Periodontal conditions of teeth adjacent to extraction sites

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Abstract. The purpose of the present clinical study was to evaluate the effect of tooth extractions on the periodontal conditions of adjacent teeth. 40 patients were selected for the study. Prior to the extractions, baseline data of the adjacent teeth were obtained. Plaque (PlI) and gingival indices (GI), pocket probing depths and probing attachment levels were scored. In addition, the alveolar bone height was determined radiographically in relation to the CEJ adjacent to the extraction sites. The contralateral side of the jaw, where no tooth had to be removed, was examined as a control. A limited hygienic phase (scaling and root planing of all surfaces examined) was performed immediately prior to the extractions. Using the same parameters, all sites were reexamined 2–4 months and 6–9 months following the extractions.

After the hygienic phase, the teeth adjacent to the extraction sites indicated a decrease in the pocket probing depths by 0.5 to 1.5 mm. In shallow pockets (1–3 mm), this decrease was less pronounced than in moderate to deep pockets (4–9 mm), where it was composed of shrinkage of the gingival tissues and gain of probing attachment. The radiographic level of the bony alveolar crest in relation to the CEJ of the adjacent teeth was not altered by the extraction procedure. The oral hygiene performances of the patients were not influenced during the 9-month observation period. Therefore, neither PlI nor GI scores showed relevant improvements. Although the extraction had a beneficial effect on the periodontal conditions of the adjacent teeth, decisions for or against removing teeth for periodontal reasons must be made in the light of a comprehensive treatment plan and on the basis of individual patient considerations.

Key words: Tooth extraction – periodontal status.

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Following the initial or hygienic phase of periodontal treatment, sites with advanced periodontitis may still yield increased pocket probing depth. Hence, repeated scaling and root planing (Morrison, Ramfjord & Hill 1980, Lindhe et al. 1982a) in combination with surgical flaps (Ramfjord & Nissle 1974) and/or hemisections or root-amputations (Amsterdam & Rossman 1960) may be justified to obtain complete periodontal health. In addition, extractions of periodontally or endodontically diseased teeth may be indicated. Also, partially and fully impacted third molars are extracted at times because of pathologically deepened pockets on the distal aspect of the second molar teeth and/or incomplete development of the alveolar septum supporting these theeth (Ash 1964, Ash, Costich & Hayward 1962). Furthermore, the extraction of strategically *non*-important (Corn & Marks 1969) and diseased teeth are thought to result in improved periodontal conditions of neighbouring teeth which may be of special strategic importance for reconstructions (Silness, Hunsbeth & Figenschou 1973). It would, therefore be of interest to be able to predict the effect of a tooth extraction on the periodontal conditions of the sites adjacent to the extraction site. Cross-sectional studies have reported improved periodontal conditions on distal sites of the last teeth of the dental arch when compared with contralateral interproximal control sites (Silness et al. 1973). One recent study has commented on the effect of tooth extractions on the periodontal conditions of neighbouring teeth (Wiskott 1982). Generally, the pocket probing depths of adjacent teeth decreased following the extraction. However, shallow pockets (1–3 mm) appeared to loose periodontal support. Baseline data were not available in this report, and there were no control sites in the contralateral jaw resulting in findings which were rather difficult to interpret.

Results from the healing of extraction sites date back to the beginning of this century (Struck 1906, Euler 1924). Resorptions in the coronal area of the alveolar crest (Euler 1924) and the constriction of the circumferential ligament (Hahn 1958) may also involve adjacent periodontal tissues.

The purpose of the present clinical study was to examine the effects of tooth extractions on the periodontal conditions of the teeth adjacent to the extraction site.

