

From: The Dental Department, University  
Hospital, Copenhagen.

## REPLANTATION OF TEETH

### I. RADIOGRAPHIC AND CLINICAL STUDY OF 110 HUMAN TEETH REPLANTED AFTER ACCIDENTAL LOSS

by

J. O. ANDREASEN

E. HJØRTING-HANSEN

#### INTRODUCTION

Replantation of teeth has been performed mainly with two purposes:

1. Treatment of periapical infections where normal endodontic treatment was impossible.
2. Treatment of traumatic accidental loss of teeth.

The present investigation will consider only the second aspect. Numerous reports dealing with single cases of replantation in relation to traumatic loss have been published. Only two reports have dealt, however, with evaluation of more material, *Lenstrup & Skieller* (1957, 1959) and *Rabinowitch* (1962). *Lenstrup & Skieller* examined 46 patients with 60 replanted teeth and found that the prognosis was very poor since root resorption occurred in nearly all cases and only 4 teeth were without resorption after observation periods varying from 2 months to 5½ years. *Rabinowitch* was able to follow 21 cases out of 64 for more than 6 years. However, the only exact information on the follow-up examination was that four of the teeth were resorbed to the point where they could no longer be retained.

The present investigation was undertaken because it was desirable to report the results from a follow-up study of more material and evaluate factors which might influence the prognosis of this treatment.

Aided by a grant from the Danish Dental Association, "Fonden til fremme af videnskabelig og praktisk odontologi".

## MATERIAL AND METHODS

The material consisted of 82 patients (55 males and 27 females) in which a total number of 110 teeth were replanted after being lost in accidents. Twelve of the 82 patients were included in *Lenstrup & Skieller's* material (1957, 1959). Varying numbers of teeth from one to six were replanted in each patient. The age of the patients at the time of the accident varied from 6 to 24 years, 64 of the patients were between 7 and 14 years of age, Table I.

Table I  
*Age in years at the time of accident*

Age	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Number of patients	4	11	4	11	11	7	9	7	4	2	4	1	0	1	0	2	3	0	1

The observation period varied from 2 months to 13 years; however, 2 cases were examined 37 and 40 years after replantation. Table II shows distribution of the replanted teeth according

Table II  
*Distribution of accidental exarticulated teeth according to location*

Maxilla			Mandibula		
Central incisor	Lateral incisor	Canine	Central incisor	Lateral incisor	Canine
89	14	0	2	4	1

to location. Sixty-two teeth were rootfilled prior to replantation; in 30 teeth the endodontic treatment was done from 2 weeks to 3 months after replantation, and in 18 teeth no endodontic treatment was carried out. The time between loss and replantation and condition — wet or dry — under which the teeth had been preserved were recorded. In the following report this time interval will be named *extra oral period*. This period varied from 1 to 1020

minutes. When the teeth had been stored under humid conditions, usually physiological saline had been used. Dilaceration of the gingiva or clinical discernible alveolar fractures were registered.

The following technique was used for the replantation: When the patient was received for treatment, the tooth was placed in physiological saline. If the tooth was dirty, the root surface was cleaned with wet gauze, otherwise care was taken to protect the periodontal membrane. The root canal was filled with guttapercha either from the apex or via a coronal approach. Thirty-six teeth were fixed with an arch wire, 22 with a cap splint and 44 with an acrylic splint. The fixation was left for varying periods from one week to four months. In 8 cases no fixation was used. In 50 cases penicillin was administered immediately after replantation. Radiographic examination was done prior to replantation and immediately after. In 72 teeth clinical and radiographic controls were performed biannually, 38 teeth were examined at the following intervals, 1—3—4—6—8 weeks, 4—8—12 months after replantation. The following clinical features were noted: The position, the mobility, the percussion sound of the tooth and the gingival condition. In teeth with incomplete rootformation replanted without endodontic treatment, thermal and electrometrical vitality tests were performed.

## RESULTS

### **Radiographic and clinical evaluation**

The material was divided into three groups according to no resorption or resorption. Furthermore the condition of the periapical area of the periodontal membrane was evaluated. If a normal lamina dura was present around the apical foramen, the condition was registered as exhibiting periapical healing, while widening of the periodontal space was considered as a radiographic sign of inflammation.

#### **Group 1. *No resorption***

This group was radiographically characterized by no signs of resorption. Since it was observed that resorption, when present, always started within one year after replantation only teeth with

an observation period of more than one year will be regarded as successful. Twenty-two teeth fulfilled these criteria, fig. 1, 2, 3, 4. Three of these teeth with observation periods of 37 and 40 years demonstrated that permanent healing was possible, fig. 5, 6. Twenty of these teeth demonstrated periapical healing; radiolucency around the apical foramen was found only in two teeth. Clinical examination of the 22 teeth showed normal position and the percussion sound was similar to adjacent normal teeth. Five teeth in group 1 showed no radiographic signs of resorption, but were followed for less than one year.

### Group 2. Replacement resorption

Replacement resorption was radiographically characterized by a continuous replacement of lost root substance with bone and no radiolucency in relation to the resorption area, fig. 10—14. Forty-four teeth showed this type of resorption. The first sign of replacement resorption was found 3—4 months after replantation, and in most cases it originated in the apical third of the root. When replacement resorption was observed, it was always seen within one year after replantation, but the rate of progression varied, fig. 20—21. In 38 teeth periapical healing was found, six teeth showed radiolucency around the apical foramen. Clinical examination showed an arrest of the normal eruption of the replanted tooth in 15 cases out of 35 examined, this feature was especially prominent in patients below 10 years at time of accident, fig. 35. The teeth were immobile, the percussion sound was very high and differed from adjacent normal teeth, indicating ankylosis.

