **Fig. 3.** Radiograph of replanted second left maxillary incisor (arrow) 60 days after the replantation.

At post replantation day 60 (Fig. 3), the obturated pulpal canal was visible as a shadow with a dim density. The dense shadow of the obturation in the crown part of the replant was well visualized. The periodontium was visible only in the cervical tooth part. The alveolar septa were clearly outlined. A lucidity of bone structure in the apical region was visible.

At post replantation day 90 (Fig. 4),



Fig. 4. Radiograph of replanted second left maxillary incisor (arrow) 90 days after the replantation.

the dense shadow of obturated pulpar canal was clearly outlined. The periodontal incisure was with a normal width in the apical part of the replant root. The structure of alveolar septa was clearly defined. A lucidity of dentin in the region of the root was visible. The bone structure was not changed.

The presence of complications and their nature are presented in Table 1. Relapses occurred in 2 out of 7 replanted incisors. In dog No 2, a rejection of the tooth accompanied by a purulent demarcation occurred 10 days following the replantation, necessitating its extraction and exclusion from further observations. In dog No 6, a tooth fracture occurred 67 days after the replantation, probably because of insufficient obturation of the pulpal root canal.

A positive effect of the treatment was achieved in 5 patients, i.e. in 71.4%.

The clinical dental observations showed that the stabilization of the tooth began after the 2nd week and was ultimately completed after the 6th week.

The function of the replanted tooth was clinically restored after the 2nd month.

DISCUSSION

On the basis of radiological data it could be concluded that during the process of replantation, a granulation tissue, destroying the cement and forming lacunae, was initially produced. Afterwards, this tissue underwent a metaplasia to bone tissue that replaced the cement and dentin of tooth root and thus the tooth adhered to the alveolus without motion. In cases when the tooth healed primarily, a limited restoration of the periodontal ligaments most probably occurred and when the healing was secondary, a cement-bone adhesion happened. The course of replantation observed by us was similar to the results reported by Oikarinen and Stoltze (1996). This was further confirmed by radiological data showing that tooth replantation occurred without complication and the tooth was attached to the alveolus via a fibrous bone transformation of adjacent soft and bony alveolar tissues. A similar finding was reported by Greer and Moule (1996) in humans where the process of replantation of a permanent central incisor was followed out by serial radiography for 6 years.

The post replantation period of avulsed teeth in our experiment followed the pattern, described by Kadankov (1976) and the known mechanisms of bone transplantation in dogs (Paskalev, 1997).

The 71.4% efficacy of maxillar incisor replantation is similar to that obtained by Holan and Botzer (1996) and Sae-Lim et al. (1998) in men. Considering the reported data, we could

speculate that the age of patients, the absence of maxillar or mandibular fracture and soft tissue injury could be added to the group of factors, favourizing the successful issue of the replantation. The latter was probably also due to the short period (15 min on the average) of separation of avulsed tooth and the alveolus (Lekic et al., 1996; Rungvechvuttivittaya et al., 1998). The statistical data of human dental literature and those of american veterinarians evidence that when the traumatically avulsed tooth is stored in dry state more than 30 minutes, irreversible changes in periodontal ligaments occur and therefore, problems during the period of restoration of replanted tooth (Dumsha, 1992; De Forge, 1998).

The good fixation of the tooth after his placement in the alveolus could be further added to the prerequisites for a successful regeneration. Despite the methods of fixation of replanted teeth with wire splint and figure-of-eight ligature, described in human dentistry (Kadankov, 1976), in our experiment we applied an additional fixation of the replant to adjacent teeth, like the method of De Forge (DeForge, 1998), taking into account the possibility of more serious loading in dogs.

The antibacterial therapy in the post replantation period was probably also important for the efficacy of the process. This opinion of ours is confirmed by the reports of Holan and Botzer (1996) and Sae-Lim et al. (1998).

Our results for teeth replantation in dogs could be authentic for cases with intact dental root periodontium and alveolus. The bleeding of the alveolus, as is the belief of Gracis and Orsini (1988) could be regarded as a means of bathing

of the wound of one hand and a very good biological bandage for the remaining healthy alveolar periodontium, on the other. Frequently, the failure of the replantation is due to falling of the replant as a result of rejection by purulent masses coming from the root or ankylosis of root surface to the alveolar bone (De Forge, 1988). This is one of the risk factors for the successful replantation, observed by us in dog No 2.

CONCLUSIONS

A good stability of replanted maxillary incisors in dogs could be achieved through a splint made of 0.4 mm dental wire, a figure-of-eight orthodontic wire cerclage and fixation of the replant to the adjacent incisors via photopolymer.

Radiologically, the regeneration of replanted teeth was observed as early as the first post-replantation days. A bone bridging (connection) was noticed between days 30 and 45 and the regeneration ended at the end of the second month.

The experimental replantation of avulsed incisors in dogs was successful in 71.4% of the cases and replanted teeth persisted for more than 8-9 months.

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