Material and Methods

40 patients, displaying at least 1 tooth to be removed and yielding an identical number of teeth, but not necessarily identical periodontal lesions in the contralateral jaw, were selected. Only completely erupted and normally occluding teeth with pocket probing depths and loss of probing attachment of less than 10 mm were used in this

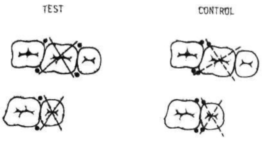

Fig. 1. Localization of measurements in test and control sites.

study. The observations could be based on 15 third molars, 16 first and second molars and 10 incisor and bicuspid teeth. The sites adjacent to the teeth to be extracted served as experimental (test) sites and were assessed on the buccal and lingual line-angles as depicted in Fig. 1

Pocket probing depth (PD) and loss of attachment (LA) from the cemento-enamel junction (CEJ) (Glavind & Löe 1967) were measured by means of a periodontal probe with a point diameter of 0.34 mm (Michigan no. M1) in the long axis of the tooth.

Oral hygiene was evaluated using the criteria of the plaqueindex system (PlI) (Silness & Löe 1964) and the gingival health or disease scored according to the criteria of the gingival index system (GI) (Löe & Silness 1963).

The distance of the bony alveolar crest to the CEJ (or a margin of a reconstruction) was measured in mm on standardized long-cone radiographs (Ash, Costich & Hayward 1962).

Prior to local anaesthesia (Ultracain D-S, carticaine 4%, epinephrine 1:200'000, Hoechst AG) and the extraction of the predetermined tooth by means of a forceps, the surfaces of the teeth adjacent to the extraction sites were scaled and root planed. However, no attempts were made to change the oral hygiene habits of the patients. Following the extraction, neither hemostatics (Schüle 1971) nor special drainage procedures (Meyer 1924) were used.

Clinical and radiographic parameters were obtained immediately prior to, at

EXPERIMENTAL DESIGN

	0	2Mt	4Mt	6Mt	9Mt
X-RAY	×	×		×	
PL I	×	×		×	
G I	×	×		×	
PD	×	×		×	
LOSS OF ATTACH.	×	×		×	
SCALING	×				
EXTRACTION	×				

Fig. 2. Experimental design.

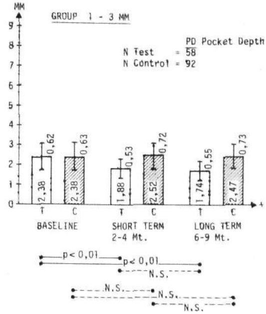

Fig. 3. Mean values, standard deviation and statistical analysis of pocket probing depth (PD) in group 1 (initial PD 1–3 mm).

2–4 months (Short term) and 6–9 months (completion of healing) following the tooth extraction (Fig. 2).

After the computation of the means and standard deviations for each parameter, cross sectional and longitudinal tests for statistical significance using the Student *t*-test and the Wilcoxon signed rank test (Hollander & Wolfe 1973) were performed.

Results

In the 40 patients, a total of 41 teeth were extracted, resulting in 114 measuring sites. These sites were grouped according to the baseline pocket probing depths of the test areas:
group 1: 1–3 mm – shallow pockets;

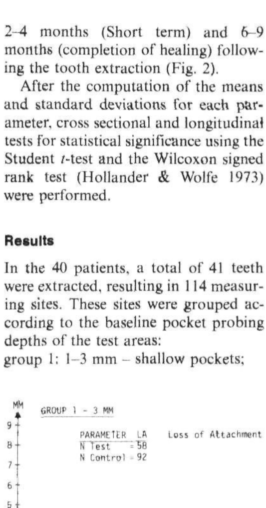

Fig. 4. Mean values, standard deviation and statistical analysis of loss of probing attachment (LA) in group 1 (initial PD 1–3 mm).

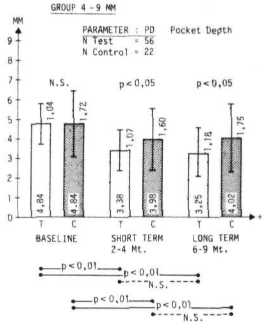

Fig. 5. Mean values, standard deviation and statistical analysis of pocket probing depth (PD) in group 2 (initial PD 4–9 mm).

group 2: 4–9 mm – moderate to deep pockets.