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Fig. 1. Before and fig. 2. immediately after replantation of 1+ and +2\*).

Fig. 3. No resorption after 6 years observation period.

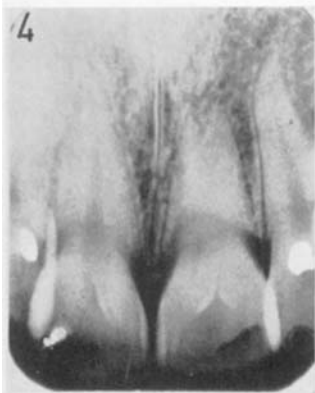
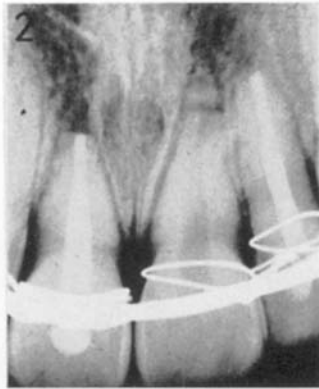
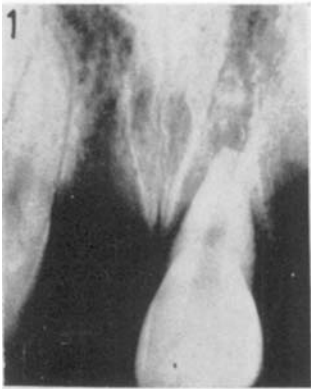
Fig. 4. No resorption 13 years after replantation of 1+. Fig. 5. Complete healing 37 years after replantation of 1+. Fig. 6. Complete healing 40 years after replantation of 1+1.

Incomplete root formation 1+1, extraoral period 90 minutes.

Fig. 7. Time of replantation. Fig. 8. 4 months later. Fig. 9. 2 years observation period. Note partial obliteration, but finished root formation.

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\*) The figures indicate the region according to Haderup's nomenclature: + designates the upper jaw and — indicates the lower jaw. If the sign is placed to the right of the figure (for example 1+), the right side is indicated and vice versa (Haderup, 1887).



**Group 3. Inflammatory resorption**

Inflammatory resorption was radiographically characterized by loss of root substance with an adjacent radiolucency in the bone, fig. 15—19. Thirty-nine teeth showed inflammatory resorption. In this group signs of resorption were often seen as early as 3—4 weeks after replantation, fig. 23—28. The localization of the first sign of resorption was the same as for teeth with replacement resorption. Inflammatory resorption was arrested with an adequate root-canal treatment in four teeth. Later follow-up examination showed repair of the resorption area and re-establishment of a normal periodontal membrane, fig. 29—30—31. In cases where no endodontic treatment was carried out inflammatory resorption was very marked, fig. 32. Fourteen cases showed a long-standing chronic inflammatory resorption, whereas the inflammatory resorption was more acute in the remaining cases, most often it resulted in loss of the tooth within the first year, fig. 33—34. Inflammatory resorption could be seen in cases with replacement resorption, especially when the replacement-resorption involved the pulp canal, fig. 22. Fourteen teeth demonstrated periapical healing, 25 teeth showed a radiolucency around the apical foramen. The chi-square test\*) showed that there was a highly significant increase ( $p < 0.0005$ ) in the proportion of teeth with apical infection in group 3, whereas group 1 and 2 did not differ from expectation. Of 16 clinically examined cases 5 teeth showed loosening and in 3 cases an elongation of the tooth was noted. Only one case showed arrest of eruption. Occasionally a fistula was present.

**Significance of extra oral period**

In Table III teeth in the three groups are tabulated according to increasing extra oral period. In order to evaluate the influence of the extra oral period on the periodontal membrane under optimal replantation-conditions 19 cases with clinically discernible alve-

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\*) The statistical analysis was done by Dr. M. Hauge, Institute of Human Genetics, University of Copenhagen.

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Figs. 10—14. Progression of replacement resorption.

Figs. 15—19. Progression of inflammatory resorption.

