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A LONGITUDINAL TWO-YEAR STUDY OF A NUMBER OF FULL DENTURE CASES

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INTRODUCTION

Mucosal changes under removable dentures are comparatively common both as acute and chronic conditions. As a rule, acute lesions heal rapidly after correction of the denture and they have received little attention in the literature, in spite of the fact that they cause many patients temporary discomfort. On the other hand, chronic mucosal changes, which are seldom accompanied by symptoms, have attracted much interest. They are not so easily treated as the acute condition; they have been said to accelerate bone resorption; they have been related to diffuse local and peripheral symptoms that are difficult to diagnose and it has been suggested that they can be a precancerous state.

The clinical picture of chronic mucosal changes — usually termed stomatitis prothetica — is one of chronic inflammation of varied degree, ranging from small local areas of erythema via large diffuse areas, often with a smooth shiny surface, to severely inflamed granulations, sometimes accompanied by swelling and oedema. The histologic picture of the denture-supporting mucosa shows corresponding changes in the epithelium and the subepithelial tissues such as have been described by, for instance, *Gasser* (1951), *Pendleton* (1951) and *Östlund* (1958).

It is generally agreed that such mucosal changes are due mainly to the foreign-body action of the denture but the explanations of the deeper mechanism vary from one author to another. They have been attributed by *Cahn* (1945) to poor oral and denture hygiene, while *Nyquist* (1953) found that denture hygiene was of minor significance in the ocurrence of stomatitis prothetica and that there seemed to be no association between the disease and the composition and the extent of the bacterial flora.

Much attention has been devoted to the possibility of a local irritative action of the denture base material, and especially with respect to residual monomer (*Hedegård*, 1955; *Smith & Bains*, 1955; *Kuck*, 1956; *Henkel*, 1961; *Axelsson & Nyquist*, 1962). The findings suggest that this factor is of little importance to the occurrence of denture stomatitis.

Hypersensitive reactions to the base material have also been discussed as a possible cause of mucosal changes under dentures (*Spreng*, 1945; *Nyquist*, 1952 and 1958), but cases of clearly manifested allergic reaction to denture materials are extremely rare, to judge from the literature.

The conclusions reached by *Nyquist* (1952) on the basis of comprehensive studies on a large clinical series of full denture cases are that potential traumatizing properties of the dentures, such as poor fit, instability and poor occlusal and articulation contacts, are important contributory causes to the appearance of stomatitis prothetica. It seems to be generally agreed that the best way of avoiding this condition is to avoid obvious traumatizing action and to perform regular checks so as to correct any bad fit and irregularities of occlusion and articulation (*Van Huysen, Fly & Leonard*, 1954).

It is, however, not only the mucosa that is subjected to changes beneath a denture, but also the jawbone. Even after the alveoli have fully healed reduction of the alveolar process continues, although at a slow rate and to a comparatively small extent under normal conditions (*Wright*, 1929; *Pendleton & Glupker*, 1935; *Häupl & Spreng*, 1956; *Hedegård*, 1962). It would also appear to occur irrespective of whether dentures have been worn (*Weinmann*, 1955; *Weinmann & Sicher*, 1955; *Campbell*, 1960). Such resorption of the alveolar process increases the risk of

trauma through resulting poor denture fit and impairment of occlusion and articulation. The dentures themselves also undergo dimensional changes (*Woelfel, Paffenberger & Sweeney*, 1961; *Wennström*, 1962), and this further increases the deleterious effect of the denture. A combination of these factors is considered to lead to flabby ridges, that is, a fibrous and resilient alveolar crest (*Epp*, 1946; *Frölich*, 1949; *Gasser*, 1949).

There seems, however, to be little information, and that unreliable, on how soon traumatizing effects can appear as a result of the aforementioned conditions. *Tallgren's* studies (1957) on the decrease in the face height in full denture cases would suggest that the denture can rapidly lose its stability.

THE PRESENT STUDY

The purpose of the present clinical study was to follow over a period of 2 years a group of patients with both upper and lower dentures. The occlusion, articulation and stability of the dentures, and the inflammatory changes in the denture-bearing mucosa were recorded at the time the dentures were supplied, after 6 months, and after 2 years.

In a supplementary study the effect of eliminating potential traumatic features of the dentures was examined on part of the series after the two-year follow up.

Case series

The case series originally consisted of all the persons that, during the period from September 1959, until March 1960, were registered for the provision of full upper and lower dentures at the Students' Clinic of the Royal School of Dentistry, Umeå, i. e. 124 persons altogether. Of these, 33, or 27 per cent, were not followed over the full 2-year period: 4 had died, 3 were admitted to hospital for chronic diseases, 4 had moved from the district and 11 could not be reached by telephone or letter; 2 patients did not wish to attend for further examination as they were completely satisfied with their dentures. Of the remaining 9 patients, 2 had lost their dentures, 3 did not wear them and 4 had had them reconstructed or relined and were therefore excluded from the study.