Group 1 comprised 58 test and 92 control sites. Group 2 yielded 56 test and 22 control sites. Initially, a 3rd group of initial pocket probing depth of 6–9 mm was formed for analysis. However, the separate analysis of the results of pockets with 4–5 mm and 6–9 mm initial probing depth yielded identical trends. Since the latter group of pockets comprised only 12 test and 5 control sites, it was decided to analyze all the pathologically deepened pockets in 1 group and hence, to present the 2 categories mentioned.

Only one approximal measurement could be determined on the radiographs, since the distinction of the buccal from the oral aspect is impossible (Lang & Hill 1977). Therefore, each radiographic measurement was taken twice, representing both buccal and lingual aspects. In this way, the same sample size as for the clinical measurements was available for statistical analysis.

Pocket probing depth (PD) and loss of probing attachment (LA)

The results for the different data categories are presented in Figs. 3–6 and were normalized in order to provide a basis for comparison, i.e., the difference of the values between test and control sites at the baseline examination was subtracted or added to the means of the control sites at all observation periods. In group 1 (PD: 1–3 mm), scaling alone (control) was not followed by a re-

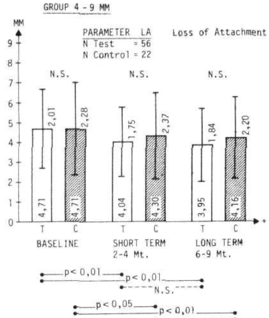

Fig. 6. Mean values, standard deviation and statistical analysis of loss of probing attachment (LA) in group 2 (initial PD 4–9 mm).

duction in pocket probing depth (Fig. 3) but by a decreased level of clinical attachment of 0.19 mm (Fig. 4). Scaling adjacent to the tooth extraction sites (test) showed a significant ($p<0.01$) reduction of the mean pocket probing depth of 0.5 mm (Fig. 3) and a gain of probing attachment of 0.24 mm (Fig. 4).

Significant ($p<0.05$) reductions in pocket probing depths of 0.86 mm (Fig. 5) and increased levels of probing attachment of 0.41 mm (Fig. 6) were noted following scaling and root planing of the control sites in group 2 (PD: 4–9 mm). After the additional removal of the adjacent tooth in the test sites, pocket probing depths were reduced by 1.46 mm (Fig. 5) and a gain of probing attachment of 0.67 mm (Fig. 6) was demonstrated.

Radiographic findings

Neither at baseline nor at any of the subsequent observation periods was there a difference in the level of the alveolar bone between test and control sites (Tables 1, 2). However, in both groups, a significantly increased ($p<0.05$) distance of the CEJ to the alveolar bone crest was noted at the short-term examination in the control groups when compared with the baseline levels. On the other hand, the radiographic level of the alveolar crest was not affected by the extractions at the test sites.

Plaque and gingivitis

PlI and GI scores tended to decrease (Tables 1, 2) as a result of scaling and root planing in both test and control sites. In group 1, the mean PlI was 1.45 at baseline and decreased to 1.28 and 1.24, respectively, following the extraction of the neighbouring tooth (Table 1). On the control sites, the PlI scores remained almost unaffected. Similarly,

Table 1. Mean values, standard deviations and statistical analysis of PlI, GI and measurements on radiographs in group 1 (initial PD 1–3 mm); *N* test: 58, *N* control: 92

	Group 1–3 mm								
	Baseline		Short-term		Long-term		Significance		
Parameter	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	Baseline short-term	Baseline long-term	Short-term Long-term
Plaque index									
PLI test	1.45	0.96	1.28	0.95	1.24	0.84	NS	NS	NS
PLI control	1.40	0.77	1.36	0.85	1.39	0.95	NS	NS	NS
Significance test-control	NS		NS		NS				
Gingival index									
GI test	1.52	0.73	1.35	0.72	1.19	0.81	NS	$p<0.01$	NS
GI control	1.29	0.64	1.38	0.74	1.23	0.73	NS	NS	$p<0.05$
Significance test-control	$p<0.05$		NS		NS				
X-ray									
RX test	1.81	1.73	1.90	1.71	1.95	1.70	NS	NS	NS
RX control	1.59	1.35	1.70	1.33	1.63	1.30	$p<0.05$	NS	NS
Significance test-control	NS		NS		NS				