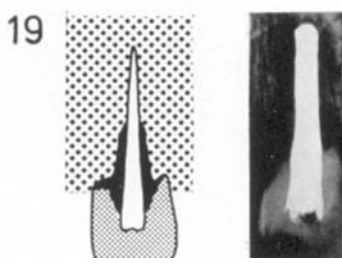
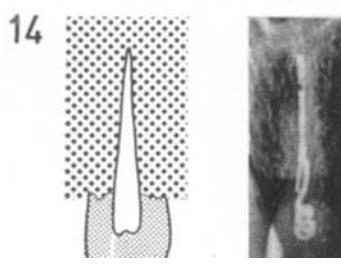
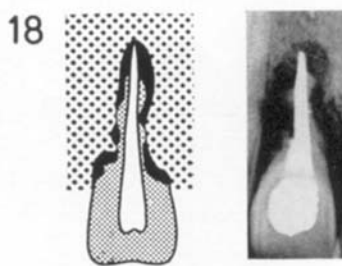
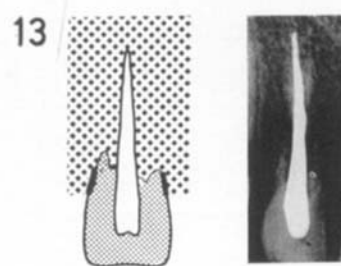
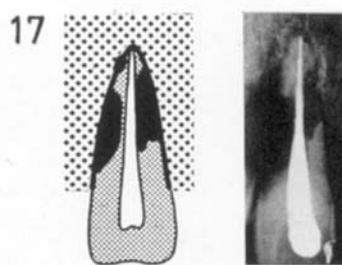
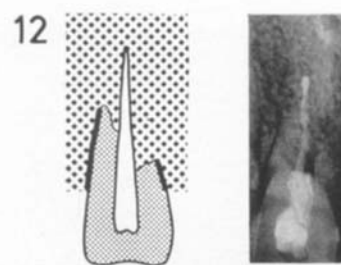
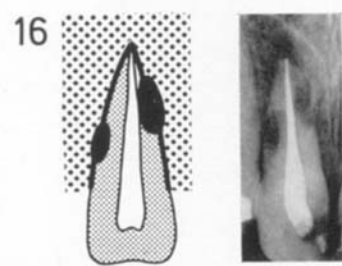
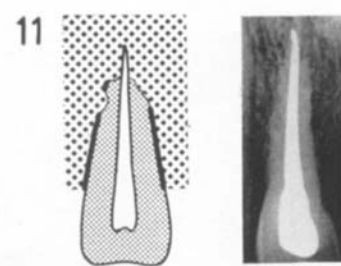
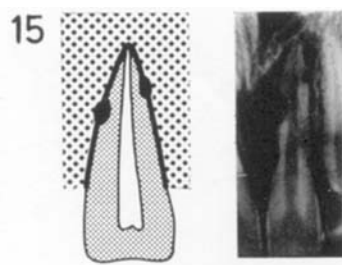
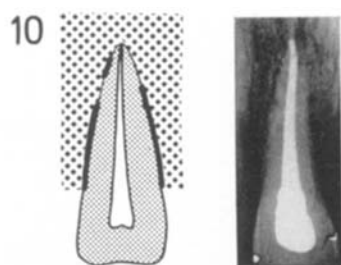


Table III

*Distribution of teeth in the three groups according to extra oral period*

Extra oral period (minutes)	(Group 1) No resorption		(Group 2) Replacement resorption		(Group 3) Inflammatory resorption	
	num- ber	percen- tage	num- ber	percen- tage	num- ber	percen- tage
0—30	9	41 %	0	0 %	1	3 %
31—60	4	18 %	2	6 %	2	6 %
61—90	5	23 %	3	9 %	5	16 %
91—120	2	9 %	7	22 %	2	6 %
121—150	0	0 %	5	16 %	3	9.5 %
151—180	0	0 %	5	16 %	3	9.5 %
181—210	2	9 %	2	6 %	4	12 %
211—1020	0	0 %	8	25 %	12	38 %
Total	22	100 %	32	100 %	32	100 %

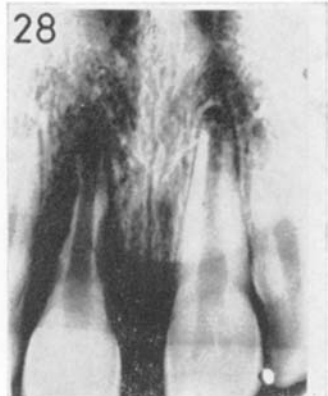
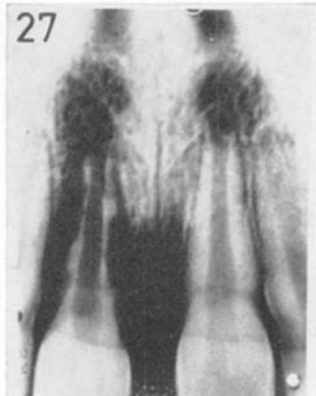
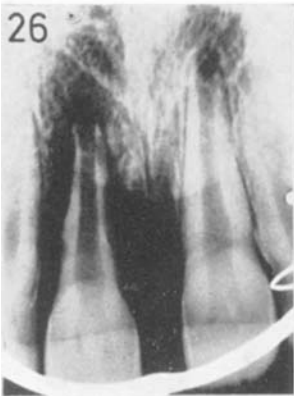
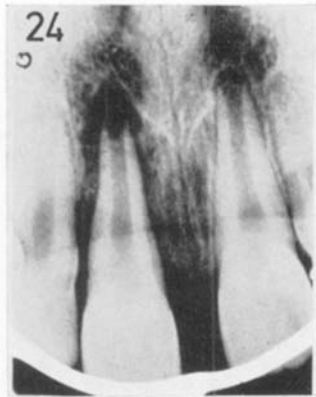
olar fractures have been omitted. The chi-square test showed no significant difference between group 2 and 3, whereas a significant difference was found between group 1 and the two resorption groups ( $0.05 > p > 0.025$ ).

Table IV gives an estimate of the chances of no resorption in teeth with varying extra oral periods. It will appear that 90 % of teeth replanted less than 30 minutes after loss showed no resorption, a slightly lower frequency was found from 31—90 minutes, whereas the majority of teeth replanted 90 minutes or

Fig. 20. Marked replacement resorption of replanted 2+ after 1½ year.