Table 1.

Age and sex distribution in re-examined full denture patients at the two-year control.

Age	Male	Female	Total
29	—	1	1
30—39	2	8	10
40—49	6	14	20
50—59	12	16	28
60—69	12	13	25
70—79	4	2	6
84	1	—	1
Total	37	54	91

Two of the remaining 91 patients did not appear for the 6-month follow-up, and the tables in the following section therefore relate to 89 patients for the 6-month follow-up and 91 for the initial and 2-year checks.

The age and sex distribution and the observations on the old dentures for the original 124 patients have been given in a preliminary report covering observations over 6 months (*Bergman, Carlsson & Hedegård*, 1961). The age and sex distributions for the final group at the two-year follow-up are shown in Table 1.

At the time they were registered at the Dental School 52 of these persons were wearing upper and lower full dentures, 29 full upper dentures and 10 none. In all cases of full dentures faulty occlusion and/or articulation was observed at the examination performed in accordance with the scheme for registration and classification drawn up for the study (see *Classification system*).

Table 2 shows the mucosal status for the 91 patients on the first occasion of examination.

The mucosas of the 10 patients not wearing dentures displayed no clinically observable inflammatory changes.

Treatment scheme

All the patients were provided with full upper and lower dentures at the Students' Clinic. The treatment procedure is outlined below.

Table 2.

Condition of the oral mucosa on denture-bearing areas at the first examination.

	Clinically healthy mucosa	Clinically inflamed mucosa	Total
Maxilla	48	43	91
Mandible	80	11	91

After a preliminary clinical examination and intra- and extraoral radiographic examination, any required surgical correction was performed (5 cases).

To enable the displaced tissues to recover their form the patients were requested not to wear their old dentures for at least 24 hours before the impressions were taken (*Lytle*, 1962). The impressions were taken in zinc oxide and eugenol paste in functionally trimmed individual trays.

Stone casts were made and mounted in centric occlusion in an individually adjustable articulator (Dentatus ARL) after intraoral bite registration. Artificial cusped teeth were used.

After the clinical check the wax dentures were embedded in a flask. Polymerization was performed at 70° for 6 hours and boiling for one hour, followed by slow cooling. After preliminary spot grinding the denture was given to the patient to wear for 3 days, after which wax indexes were taken for the final grinding. No denture was given to the patient until it had been passed as satisfactory with respect to stability, occlusion and articulation by 2 investigators, one of whom subsequently performed all the other clinical registrations.

Clinical registrations

All the registrations at the initial examination, the 6-month and 2-year follow-ups and the supplementary study were performed by the same investigator.

The following factors were examined:

(a) Stability of the dentures
(b) Centric occlusion
(c) Articulation
(d) Clinical status of the oral mucosa in the denture-supporting areas of the upper and lower jaws.
e) Resilience of the alveolar process in the anterior segment.

Classification system

The clinical registration was performed in accordance with a classification system worked out for the present study and based on the principles outlined by *Nyquist* (1952) for his investigation. After testing the classification system on a series of full denture cases not included in our study the following methods and classification groups were decided upon.

Stability of the denture

To test the stability of the denture it was pressed lightly against its bed — in the maxilla with two fingers in the centre of the denture base, and in the mandible in the premolar region of the denture — and an attempt was made to tip, rotate and/or displace it horizontally. The stability was assessed as *satisfactory* when no more than slight movements of the denture were caused. Otherwise *defective stability* was recorded.

Occlusion

Correct centric occlusion was recorded when there was correct intercuspidation without premature contact on repeated habitual closing from the rest position and firm intermaxillary contact could be obtained in the lateral and anterior segments by means of a metal spatula. Otherwise *incorrect centric occlusion* was recorded.

Articulation

Correct articulation was recorded when an examination with a metal spatula showed firm bilateral contact in lateral positions after gliding half the width of a premolar, and bilateral contact in protrusion position after forward gliding about 3 mm. Otherwise *incorrect articulation* was recorded.

Oral Mucosa

The mucous membrane was recorded as *healthy* when no clinical signs of an inflammatory reaction were observed. It was noted as *inflamed* when local/or general inflammation was observed in the palate or in the fore part of the mucosa of the alveolar process.

Resilience of alveolar process

The assessment was performed for the upper and lower jaws in accordance with the following scale:

Grade 1. — Mucosa taut over bone

Grade 2. — Top of ridge mobile against the bone

Grade 3. — One-half the height of the ridge or more mobile against the bone; and in cases where the alveolar process was absent.

Error of the method

To obtain an impression of the reliability of the clinical observations performed in accordance with the system of classification, two investigators performed independently, and according to written instructions, clinical examinations and registrations of the first 46 registered full denture cases. Since a complete account of these results has been published elsewhere (*Bergman, Carlsson & Hedegård,* 1961), it will suffice to give a summary here.