Table 2. Mean values, standard deviations and statistical analysis of PlI, GI and measurements on radiographs in group 2 (initial PD 4–9 mm); *N* test: 56, *N* control: 22

	Group 4–9 mm								
	Baseline		Short-term		Long-term		Significance		
Parameter	*Mean*	*Standard deviation*	*Mean*	*Standard deviation*	*Mean*	*Standard deviation*	*Baseline short-term*	*Baseline long-term*	*Short-term Long-term*
Plaque index									
PLI test	1.64	0.70	1.20	0.84	1.29	1.00	$p<0.01$	$p<0.05$	NS
PLI control	2.09	0.68	1.50	0.74	1.05	0.90	$p<0.05$	$p<0.01$	$p<0.05$
Significance test-control	$p<0.05$		NS		NS				
Gingival index									
GI test	1.63	0.65	1.27	0.86	1.16	0.85	$p<0.05$	$p<0.01$	NS
GI control	1.77	0.53	1.45	0.67	1.27	0.63	NS	$p<0.01$	NS
Significance test-control	*NS*		NS		NS				
X-ray									
RX test	3.07	1.97	3.29	2.02	3.13	2.07	NS	NS	$p<0.05$
RX control	3.41	2.15	3.68	1.99	3.68	1.96	$p<0.05$	NS	NS
Significance test-control	NS		NS		NS				

the mean values corresponded to baseline throughout the study, while the mean GI decreased significantly ($p < 0.01$) from baseline on the test sites (Table 1).

In group 2, more pronounced reductions from baseline in mean PlI were seen both for short-term as well as observations following the completion of healing ($p < 0.05$). Also, the test sites yielded lower mean PlI scores than did the control sites at baseline ($p < 0.05$) and 2–4 months following the tooth extractions (Table 2). Similar changes were observed for the mean GI scores in this group. Not only did the mean GI scores decrease for both test ($p < 0.01$) and control sites ($p < 0.01$) at the short-term as well as observation period following completion of healing, but also, the mean GI scores were (not significantly) lower for the test sites at both observation periods (Table 2).

Discussion

The present investigation evaluated clinical periodontal and radiographic changes up to 9 months following adjacent tooth extractions. Baseline values were determined just prior to the extractions, which was supplementary to previous studies (Silness et al. 1973, Wiskott 1982).

The clinical measurements of pocket probing depth and loss of probing attachment were performed by means of a calibrated periodontal probe to the nearest mm, a fact which should be taken into consideration when discussing the statistical and/or clinical significance of results based on mean scores. Furthermore, it has been realized that levels of attachment may not be accurately determined by periodontal probing (Armitage et al. 1977, Fowler et al. 1982, Jansen et al. 1981, Lindhe et al. 1982b, Listgarten, Mao & Robinson 1976, Magnusson & Listgarten 1980, Polson et al. 1980, Saglie, Johansen & Fløtra 1975, Sivertson & Burgett 1976, Van der Velden 1980, Van der Velden & Jansen 1981). Factors such as inflammation (Magnusson & Listgarten 1980, Armitage et al. 1977, Sivertson & Burgett 1976), probing force (Polson et al. 1980, Van der Velden 1980, Van der Velden & Jansen 1981, Van der Velden & de Fries 1980) and the diameter of the probe tip (Listgarten et al. 1976) may affect the reproducibility of clinical measurements. It is well-known that in case of gingival health, the probe tip may not reach the most apical cell of the junctional epithelium (Armitage et al. 1977), while in the case of gingivitis, it may be located at the apical extent of the epithelial attachment (Jansen et al. 1981). However, in the case of periodontitis, the probe tip generally penetrates into the underlying connective tissue and is stopped by the first healthy dento-gingival fibers (Magnusson & Listgarten 1980). It is therefore of great importance that in clinical studies, conditions are created which minimize these factors affecting measurement error. In the present study, an attempt was made to fullfil these criteria by assessing pocket probing depth and loss of probing attachment by the same investigator who had been calibrated for intra-examiner variation. Furthermore, a set of identical periodontal probes were used. Since in previous studies standardized probing forces did not always show better reproducibility (Van der Velden & de Fries 1980), no such probes were used in the present study. On the other hand, the limited hygienic phase treatment of the test and control sites performed in the present trial without special home care instruction, contributed to a significant improvement of the gingival and periodontal conditions, and hence influenced the subsequent probing measurements (Armitage et al. 1977, Fowler et al. 1982).