Fig. 21. Same degree of replacement resorption 9½ years after replantation of 1+. Fig. 22. Inflammatory resorption occurs when root canal is involved in replacement resorption +1.

Figs. 23—28. Inflammatory resorption of 1+. Fig. 23. 0 days, fig. 24, one week, fig. 25. 3 weeks, fig. 26. 4 weeks, fig. 27. 6 weeks, and fig. 28. 8 weeks after replantation, note the first sign of resorption after 3 weeks and the rapid progression in the following 5 weeks.



more after loss showed resorption. The possible influence of the storage condition — wet or dry — was examined, but no association with the final result could be demonstrated in the present material.

Table IV

*Number and percentage of teeth with no resorption according to length of extra oral period*

Extra oral period (minutes)	Number of teeth (Group 1+2+3)	Number and percentage of teeth with no resorption	
		Number	Percentage*
0— 30	10	9	90 % (55.5—99.8 %)
31— 60	8	4	50 % (15.7—84.3 %)
61— 90	13	5	38 % (13.9—68.4 %)
91 —120	11	2	18 % ( 2.2—51.8 %)
121— 150	8	0	0 % ( 0.0—36.9 %)
151— 180	8	0	0 % ( 0.0—36.9 %)
181— 210	8	2	25 % ( 3.1—65.1 %)
211—1020	20	0	0 % ( 0.0—16.8 %)

\*) Number in brackets indicates the 95 % confidence limits.

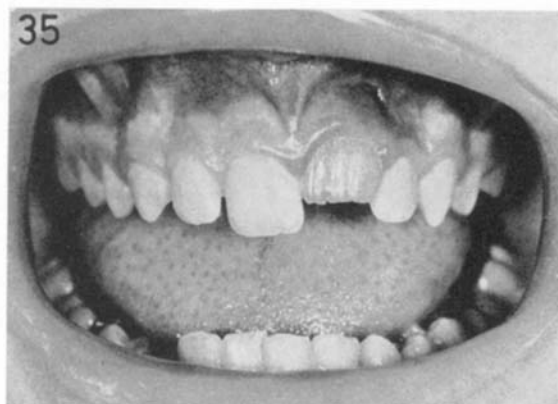
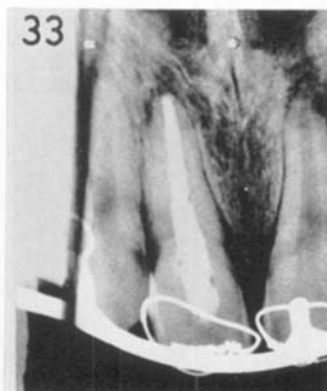
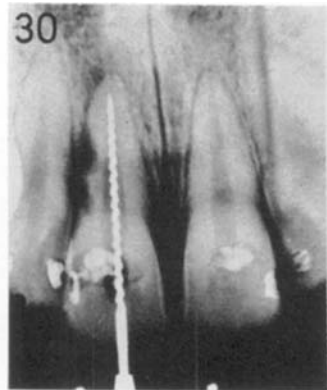
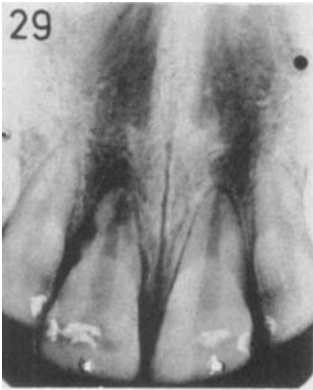
#### Observation period

In all cases the primary healing was uneventful. The follow-up examination showed, that 51 teeth (45 %) were removed or lost due to resorption. Thirty-two teeth (29 %) showed varying degrees of resorption. Twenty-seven teeth showed no resorption, 22 (20 %) of these were followed for more than one year.

Figs. 29—31. Illustrate the arrest of inflammatory resorption by root canal treatment of 1+. Fig. 29. Immediately after replantation, fig. 30. 3 weeks after, and fig. 31. 1½ year after. Note re-establishment of normal periodontal space.

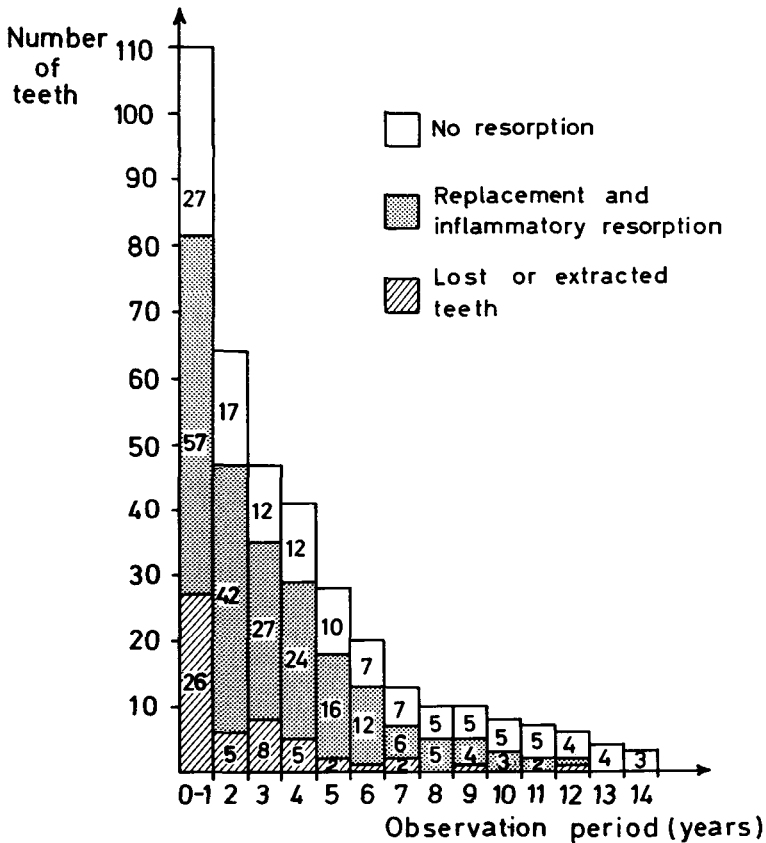
Fig. 32. 1—1 replanted after root-filling, 2— without. Note the difference in severity of inflammatory resorption after three months. Fig. 33—34 illustrate longstanding inflammatory resorption of 1+. Fig. 33. Immediately after replantation and fig. 34. 5½ years later.

