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# Effect of controlled oral hygiene procedures on caries and periodontal disease in adults

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*Abstract.* The present investigation was carried out to determine if the occurrence of caries and the progression of periodontitis can be prevented in adults, and maintained at a high level of oral hygiene by regularly repeated oral hygiene instructions and prophylaxis. An attempt was also made to study the progression of dental diseases in individuals who received no special oral hygiene instruction but regularly received dental care of a traditional type. Two groups of individuals from one geographic site were recruited in 1971–72 for the trial; 375 were assigned to a test and 180 to a control group. A baseline examination revealed that the socio-economic status, the oral hygiene status, the incidence of gingivitis and the caries experience were similar among the test and control participants prior to the start of the study. During the subsequent 3-year period, the control patients were seen regularly once a year and given traditional dental care. The test group participants, on the other hand, were seen once every 2 months during the first 2 years and once every 3 months during the third year. On an individual basis they were instructed in a proper oral hygiene technique and given a careful dental prophylaxis including scaling and root planing. Each prophylactic session was handled by a dental hygienist. A re-examination was carried out towards the end of the third treatment year. The results of the trial clearly showed that it is possible, by regularly repeated tooth cleaning instruction and prophylaxis, to stimulate adults to adopt proper oral hygiene habits. The findings also demonstrated that persons who utilized proper oral hygiene techniques during a 3-year period had negligible signs of gingivitis, suffered no loss of periodontal tissue attachment, and developed practically no new carious lesions. The control patients, who during the same period received merely symptomatic treatment, suffered from gingivitis, lost periodontal tisssue support and developed several new as well as recurrent, carious lesions. These results indicate that dental treatment is a highly *ineffective* means of curing caries and periodontal disease.

It has been known for many years that microorganisms, which colonize the tooth surface constitute the primary etiologic component for the two most important oral diseases, dental caries and periodontitis (for review see Page & Schroeder 1976 and Theilade & Theilade 1976). This statement does not imply, however, that differences among individuals in their natural resistance to plaque infection are not appreciated and that the presence of various contributing and modifying factors in the progression of these diseases is overlooked.

Until recently, the bacterial infections causing the dental disorders were regarded as nonspecific in character, but findings

reported during the last few years have revealed the possibility of associating caries as well as gingivitis/periodontitis with specific plaque infections. As a result, various chemical agents, effective against certain types of pathogenic microorganisms and their products, have been tested in trials aiming at caries and gingivitis/periodontitis prevention (An excellent review on "Chemotherapy of dental plaque infections" was presented by Loesche 1976). Even if considerable information exists regarding the toxicology and effectiveness of a number of different antimicrobial drugs, their introduction and use in "every day" dentistry have not yet been recommended. Hence, therapy and prevention of the two major dental disorders have largely been focused on mechanical debridement of the plaque from the tooth surfaces. A number of longitudinal studies carried out in adults have been presented which demonstrate the effectiveness of mechanical plaque control in the prevention of gingivitis and periodontal disease progression (e. g. Lövdal et al. 1961, Suomi et al. 1971, Ramfjord et al. 1973, Lindhe & Nyman 1975). To our knowledge, however, no longitudinal study involving adults has so far been published on the effect of the introduction of proper oral hygiene habits on both dental caries and periodontitis.

The aim of the present investigation was to determine if the recurrence of caries and the progression of periodontitis can be prevented in individuals maintained at a proper level of oral hygiene. An attempt was also made to study the progression of dental diseases in individuals who did not receive any special oral hygiene instructions, but who received dental care of a traditional type annually.

## Material and Methods

Two groups of individuals from one geographic site (the city of Karlstad, Värmland, Sweden; 100,000 inhabitants) were recruited in 1971 for this trial; 375 were assigned to a test and 180 to a control group. The socio-economic status of the two groups of participants was similar. During the 3-year study, 51 individuals in the test group (14 %) and 24 controls (13 %) were lost. This means that 324 test and 156 control patients remained in the program during the entire observation period (Table 1).

*Table 1.* Number of participants in the clinical trial divided into test/control and age groups. Only those individuals who remained in the study throughout the 3-year period have been included in the analysis

*Anzahl der Teilnehmer an der klinischen Studie, eingeteilt in Test/Kontroll und Altersgruppen. Es wurden die Daten nur solcher Versuchspersonen analysiert, die während der Gesamtversuchszeit von drei Jahren den Versuchsgruppen angehört hatten*

*Nombre de participants à l'essai clinique: répartition dans les groupes expérimentaux (test)/ témoins (control) et dans les groupes d'âge. On n'a pris en considération dans l'analyse que les sujets ayant continué à participer à l'étude pendant les trois années*

| Age group | | Test | Control |
|---|---|---|---|
| I | < 35 years | 131 | 49 |
| II | 36–50 years | 128 | 54 |
| III | > 50 years | 65 | 53 |
| | Total | 324 | 156 |
| | In all | 480 | |

Participants were recruited using two means; one, being the recall list of three general private practitioners, and the other, the waiting list of three large public dental health clinics. Potential participants for the test group were informed by letter of the purpose of the study and asked to volunteer for the trial. Potential members

of the control group were informed that if they agreed to receive a very detailed oral examination they would be recalled for dental treatment to the public dental health clinic once a year during the next 3 years. Only those volunteers who had sought and received dental treatment annually during the last 5 years were selected.