In their assessment of denture stability, articulation, mucosal status in the mandible and the resilience of the alveolar process the investigators differed in one case for each factor. On occlusion and mucosal status in the maxilla there was a difference of opinion in two cases.

Duplicate determinations were performed by the same 2 investigators also after the 6 month and 2 year follow-up examinations, and with corresponding results.

Considering the small differences between investigators on the three occasions of examinations, it would seem that the system of classification is sufficiently reliable for the present longitudinal study.

Statistical analysis

In the analysis of the fourfold tables the chi-square test was performed, using Yate's correction (*Baily*, 1959).

The following levels of significance were used:

$P < 0.01$, significant

$0.01 < P < 0.05$, almost significant.

RESULTS

Initial examination

The initial clinical registration showed incorrect occlusion and/or articulation for all the patients previously having full dentures (52 cases); of these 29, or 56 per cent, exhibited inflammation of the upper denture-bearing mucosa. From the initial analyses it was evident that grade 3 of mucosal resilience was accompanied by a significantly higher frequency of inflamed palatal mucosa (16 out of 19 cases) than were grades 1 and 2 (13 out of 33 cases).

Six-month and 2-year follow-ups

Table 3 presents a survey of the condition of the full dentures after an observation period of 6 months and 2 years. If one or more of the factors denture stability, occlusion and articulation were found not to be acceptable the condition of the denture was considered to be defective, otherwise satisfactory.

It would seem that the oral conditions and/or the dentures changed with time so that, at the follow-up, originally acceptable dentures proved to be defective with respect to at least one of the factors in question; after 6 months one-half and after 2 years three-quarters of the dentures were not acceptable from one or more of the aspects mentioned. The increase was significant in both cases.

As is evident from Table 4 the change in denture stability took place chiefly during the first 6 months, the number of cases showing a subsequent deterioration in this respect being small.

The number of cases of full dentures with correct occlusion and articulation fell significantly to 63 after 6 months and to 33 after 2 years (Table 5). After the first follow-up period the

Table 3.

Denture condition after 6 months and 2 years.

Denture condition	Number of dentures	
	observ. time ½ year	observ. time 2 years
Acceptable	44	22
Deficient	45	69
Total	89	91

articulation alone had worsened in 21 out of 89 full dentures, whereas only 5 showed both incorrect occlusion and articulation. After 2 years the latter group comprised 44 of the 91 checked full dentures, whereas the remaining 14 had incorrect articulation only.

At the 6-month follow-up there was no significant increase in the inflammation of the upper and lower mucosas (Table 6). The increase in the number of cases with maxillary inflammation between the 6 month and 2-year follow-up was almost significant.

For a closer study of the relationship between the mucosal status and the condition of the denture the case series was

Table 4.

Denture stability after 6 months and 2 years.

Denture stability	Number of dentures	
	observ. time ½ year	observ. time 2 years
Acceptable	59	57
Defective	30	34
Total	89	91

Table 5.

Occlusion and articulation after 6 months and 2 years.

Status of occlusion and articulation	Number of dentures	
	observ. time ½ year	observ. time 2 years
Correct centric occl. and artic.	63	33
» » » , incorrect artic.	21	14
Incorrect centric occl. and articulation	5	44
Total	89	91

Table 6.

Condition of the oral mucosa on denture-bearing areas after 6 months and 2 years.

Jaw	Control	Number of patients with		Total
		clinically healthy mucosa	clinically inflamed mucosa	
Maxilla	0 year	48	43	91
	½ year	47	42	89
	2 years	31	60	91
Mandible	0 year	80	11	91
	½ year	74	15	89
	2 years	74	17	91

divided into 2 groups, one containing 48 persons that at the first examination had a healthy mucosa in the upper denture-bearing area, and the other, 43 patients that on the same occasion were found to have inflamed upper mucosas. Tables 7 and 8 give the results.

Table 7.

Condition of the maxillary oral mucosa in relation to the denture condition after 6 months and 2 years in the 48 patients with originally healthy maxillary mucosa.

Denture condition	Number of patients with			
	clinically healthy mucosa		clinically inflamed mucosa	
	observ. time 1/2 year	observ. time 2 years	observ. time 1/2 year	observ. time 2 years
Acceptable	20	5	5	5
Deficient	12	18	11	20
Total	32	23	16	25

Table 8.

Condition of the maxillary oral mucosa in relation to the denture condition after 6 months and 2 years for the 43 patients with originally inflamed maxillary mucosa.

Denture condition	Number of patients with			
	clinically healthy mucosa		clinically inflamed mucosa	
	observ. time 1/2 year	observ. time 2 years	observ. time 1/2 year	observ. time 2 years
Acceptable	8	4	11	6
Deficient	7	4	15	29
Total	15	8	26	35

In the second group with originally healthy upper mucosa the inflammatory reaction had appeared beneath the new dentures in 16 cases after 6 months and in 25 cases after 2 years (Tables 7 and 8). The difference is significant. The distribution of these cases with respect to observable traumatic and non-traumatic dentures showed no significant differences.