Fig. 35. Arrest of normal eruption, condition 4 years after replantation of +1.



In fig. 36 the material is tabulated in the following way: The first bar represents the total number of teeth observed within one year. The hatched area indicates the number of extracted or lost teeth within the first year; the dotted area indicates the number of teeth with replacement and inflammatory resorption. The next

**Fig. 36**  
**Loss of teeth during observation period,**  
**entire material.**



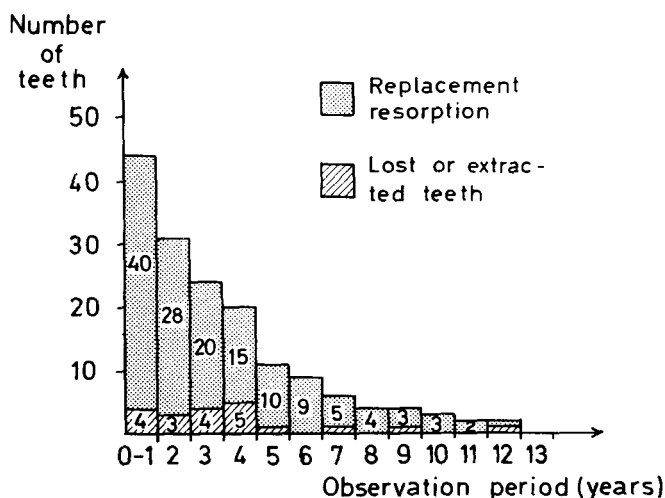
bar in the histograms represents the number of teeth examined in the second observation year, teeth extracted during the first year, or teeth with observation period shorter than 2 years are not included. Figures 37 and 38 illustrate the resorption groups tabulated in the same way. The loss of teeth during the first year in the inflammatory resorption group was significantly higher than the loss in the replacement resorption group  $p < 0.0005$ .

#### Condition of the pulp

*Completed root formation.* In the evaluation of the influence of the pulp condition on the replantation, distinction was made between root-filling in relation to the replantation, later root-filling or no root-filling. In Table V this material is presented, excluded are the same cases as in the evaluation of the extra oral period, as well as cases with incomplete root formation at the time of accident. Relatively more teeth with no immediate

Fig. 37

Loss of teeth during observation period, replacement resorption group.



root-filling are found in group 1, but the difference is not significant ( $0.10 > p > 0.05$ ). In the resorption groups the two conditions for root-filling were equally represented. Since teeth with short extra oral period mainly showed no resorption, Table IV, the possible influence of immediate or later root-filling on the final outcome was studied for teeth with similar extra oral periods, Table V. No definite influence of this factor on the result could be demonstrated. Teeth replanted within 30 minutes after accident could not be analyzed, as endodontic treatment and the replantation procedure most often will exceed 30 minutes. In six teeth no root-filling was carried out. Four of the cases in group 1 showed apparent re-establishment of vascularization, three of these with obliteration of the pulp chamber; two of the four teeth responded positive on a vitality test.

*Incomplete root formation.* Thirteen teeth showed only partial root formation at the time of accidental loss. These teeth were replanted without endodontic treatment in an attempt to re-

Fig. 38

Loss of teeth during observation period, inflammatory resorption group.

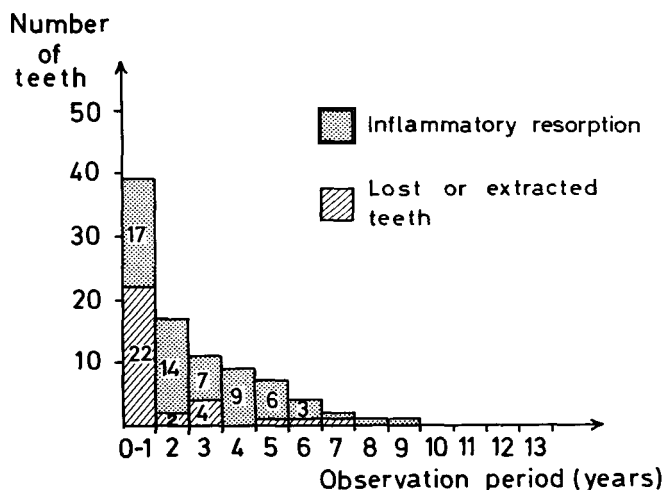


Table V

*Distribution of teeth with completed root formation in the three groups according to immediate, later or no root-filling and extra oral period*