In agreement with recent reports (Morrison et al. 1980, Pihlström et al. 1982), the scaling after the baseline examination was not followed by any noticable change in pocket probing depth but by a slightly increased loss of probing attachment at sites initially scoring 1–3 mm. The removal of the neighboring tooth, however, reduced pocket probing depth after 3 months by about 0.5 mm. This reduction was maintained for 6 months, indicating that this was a sequellae of the extraction and/or the absence of the adjacent tooth, facilitating access for oral hygiene procedures. In disagreement with another report (Wiskott 1982), a significant gain of clinical attachment was found at the tooth surfaces adjacent to the extraction sites at the completion of healing 6–9 months following the extraction. Most likely this was of minor clinical importance. However, it is evident from these data that tooth extraction in periodontally healthy areas will not injure adjacent periodontal tissues and will not be followed by any increased loss of attachment at the sites of neighbouring teeth.

Although no efforts had been made to improve the oral hygiene practices of the patients, a decrease in GI scores was noted on the test sites documenting that the improved gingival conditions were the result of a newly established tight connective tissue cuff adjacent to the extraction sites. When periodontal pockets of 4–9 mm probing depth at baseline were evaluated 2–4 months and 6–9 months following the extraction of the adjacent tooth, a mean reduction in probing depth of 1.46 mm was seen. Obviously, this value was significantly greater than what had been achieved by scaling and root planing alone. In agreement with previous studies (Morrison et al. 1980, Pihlström et al. 1982), a reduction of 0.86 mm could be attributed to the hygenic phase procedure, while the additional 0.6 mm were the result of the improved gingival conditions following the extraction of the neighboring tooth. These additional benefits were observed in conjunction with decreased plaque and gingival index scores at the test sites, suggesting that oral hygiene practices were also facilitated by the tooth extractions.

Due to the fact that the control teeth had to be homologous teeth on the contralateral side, it has to be realized that the data set for the group of pockets with 6–9 mm initial probing depths was rather limited in size and interpretation subject to speculation. Generally, similar results were obtained in these deep pockets as in the 4–5 mm category which lead to the collapse of these 2 categories.

In conclusion, it may be stated that following tooth extraction, no permanent injury was observed on healthy periodontal tissues of adjacent neighbouring teeth. Furthermore, a reduction in pocket probing depth following tooth extraction in addition to that obtained by scaling and root planing could be demonstrated at sites adjacent to the edentulous area. This reduction was the result of gingival shrinkage and was greater at sites of deep than at sites with moderate pocket probing depth. The benefical effects of tooth extractions to the adjacent periodontium should be considered when patients with advanced periodontal disease are treated comprehensively. Also, these results demand a careful re-evaluation of the periodontal status following the completion of a hygienic treatment phase, especially following extraction of periodontally or endodontically diseased teeth of minor strategic importance.