Of the group of 43 cases with inflamed mucosa at the first examination, 15 displayed healing after 6 months, but at the 2-year follow-up this number had fallen to 8. The difference in the number of inflamed palatal mucosas under clinically satisfactory and unsatisfactory dentures was not significant for the maxilla.

Nor was the difference in the number of inflamed mucosas for the different denture groups significant for the mandible. Only 17 out of 91 showed chronic mucosal inflammation after 2 years.

The number of patients whose mucosa was firmly adherent to, and not movable against the bone diminished during the

Table 9.

Alveolar ridge resilience at original examination and after 6 months and 2 years.

Jaw	Resilience	Control		
		0 year	1/2 year	2 years
Maxilla	Grade 1	18	16	9
	Grade 2	44	40	70
	Grade 3	29	33	12
	Total	91	89	91
Mandible	Grade 1	35	28	5
	Grade 2	23	28	54
	Grade 3	33	33	32
	Total	91	89	91

Table 10.

Denture condition at the 2-year control in relation to the resilience of the alveolar ridges.

Denture condition	Number of traumatizing factors	Resilience of the alveolar ridges, max. and mand.		
		Either or bot jaws Grade 1 (1-1; 1-2)	Both jaws Grade 2	Either or both jaws Grade 3
Acceptable	0	5	15	2
Deficient	1	3	16	3
	2	2	8	16
	3	—	7	14
Total		10	46	35

follow-up period (Table 9). In the maxilla there was also a significant reduction in the number of patients with grade 3 resilience between the 6-month and 2-year checks.

As is evident from Table 10, the number of traumatizing factors associated with the dentures increased with the resilience

Table 11.

Condition of the maxillary mucosa at the 2-year follow-up in males and females.

	Clinically healthy mucosa	Clinically inflamed mucosa	Total
Male	14	23	37
Female	17	37	54
Total	31	60	91

of the alveolar process. A corresponding analysis of the condition of the mucosa at the 2-year check in relation to the resilience of the alveolar process revealed no significant differences.

There was a close agreement in the numbers of men and women with inflammation of the upper mucosa (62 and 69 per cent of men and women; Table 11).

EXPERIMENTAL STUDY

From the findings of previous investigations (*Nyquist* 1952) there was reason to expect a higher frequency of healing of the mucosal inflammation in the maxilla than was found in this study (Table 8). In Nyquist's study, however, none of the patients had been supplied with new upper and lower dentures; the only measure taken was to reline the old upper denture, to provide a new lower denture and/or to correct occlusion and articulation by grinding. In the present study, the fact that patients were supplied with new upper and lower dentures may have led to adaptation difficulties — for instance through a new pattern of mastication. Moreover, there are differences in the composition and size of the series, in follow-up period and in certain criteria of evaluation; it is therefore difficult to compare the two studies.

The authors considered, however, that further examination of the significance of the traumatizing factors in the present case series was desirable and the following study was therefore designed:

The 2-year follow-up examination of the series was performed in two stages at an interval. In the first stage, 43 patients with inflamed mucosa and traumatizing dentures were registered. These were summoned for correction of their dentures to be performed by one of the authors. Thirty-eight patients appeared for the denture correction, which consisted in relining dentures which were unstable (21 cases) and grinding all dentures. The relining was performed in the laboratory by an indirect technique with cold curing resin after taking an impression in the denture with zinc oxide and eugenol paste. All the dentures were ground in the Dentatus ARL articulator. Checks and final corrections were performed clinically.

About 7 weeks after correction the patients were re-called for a new check, which was performed at the same time as the 2-year follow-up of the rest of the patients. The investigator (who had not performed the treatment) was unaware of whether a particular patient belonged to the experimental group or the remainder of the ordinary patient group appearing for the 2-year follow-up.

Two of the patients of the experimental group did not attend, one because of illness and the other because of employment in another part of the country.

Table 12.

Condition of the maxillary mucosa 7 weeks after correction of traumatizing dentures.

Number of patients	Maxillary mucosa		
	healed	improved	unchanged
34	22	6	6

Of the 36 patients in the follow-up group, 9 had had inflammation of both upper and lower mucosas, 25 only of the upper and 2 only of the lower mucosa.

As seen from Table 12, the great majority of cases showed healing and improvement after 7 weeks. In 5 of the 6 cases in which no change in the mucosal status was recorded, the dentures were found to exert a traumatic effect, there being incorrect articulation in 2, slightly incorrect occlusion in 2 and instability in one case.