Extra oral period (min.)	No resorption (Group 1)			Replacement resorption (Group 2)			Inflammatory resorption (Group 3)		
	Immediate root-filling	Later root-filling	No root-filling	Immediate root-filling	Later root-filling	No root-filling	Immediate root-filling	Later root-filling	No root-filling
0—30	0	5	3	0	0	0	0	1	0
31—120	4	2	1	8	4	0	2	4	0
120	1	1	0	14	5	0	18	3	2
Total	5	8	4	22	9	0	20	8	2

establish vascularization of the pulp. In Table VI the follow-up findings are tabulated. The stage of root formation is according to *Öhman* (1965); stage I root length incomplete and stage II root length complete, but with the apical foramen wide open. In 7 cases the pulp apparently survived the exarticulation, and these teeth showed a gradual obliteration of the pulp chamber, figs. 7—9. This may be the reason why only 3 teeth gave a positive response on a vitality test. In all the cases where the pulp survived, the extra oral period was less than two hours; except for one, these teeth showed no resorption with observation periods exceeding one year. Six cases showed pulpal necrosis. This necrosis was in five cases accompanied by an extensive inflammatory resorption occurring very soon after replantation. In some cases the entire root was nearly resorbed within two months after replantation, figs. 23—28.

#### Other factors examined

*Complicating alveolar fractures.* Fractures of the alveolar bone were diagnosed in 19 cases, all of these showed resorption at the follow-up examination. In cases with alveolar fractures replacement resorption occurred in 12, while inflammatory resorption was seen in 7 cases, in all cases resorption started very early

Table VI  
*13 teeth with incomplete root-formation replanted without root-filling.*

age of patient (years)	tooth number	stage of root-formation	length of extra oral period (minutes)	total	observation period	positive vitality test	continued root-formation	obliteration of pulp chamber	replacement resorption	inflammatory resorption	later complications
7	1+	1	0	5	1 year	+	+	+	—	—	—
8	+1	1	0	5	11 years	+	+	+	—	—	—
7	+1	2	35	0	5 months	—	—	—	—	+	1
9	1+	2	0	45	13 years	—	—	+	—	—	—
9	+1	2	30	30	2 years	—	—	—	+	—	—
7	1+	2	45	45	2 years	—	+	+	—	—	—
7	+1	2	45	45	2 years	—	+	+	—	—	—
6	+1	1	0	105	6 years	?	+	+	—	+	2
9	1+	2	15	100	3 months	—	—	—	—	+	3
6	+1	1	90	30	2 years	+	+	+	—	—	—
9	1+	2	15	120	1 year	—	—	—	+	—	4
7	1+	2	0	140	3 months	—	—	—	—	+	5
7	—2	1	0	150	3 months	?	—	—	—	+	6

<sup>1</sup> Pulpal necrosis, extraction after 5 months

<sup>2</sup> Secondary pulpal necrosis after 3½ year

<sup>3</sup> Pulpal necrosis, extraction after 3 months

<sup>4</sup> Pulpal necrosis, root-filling after 5 weeks

<sup>5</sup> Pulpal necrosis, extraction after 3 months

<sup>6</sup> Pulpal necrosis, extraction after 3 months

and had a rapid progression. Apparently relatively more teeth with alveolar fractures showed replacement resorption than inflammatory resorption but the difference is not significant ( $0.4 > p > 0.3$ ). The difference between the occurrence of alveolar fractures in the two resorption groups compared with group 1 is highly significant ( $0.05 > p > 0.025$ ).

*Gingival condition.* Reattachment of the marginal gingiva seemed to occur; a slight increase in pocket depth was only found in 5 out of 70 teeth examined.

*Type and length of fixation.* The possible influence of the various types of fixation methods or no fixation and the length of the fixation period was analyzed. No correlation between fixation and result of replantation could be demonstrated.

*Antibiotic therapy.* There was an equal distribution of the material in the three groups regardless of antibiotic therapy or not. In 50 cases penicillin was given immediately after replantation; in 60 cases no antibiotics were given.

*Sex and age of patients.* The distribution of males and females was equal in all three groups. With regard to the age distribution, there was a significantly higher number of patients of age 6—7 in group 3 as compared to the entire material, as well as to group 2. On the other hand a higher number of patients was found in the age beyond 14 years in group 2 as compared with the entire material as well as group 3 ( $0.05 > p > 0.025$ ). Group 1 did not differ from the material as a whole.

#### DISCUSSION

The material demonstrated that under certain conditions, a tooth can remain without resorption after a replantation and maintain a normal function. Also it was demonstrated, that the duration of the extra oral period was of vital importance in determining the results. When the extra oral period exceeded 90 minutes the frequency of healing was significantly lowered.

The conclusions are in agreement with other authors. *Flanagan & Myers* (1958) found in a study on replantation of molars in hamsters, that 63 % of the teeth, replanted after 30 minutes storage in sterile physiologic saline, showed uncomplac-

ed healing, whereas after 6 hours storage, none of the replanted teeth showed normal healing.