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Zusammenfassung

Parodontale Befunde an Zähnen, die Extraktionslücken begrenzen

Mit dieser klinischen Studie wurde beabsichtigt, die Einwirkung von Zahnextraktionen auf die parodontalen Verhältnisse der die Lücke begrenzenden Nachbarzähne zu beurteilen. Für die Studie wurden 40 Patienten ausgewählt. Vor den Extraktionen wurden die Basisdaten der aktuellen Zähne registriert. Die Beurteilungseinheiten der Plaque (PlI) und Gingivalindizes (GI) wurden festgestellt sowie die Taschentiefen und die Attachmentniveaus sondiert. Zusätzlich wurde die Höhe des alveolaren Knochens in Bezug auf die der Extraktionsseite zugekehrten Schmelzzementgrenze bestimmt. Als Kontrollseite wurde die kontralaterale Seite des Kiefers ohne Extraktionslücken untersucht. Eine begrenzte Hygienephase (Zahnsteinentfernung und Wurzelglättung aller untersuchten Oberflächen) wurde direkt vor der Extraktion durchgeführt.

Nach der Hygienephase wurde an den der Extraktionslücke zugekehrten Seiten eine Verringerung der sondierten Taschentiefen von 0.5–1.5 mm beobachtet. Bei flachen Taschen (1–3 mm) trat diese Verringerung weniger deutlich auf als bei vertieften bis tiefen Taschen (4–9 mm), bei denen dieser Vorgang durch Schrumpfung der gingivalen und des sondierten Attachmentgewebes überlagert wurde. Das durch das Röntgenbild in Bezug auf die CEJ bestimmte Niveau der alveolaren Knochenleiste wurde durch die Extraktion nicht verändert. Die oralen Hygienemassnahmen der Patienten wurden durch die 9-monatige Beobachtungszeit nicht beeinflusst. Das scheint der Grund dafür zu sein, dass die Beurteilungseinheiten der PlI und der GI keine verbesserten Werte zeigten. Obwohl die Extraktion einen günstigen Einfluss auf die parodontale Situation der den Lücken angrenzenden Zähne hatte, müssen Entscheidungen für oder gegen eine Extraktionsindikation aus parodontalen Gründen, als Teil eines Gesamt-Behandlungsplanes gefällt werden und von Überlegungen ausgehen, die der oralen Situation des einzelnen Patienten Rechnung tragen.

Résumé

Etat parodontal des dents voisines de dents extraites

Le but de la présente étude clinique était d'évaluer l'effet des extractions dentaires sur l'état parodontal des dents voisines. L'étude a porté sur 40 patients sélectionnés à cet effet. Avant de pratiquer les extractions, les données suivantes concernant les dents voisines ont été établies: Indice de Plaque (PlI), Indice Gingival (GI), profondeur des poches au sondage et niveau de l'attache mesuré par sondage. De plus, à l'aide de radiographies, on déterminé la hauteur de l'os alvéolaire pa rapport à la limite émail-cément (CEJ) à côt des dents à extraire. Le côté controlatéra de la même mâchoire, où aucune extractio n'était prévue, servait de témoin et subissai les mêmes examens. Une phase hygiéniqu limitée (détartrage et surfaçage radiculaire d toutes les surfaces examinées) a pris plac immédiatement avant les extractions. En uti lisant les mêmes paramètres, on a pratiqué

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des examens de rappel 2–4 mois et 6–9 mois après les extractions.

Après la phase hygiènique, les dents voisines des dents à extraire présentaient une réduction de la profondeur des poches au sondage de 0.5 à 1.5 mm. Dans les poches peu profondes (1–3 mm) cette diminution était moins prononcée que dans les poches de profondeur modérée à importante (4–9 mm), où il s'agissait d'un retrait des tissus gingivaux et d'un gain concernant la profondeur d'attache. Le niveau radiographique le la crête alvéolaire osseuse par rapport à la limite CEJ des dents voisines n'était pas altéré par les extractions. Le niveau de l'hygiène buccale atteint par les patients restait sans changement pendant les 9 mois de la période d'observation. Ni PlI, ni GI ne présentaient donc une amélioration significative de leurs scores. Malgré l'action favorable des extractions sur l'état parodontal des dents voisines, il convient de prendre les décisions pour ou contre les extractions pour raison d'ordre parodontal, en tenant compte des détails du plan de traitement et des considérations individuelles concernant le patient en question.

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