DISCUSSION

Of the original 124 patients, 91 were included in the investigation. Twenty-two of those excluded had not attended for reasons unconnected with the treatment, while 2 more gave satisfaction with their dentures as their reason for not attending the follow-up. On the other hand, it is difficult to explain what effect the 9 remaining absentees would have on the results of the study had they been present. Four of them had had their dentures relined or reconstructed — a strong indication of an association

with the causal factors with which this study was concerned. The same may be assumed to apply to the other 5 patients; 3 of them did not wear their dentures and 2 had lost theirs. These cases constitute a factor of uncertainty in the evaluation of the results of the study and account of this has been taken in the discussion.

After 6 months the occlusion was correct for a greater part of the dentures (84 out of 89), while only two-thirds (63 out of 89) had preserved correctly balanced articulation. After 2 years there had been a further deterioration of both these conditions; only about one-third of the dentures (33 out of 91) having correct occlusion and articulation, a further one-seventh (13 out of 91) incorrect articulation balance, and no less than one-half (44 out of 91) both incorrect occlusion and articulation (Table 5). Of particular interest is the large number of dentures that had lost occlusal balance during the period between the follow-ups.

Similar observations have been reported as regards occlusion and articulation in other series, but these have chiefly been longitudinal studies of partial dentures (*Koivumaa,* 1959; *Carlsson, Hedegård & Koivumaa,* 1962). The present observations would seem, however, not to have been reported for full denture cases although suspicions of early changes in the intermaxillary contact relation have not infrequently been mentioned. The results therefore indicate the importance of an annual check of full denture cases with a view to correcting occlusal and articulatory defects.

At the 6-month follow-up it was found that one-third of the dentures (30 out of 89) had deteriorated in stability while only 4 showed further deterioration during the next 18 months (Table 4). It may be noted in this connection that in an X-ray cephalometric study of the change in face height in full denture patients *Carlsson & Ericsson* (1963) found a considerably greater reduction during the first 6 months after the dentures had been supplied than during the next 6 months. This underlines the necessity for following up full denture patients. As regards instability, corrective measures might be taken even in the first year after the denture was made.

Deterioration in stability and intermaxillary relation of dentures is probably due chiefly to changes in the denture bed, and

often combined with changes in shape of the denture base. Although both factors have been much discussed in the literature further research is required to disclose the pattern of the change.

In the present study the cases recorded as having inflamed mucosas were those in which chronic inflammation had appeared irrespective of intensity and extent. On the other hand, no note was made in the main study of any deterioration of existing mucosal inflammation or improvement without full healing. This of course implies a limitation of the interpretation of other findings. Only in the experimental study were changes in the inflammatory picture noted.

In some cases, clinically observable mucosal lesions had appeared under dentures assessed as not being of a traumatic nature. Moreover, it is evident that the fact that a new full denture was judged not to be traumatizing was no guarantee that existing mucosal inflammation would clear up. The view that the risk of mucosal changes is greater in the case of traumatizing dentures is, however, borne out by the present results.

A closer examination of this problem was made in the experimental study of part of the series with upper mucosal inflammation and traumatizing dentures. The removal of the traumatizing factors appears to have resulted in healing of the mucosa to a much greater extent than the supply of new dentures. Complete healing was obtained in two-thirds of the cases and partial healing in a further one-sixth. Most of the few cases in which the inflammatory picture was unchanged displayed some traumatic effect of the denture (Table 12). This is in agreement with Nyquist's results.

There are grounds for supposing that there may be other factors than clinically demonstrable traumatizing factors. Deviations in form and defects in occlusion and articulation of so minor degree as not to be clinically recordable may certainly impair the non-physiologic conditions implied in the covering of the mucosa with a denture.

A factor on which the effect of these prosthetic factors is greatly dependent is the resistance of the mucosa. The individual variations are also affected by the state of health, age and sex. Some workers have found that stomatitis prothetica is more common among women (*Reither,* 1961; *Neill,* 1961) especially

at the menopause. *Kutzleb* (1957) noted that the oral mucosa had a greater tendency for inflammatory reaction in women than in men. In the present series no such sex difference was found, there being a close agreement in the incidence of inflammation between the sexes (Table 11).

During the observation period there was a gradual change in the alveolar ridge, with an increase in soft-tissue mobility against the bone, probably owing to resorption of the bone through function. This change is in agreement with earlier clinical experience. However, the remarkably great reduction in mobility of the upper alveolar process from grade 3 to grade 2 after 2 years in which the dentures were worn was unexpected (Table 9). It is conceivable that the new upper denture had a stabilizing effect on the alveolar process by virtue of its better fit, thereby producing a structural change in the process.