*Løe & Waerhaug* (1961) in a study of replantation in dogs and monkeys examined the effect of drying the tooth before replantation with extra oral periods of 15—30—45 and 120 minutes. They found that the histologic picture to some extent varied with the duration of the extra oral period. Areas with normal periodontal membrane dominated in the 15 and 30 minutes groups, but also resorption areas of the cementum could be seen. After 120 minutes drying numerous resorption areas on the root surface as well as ankylosis were present.

The present study demonstrated that teeth with incomplete root formation replanted without endodontic treatment, in nearly all cases re-established vascularization, when the extra oral periods were less than 90 minutes. Apparently, some pulpal damage may occur resulting in an obliteration of the pulp chamber.

Similar findings have been reported, mainly as case histories (*Archer*, 1952, *Herbert*, 1953, *Lindahl & Mårtensson*, 1960, *Ljungdahl & Mårtensson*, 1955, *Miller*, 1953, and *Pålsson*, 1944) and also in one comprehensive report concerning 85 immediately replanted human teeth (*Öhman*, 1965). In the last-mentioned study it was demonstrated, that even teeth with completed root formation in some cases were able to re-establish vascularization, and this was also seen in four cases in the present study. The same findings were also reported in replantation studies in hamsters, *Flanagan & Myers* (1958) and in dogs, *Scheff* (1892) and by *Nordenram* (1963) in a study of autotransplantations in humans.

The present study demonstrated two types of resorption after replantation viz.: Replacement resorption and inflammatory resorption. These findings were corroborated by a histological analysis of 22 replanted teeth (*Andreasen & Hjørtting-Hansen* 1966).

The replacement resorption is preceded by ankylosis between the root and the alveolar bone. The ankylosis eventually leads to a complete resorption of the hard dental tissues which subsequently are then replaced with bone.

The differences in the rate of progression for this phenomenon may be related to the initial extent of the ankylosis. If the tooth

is replanted shortly after accidental loss the periodontal membrane is either re-established completely (group 1) or only few areas of ankylosis may occur. In this case a long time will elapse before the process of replacement results in total resorption of the root.

The inflammatory resorption is probably caused by an inflammatory reaction in the periodontal membrane. The inflammation may be due to a necrosis of the pulp or to remnants of the pulp with or without infection. The characteristic radiographic finding is a bowl-shaped resorption of the root, corresponding to this area there is always a radiolucency of the bone. This kind of resorption could be arrested by appropriate endodontic treatment. In cases where endodontic treatment was not carried out this resorption rapidly resulted in a loss of the tooth. This usually occurred after two to ten months.

This observation too is supported by a recent report by *Knight et al.* (1964), demonstrating that endodontic treatment at the time of replantation in dogs reduced the amount of root resorption compared to teeth replanted without endodontic treatment. The deleterious effect of the damaged pulp tissue was also demonstrated in the present study by the presence of a radiolucency around the apical foramen in 64 % of the teeth in the inflammatory resorption group in contrast to, respectively, 9 % and 14 % in group 1 and 2.

Since no difference in the result of replantation was found between immediate and later root-filling of replanted teeth, it seems appropriate to replant as soon as possible after accidental loss and postpone the endodontic treatment in order to decrease the extra oral period as much as possible.

There was a significantly higher number of patients between 6—7 years of age in the inflammatory resorption group. Since the distribution of teeth according to endodontic treatment was similar in all age groups, this higher number of inflammatory resorption in age group 6—7 may be the result of insufficient root-canal treatment in teeth with wide root canals and with thin dentinal walls. If the suggested pathogenesis for the inflammatory resorption is correct pulpal remnants will easily cause inflammatory changes in the periodontal membrane of these teeth. *Lenstrup & Skieller* (1957 and 1959) found no correlation between

the extra oral period and the degree of resorption, they concluded, however, that healing without resorption only can be expected when the replantation is done shortly after loss. The four cases without resorptions in their material were all replanted within 1/2 hour after the accident.

The prognosis for the material has shown that only 20 % are without resorption after longer periods of observation. Extensive studies have been carried out with replantation related to endodontic treatment. It would be natural to assume a higher frequency of success for this treatment compared to the replantation after accidental loss; thus *Emmertsen* (1956) reported that 22 teeth (48 %) out of 46 followed for more than 2½ years were clinically and radiographically successful. Criteria for the radiographic evaluation was that no radiolucency was seen around the roots. Contrary to this *Heiss* (1944) found that only 7 (17 %) out of 41 teeth were clinically and radiographically successful after observation periods from 1—6 years using the same criteria as in the present investigation.

Experimental investigations are now undertaken to clarify the various factors influencing the prognosis for replanted teeth.

#### SUMMARY

The present investigation is a clinical and radiographic study of 110 teeth replanted after accidental loss. The observation period varied from 2 months to 13 years.

Radiographic examination showed three types of healing: *Healing* with establishment of a normal periodontal membrane. *Replacement resorption* (ankylosis) with disappearance of the periodontal membrane and progressive resorption of the root and replacement with bone.

*Inflammatory resorption* with periradicular radiolucency in relation to the areas with resorption.

Twenty-two teeth (20 %) showed complete healing with observation periods of more than one year. Ninety per cent of teeth replanted within 30 minutes after accident were without resorption, 43 % replanted 31—90 minutes after accident were without resorption, whereas only 7 % were without resorption when the extra oral period exceeded 90 minutes. Thirteen teeth

with incomplete root formation were replanted without root-filling. The pulp was revascularized in 7 cases. In four cases revascularization of the pulp was seen in teeth with completed root formation.