CONCLUSIONS

The investigation suggested the following conclusions,

1. Occlusal balance was retained fairly well during the first 6 months after the full denture was supplied, but during the following 18 months there was a marked deterioration.
2. There was some deterioration in the articulation balance in several cases during the first 6 months, and a marked worsening during the next 18 months.
3. The stability of the denture became poorer in some cases during the first 6 months, but there was no apparent deterioration during the next 18 months.
4. The provision of a new full denture with satisfactory stability and occlusion and articulation did not in all cases result in healing of existing maxillary stomatitis prothetica.
5. The provision of a new denture with satisfactory stability and correct occlusion and articulation gave rise in a number of cases to chronic inflammation of the upper mucosa after only 6 months and 2 years.
6. Chronic inflammation of the mucosa under the denture was considerably more common in the maxilla than in the mandible.
7. The change in resilience of the alveolar process appeared to be associated with the traumatic effect of the dentures.

8. There was no difference in the incidence of inflammation of the upper mucosa between male and female denture wearers.

9. Healing and improvement of chronic inflammatory conditions in denture-bearing mucosas were often obtained on elimination of trauma caused by dentures.

SUMMARY

A longitudinal study was performed over a 2-year period on a series of 124 full denture cases. 33 of these could not be followed up over the full observation period. For the remaining 91 cases a report is given of the results of examinations performed when the dentures were handed over to the patient, after 6 months and after 2 years. The study comprised observations on the occlusion, articulation and stability of the dentures on their beds, the clinical status of the denture-bearing mucosa and the resilience of the alveolar processes.

Special classification systems and tests were worked out for the various factors observed. The same investigator performed all the recordings. At each examination, duplicate determinations were performed with another clinical investigator in order to examine the reliability of the clinical observations according to the classification system. There was close agreement on all three occasions.

The results of the study are reported in tables under *Results* and are discussed in the following sections. The essential results are presented in a final section entitled *Conclusions*.

RÉSUMÉ

ÉTUDE LONGITUDINALE DE CAS DE PROTHÈSES COMPLÈTES PORTANT SUR DEUX ANS

Une étude longitudinale portant sur une période de deux ans a été effectuée sur une série de 124 cas de prothèses complètes; 33 de ces cas n'ont pu être suivis pendant la totalité de la période d'observation. En ce qui concerne les 91 cas restants, les auteurs donnent un compte-rendu des résultats d'examens pratiqués au moment de la mise en place des prothèses, 6 mois après, et 2 ans après. L'étude a comporté des observations concernant l'occlu-

sion, l'articulation et la stabilité des prothèses sur leur assise, l'état clinique de la muqueuse d'appui et la résilience des procès alvéolaires.

Des systèmes spéciaux de classification et des tests concernant les divers facteurs observés ont été élaborés. Tous les enregistrements ont été effectués par un même observateur. A chacun des examens, des enregistrements ont été faits parallèlement par un autre observateur clinique, dans le but de faire l'épreuve de la sûreté des observations cliniques d'après le système de classification. Il y avait une concordance étroite dans les trois cas.

Les auteurs rendent compte de l'essentiel des résultats et les discutent. Les conclusions suivantes peuvent être tirées:

1. L'équilibre occlusal se maintenait assez bien pendant les 6 premiers mois suivant la mise en place des prothèses complètes, mais, au cours des 18 mois suivants, il se produisait un perturbation marquée.

2. Il se produisait une certaine perturbation de l'équilibre occlusal dans plusieurs cas pendant les 6 premiers mois, et une aggravation marquée pendant les 18 mois suivants.

3. La stabilité des prothèses s'altérait dans certains cas pendant les 6 premiers mois, mais il ne se produisait pas de perturbation apparente pendant les 18 mois suivants.

4. La mise en place de nouvelles prothèses complètes satisfaisantes du point de vue de la stabilité, de l'occlusion et de l'articulation n'amenait pas dans tous les cas la guérison de stomatites sous plaques prothétiques existant au maxillaire supérieur.

5. La mise en place d'une prothèse ayant une stabilité satisfaisante et une occlusion et une articulation correctes a donné lieu dans un certain nombre de cas à une inflammation chronique de la muqueuse à la mâchoire supérieure après seulement 6 mois et 2 ans.

6. L'inflammation chronique de la muqueuse siégeait beaucoup plus souvent à la mâchoire supérieure qu'à la mâchoire inférieure.

7. Les modifications de la résilience du procès alvéolaire semblaient être en rapport avec l'action traumatique des prothèses.

8. La fréquence de l'inflammation de la muqueuse à la mâchoire supérieure chez les porteurs de prothèses ne présentait pas de différence suivant le sexe.

9. On obtenait souvent la cicatrisation et l'amélioration des lésions inflammatoires chroniques de la muqueuse d'appui par élimination des traumas provoqués par les prothèses.

ZUSAMMENFASSUNG

EINE LONGITUDINALE, ZWEIJÄHRIGE STUDIE ÜBER EINE SERIE VOLLPROTHESENPATIENTEN

Die Verfasser haben in einer Zweijahresperiode eine longitudinale Studie über eine Serie Vollprothesenfälle durchgeführt. Die Untersuchung enthielt anfangs 124 Patienten. Von diesen konnten 33 verschiedener Ursachen wegen nicht die ganze Beobachtungszeit gefolgt werden.

Für die übrigbleibenden 91 Patienten werden die Untersuchungsresultate bei drei Kontrollzeitpunkten beschrieben: bei dem Eingliedern, nach sechs Monate und nach zwei Jahren.

Die Untersuchung umfasst Beobachtungen über Okklusion, Artikulation und Stabilität der Prothesen sowie über den klinischen Status der prothesetragenden Schleimhaut und die Nachgiebigkeit des Kieferkammes.

Ein besonderes Klassifizierungssystem wurde für die verschiedenen Beobachtungsfaktoren entworfen und geprüft. Ein und derselbe Beobachter führte alle Registrierungen aus. Bei jedem Beobachtungszeitpunkt wurden Doppelbestimmungen mit einem anderen klinischen Beobachter ausgeführt um die Zuverlässigkeit der klinischen Beobachtungen dem Klassifizierungssystem nach zu untersuchen. Gutes Übereinstimmen lag bei sämtlichen drei Gelegenheiten vor. Die Resultate der Untersuchung sind in Tabellen und Artikeltext wiedergegeben und sind in darauf folgenden Abschnitten diskutiert. Die wesentlichsten Resultate können in folgenden Punkten zusammengefasst werden:

1) Der Okklusionskontakt wird einigermassen gut die ersten sechs Monate nach dem Eingliedern der Vollprothese beibehalten, während er sich in dem nachfolgenden anderthalben Jahr wesentlich verschlechtert.

2) Das Artikulationsgleichgewicht bei der Vollprothese erleidet eine Verschlechterung während der ersten sechs Monate in nicht geringer Anzahl Fälle, und verschlechtert sich weiter erbeblich in dem nachfolgenden anderthalben Jahr.

3) Die Stabilität der Prothesen verschlechtert sich im gewissen Masse während der ersten sechs Monate, zeigt doch dann keine weitere Verschlechterung in den darauffolgenden 18 Monaten.

4) Behandlung mit einer neuen Vollprothese mit akzeptabler Stabilität und korrekter Okklusion und Artikulation bei der Eingliederung garantiert keine Heilung von schon vorhandener Entzündung der Gaumenschleimhaut obwohl eine Heilung in gewisser Anzahl Fälle vorkommt.

5) Behandlung mit einer neuen Vollprothese mit akzeptabler Stabilität und korrekter Okklusion und Artikulation bei der Eingliederung der Prothese kann mit nicht geringer Frequenz kronische Schleimhautentzündung im Oberkiefer verursachen, schon nach so relativ kurzer Zeit wie ½ und 2 Jahre.

6) Die Frequenz kronischer Schleimhautentzündung unter den Prothesen ist wesentlich niedriger im Unter- als im Oberkiefer.

7) Erhöhte Nachgiebigkeit des Kieferkammes scheint mit erhöhtem traumatizierenden Effekt der Prothesen verbunden zu sein.

8) Kein Unterschied in der Frequenz von Gaumenschleimhautentzündung liegt zwischen Männer und Frauen vor.

9) Heilung und Verbesserung von kronischen Entzündungen in der prothestragenden Schleimhaut wird in hohen Masse durch Entfernung von traumatizierenden Faktoren der Vollprothese erhalten.

REFERENCES

Axelsson, B., 1955: Metylmetakrytalens polymerisationsgrad. Odont. Revy *6:* 1.

Brunel, M., 1948: *Les manifestations buccales d'intolerance aux resines methacryliques.* Thèse de l'Université de Paris.

Cahn, L. R., 1949: The denture sore mouth. N. Y. St. dent. J. *15:* 158.

Campbell, R. L., 1960: A comparative study of the resorption of the alveolar ridges in denture wearers and non-denture-wearers. J. Amer. dent. Ass. *60:* 143.

Carlsson, G. E., B. Hedegård & K. K. Koivumaa, 1963: Studies in partial dental prosthesis III. Acta odont. scand. *20:* 95.

Carlsson, G. E. & Ericsson, S., 1963: Ansiktshöjdens förändringar hos helprotesbärare (manuscript).

Deichmann, W., 1941: Toxicity of methyl, ethyl and N-buthyl methacrylate. J. industr. Hyg. *23:* 343.

Epp., M., 1956: Reizungen der Mundschleimhaut durch Farbzusätze der Prothesenwerkstoffe. Dtsch. zahnärztl. Z. *11:* 678.

Frölich, E., 1949: Zur Pathologie und Therapie des sogen. Schlotterkammes. Dtsch. zahnärztl. Z. *4:* 473.

Frölich, E., 1950: Das Verhalten des Kieferknochens unter dem Einfluss der schleimhautgetragenen Plattenprothese. Dtsch. zahnärztl. Z. *5:* 1222.