It was found that the prognosis for cases with complicating alveolar fractures was poor.

Endodontic treatment was carried out, either in relation to replantation or later; no influence on the result could be demonstrated. Type and length of fixation were analyzed, but no correlation between these factors and the degree or severity of resorption was demonstrated.

#### RÉSUMÉ

#### RÉIMPLANTATION DE DENTS

I. ÉTUDE RADIOGRAPHIQUE ET CLINIQUE DE 110 DENTS HUMAINES RÉIMPLANTÉES APRÈS ACCIDENTS AYANT PROVOQUÉ LEUR EXPULSION.

Le présent travail est une étude clinique et radiographique faite sur 110 dents réimplantées après accident ayant provoqué leur expulsion. La période d'observation a varié de deux mois à 13 ans.

L'examen radiographique a révélé trois types d'évolution: *Consolidation* avec établissement d'un desmodonte normal. *Résorption avec remplacement* (ankylose): disparition du desmodonte et résorption progressive de la racine, compensée par formation osseuse. *Résorption inflammatoire* avec aspect périradiculaire radioclaire au niveau des zones de résorption.

Vingt-deux dents (20 %) présentaient une consolidation complète avec des périodes d'observation de plus d'un an. 90 % des dents réimplantées au bout d'au plus 30 minutes après l'accident ne présentaient pas de résorption, 43 % des dents réimplantées au bout de 31—90 minutes après l'accident ne présentaient pas de résorption, tandis que 7 % seulement des dents réimplantées au bout de plus de 90 minutes étaient exemptes de résorption. Treize dents n'ayant pas terminé la formation de leurs racines ont été réimplantées sans obturation radiculaire. La pulpe s'est revascularisée dans 7 cas. Dans quatre cas, la revascularisation de la pulpe a été observée dans des dents ayant terminé la formation de leurs racines.

Le pronostic s'est révélé peu favorable dans les cas que compliquaient des fractures alvéolaires.

Le traitement pulpaire a été effectué soit au moment de la réimplantation soit plus tard; aucune influence sur le résultat n'a pu être mise en évidence. Le type et la durée de la contention ont fait l'objet d'une analyse, mais aucune corrélation n'a été mise en évidence entre ces facteurs et le degré ou la gravité de la résorption.

#### ZUSAMMENFASSUNG

#### REPLANTATION VON ZÄHNEN

##### I. EINE KLINISCH-RÖNTGENOLOGISCHE UNTERSUCHUNG VON 110 MENSCHLICHEN NACH VERLUST DURCH UNFALL REPLANTIERTEN ZÄHNEN

Die vorliegende Arbeit ist das Ergebniss einer klinisch-röntgenologischen Untersuchung von 110 Zähnen, die nach Verlust durch Unfall replantiert wurden. Die postoperative Beobachtung erstreckte sich über einen Zeitraum von 2 Monaten bis zu 13 Jahren.

Auf Grund röntgenologischer Kontrollen lassen sich 3 Heilungstypen aufstellen:

*Einheilung* mit Bildung eines normalen Periodontiums.

*Substitutionsresorption* — ankylotische Einheilung unter Verschwinden des Periodontiums mit fortschreitender Wurzelresorption und anschliessender Auffüllung mit Knochengewebe.

*Entzündliche Resorption* mit periradiculärer, röntgenologisch sichtbarer Aufhellung den Resorptionszonen entsprechend.

Bei 22 Zähnen (20 %) fand man bei einer postoperativen Beobachtung von mehr als einem Jahre völlige Einheilung. Bei 90 % der innerhalb von 30 Minuten nach dem Vorfall replantierten Zähne und bei 43 % der innerhalb von 31 bis 90 Minuten nach dem Vorfall replantierten Zähne wurde keine Resorption festgestellt, wohingegen fehlende Resorption nur bei 7 % der Fälle gefunden wurde, bei denen sich extraorale Zustand über mehr als 90 Minuten ausdehnte.

13 Zähne mit unvollständiger Wurzelbildung wurden ohne Wurzelfüllung replantiert. In 7 dieser Fälle fand eine Revascularisation ihrer Pulpa statt. In 4 Fällen wurde eine solche bei Zähnen mit vollständiger Wurzelbildung gesehen.

Es konnte festgestellt werden, dass die Prognose in Fällen komplizierender Alveolefraktur gering ist.

Hinsichtlich der Ergebnisse fand sich kein Unterschied zwischen den Fällen, bei denen eine endodontale Behandlung im Zuge der Replantation vorgenommen wurde und denjenigen, bei denen eine solche erst später stattfand.

Die Art und Weise, sowie die Dauer der Fixation wurden genauestens registriert und geprüft, doch liess sich kein Zusammenhang zwischen diesen Faktoren einerseits und der Art und der Schwere der Resorption andererseits feststellen.

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## Addresses:

*J. O. Andreasen,*  
*Dental Department,*  
*University Hospital,*  
*(Rigshospitalet)*  
*Blegdannelsvej 9,*  
*Copenhagen,*  
*Denmark.*

*E. Hjørting-Hansen,*  
*Dental Department,*  
*University Hospital,*  
*(Rigshospitalet)*  
*Blegdannelsvej 9,*  
*Copenhagen,*  
*Denmark.*