Frölich, E., 1952: Gewebsveränderungen als Folge schleimhautgetragener Prothesen. Dtsch. zahnärztl. Z. *7:* 107.

Gasser, F., 1949: *Über Schlotterkämme, chirurgische und prothetische Behandlung.* Beiträge zur Zahnmedizin, Basel.

Gasser, F., 1951: *Die Gaumenschleimhaut unter dem Einflusse zahnärztlicher Prothesen.* Urban & Schwarzenberg, München/Berlin.

Hansson, G., 1955: Partiella mandibulära friändsproteser, en efterkontroll. Svensk tandläk.-T. *48:* 223.

Hedegård, B., 1955: *Cold-polymerising Resins. A Clinical and Histological Study.* Acta odont. scand. *13:* suppl. 17.

Hedegård, B., 1960: Complete immediate maxillary denture cases. Manuscript.

Hildebrand, G. Y., 1937: *Studies in Dental Prosthetics.* Svensk tandläk.-T. *30:* suppl.

Häupl, K. & M. Spreng, 1956: *Die Beziehungen der zahnärztlichen Prothese zum lebenden Gewebe.* Die Zahn-, Mund- und Kieferheilkunde. Urban & Schwarzenberg, München/Berlin.

Koivumaa, K. K., 1959: Undersökningar om gingivalt stödda mandibulära friändsproteser. Svensk tandläk.-T. *52:* 461.

Koivumaa, K. K., B. Hedegård & G. E. Carlsson, 1960: Studies in partial dental prosthesis. I. An investigation of dentogingivally supported partial dentures. Suom. Hammaslääk. Toim. *56:* 284.

Kuck, M., 1956: Reizungen der Mundschleimhaut durch Farbzusätze der Prothesenwerkstoffe. Dtsch. zahnärztl. Z. *11:* 678.

Kutzleb, H. J., 1957: Erkrankungen des Zahnfleisches: Einfluss von Pubertät, Menstruation, Schwangerschaft und Klimakterium. Umschau *57:* 371.

Lytle, R. B., 1962: Soft tissue displacements beneath removable partial and complete dentures. J. Prosth. Den. *12:* 34.

Nyquist, G., 1952: *A Study of Denture Sore Mouth.* Acta odont. scand. *10:* suppl. 9.

Nyquist, G., 1953: The influences of denture hygiene and the bacterial flora on the condition of the oral mucosa in full denture cases. Acta odont. scand. *11:* 24.

Nyquist, G., 1958: Sensitivity to Methyl Metacrylate. Transactions of the Royal Schools of Dentistry, Stockholm and Umeå No. *1:* 36.

Paffenbarger, G. C., J. B. Woelfel & W. T. Sweeney, 1961: Changes in dentures during storage in water and in service. J. Amer. dent. Ass. *62:* 643.

Pendleton, E. C. & H. Glupker, 1935: Research on the reaction of tissues supporting full dentures. J. Amer. dent. Ass. *22:* 76.

Pendleton, E. C., 1951: Changes in the denture supporting tissues. J. Amer. dent. Ass. *42:* 1.

Reither, W., 1961: Die Bedeutung endogener Faktoren für die Entstehung von Prothesenstomatopathien. Dtsch. zahnärztl. Z. *16:* 109.

Rink, G., 1952: Studien über die Polymerization und die Mängel der heutigen Verarbeitungsweise der Kunststoffe. Dtsch. zahnärztl. Z. *7:* 1293.

Smith, D. C. & M. E. O. Bains, 1955: Residual methyl methacrylate in denture sore mouth. Brit. dent. J. *98:* 55.

Spealman, C. R., R. J. Main, H. B. Haag & P. S. Larsson, 1945: Monomeric methylmethacrylate-studies on toxicity. Indstr. Med. Surg. *14:* 292.

Spreng, M., 1945: *Die Prothese und die lebenden Gewebe.* Appolonia Verlag, Basel.

Van Huysen, G., W. Fly & L. Leonard, 1954: Artificial dentures and the oral mucosa. J. prosth. Dent. *4:* 446.

Wannenmacher, E., 1954: Die Prothese als schädigender Faktor durch Reizwirkung auf die Schleimhaut. Dtsch. zahnärztl. Z. *9:* 89.

Weinmann, J. P., 1955: Variations in the structure of bone and bones and their significance in radiology. Oral Surg. *8:* 988.

Weinmann, J. P. & H. Sicher, 1955: *Bone and Bones.* Fundamentals of Bone Biology. Henry Kimpton, London.

Wennström, A., 1962: Några iakttagelser över formförändringar hos protesbaser. Svensk tandläk.-T. *55:* 457.

Wright, W. H., 1929: The importance of tissue changes under artificial dentures. J. Amer. dent. Ass. *16:* 1027.

Östlund, S. G:son, 1958: The effect of complete dentures on the gum tissues. Acta odont. scand. *16:* 1.

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