Within each test and control group, the individuals were subdivided into three age groups. Age group I consisted of patients 35 years of age or less, group II contained patients 36–50 years of age and group III comprised patients who were more than 50 years old. Table 1 gives the number of participants in the test and control groups, as well as their distribution into age groups.

*Baseline Examination*

In the fall of 1971 and spring of 1972, when all members of the test and control groups had been recruited, they were subjected to a baseline examination which included assessments of oral hygiene status, gingival inflammation, periodontal disease and caries.

*Oral hygiene status.* The teeth were stained with a disclosing solution (Astra Rondell®, pellet) containing 4 % erythrosine. The patient was asked to rinse the mouth vigorously with tap water. The *presence* or *absence* of *continuous plaque* in the cervical portion of four tooth surfaces (buccal, lingual, mesial, distal) of each individual tooth in the dentition was then determined. For each individual, the percentage of susceptible tooth surfaces accumulating plaque was calculated.

*Gingival inflammation.* Bleeding on probing was considered a clinical sign of gingival inflammation. The *presence* or *absence* of gingivitis (bleeding on probing) in four gingival units (buccal, lingual, mesial, distal) around each single tooth was assessed following probing. For each individual, the percentage of inflamed gingival units, in relation to the total number of gingival units present, was calculated.

*Periodontal disease. Pocket depths.* Depths of the clinical periodontal pockets were measured with a flat graduated periodontal probe (Hu-Friedy®) on four surfaces around each tooth. On the mesial (distal) surface, the pockets were measured both at the mesio-buccal (disto-buccal) and the mesio-lingual (disto-lingual) line angle. Of the two measurements, only the largest value was recorded. The pocket on the buccal tooth surface of single-rooted teeth was always assessed at the most buccal aspect of the crown. For molars, the corresponding measurements were made at the most buccal aspect of the mesial root. The pocket on the lingual surface was assessed at the most lingual aspect of the crown (root), with the exception of mandibular molars for which the lingual pocket depth was measured at the most lingual aspect of the mesial root.

Pocket depth measurements were adjusted to the nearest mm.

*Attachment levels.* The largest distance between the cemento-enamel junction (or another well-defined landmark on the crown of the tooth if the cemento-enamel junction was occupied by a restoration) and the bottom of the clinical pocket was assessed at all buccal, lingual and mesial tooth surfaces according to the technique described by Ramfjord et al. (1968, 1973). The attachment level measurements were made with the same graduated periodontal probe as the pocket depth measurements and in the same locations. These measurements were also adjusted to the nearest mm.

*Dental caries.* One week before the clini-

cal examination, four bite-wing radiographs (Ultra high speed®, Kodak), two of each lateral segment of the jaws, were taken of each subject. The parallelling long cone (Heliodont®, Siemens) technique was used. The radiographs were, in conjunction with the clinical examination, studied systematically and read through a Mattson's Magnifier (Elema- Schönander, Sweden).

Immediately prior to the clinical examination, the teeth were carefully cleaned and dried with a blast of air. The area of examination was kept dry by placing cotton rolls in the vestibule. New plane mirrors and new Maillefer® explorers No. 6 were used for each patient.

The criteria for a caries diagnosis were: *Clinical caries:* Loss of tooth substance having reached the stage of cavitation that can be diagnosed with certainty with mirror and explorer and appearing on an otherwise intact (sound) tooth surface, pits and fissures, not earlier restored, where the probe with a little pressure sticks and requires a definite pull for removal (Koch 1967 – Code 1). *Radiographic caries.* Well-defined decrease in the radiopacity of the proximal enamel which is diagnosed radiographically but cannot be verified clinically (Koch 1967 – Code 3). *Recurrent caries.* Caries, according to the criteria stated for clinical caries, but occurring on a restored surface (Koch 1967 – Code 4).

*DMF-teeth, DMF-surfaces.* Following examination, each tooth (t) and each surface (s) was recorded as either healthy (S), decayed or filled (DF) or missing (M). If a tooth or a surface was both filled and decayed the carious lesion was regarded as recurrent caries and included in the recurrent caries pool.

*Radiographical Examination*

For each patient, full-mouth radiographs were taken. A long cone technique was utilized and the radiographs produced in accordance with the method described by Eggen (1969).

*Treatment*

Following the baseline examination, all carious lesions were treated and all ill-fitting dental restorations adjusted. Each patient was also given a detailed case presentation and a dental prophylaxis.

*Plaque Control Regimen*

Except for the case presentation and oral hygiene instructions given after the baseline examination, the *control* patients were not involved in any dental health program during the 3-year period. However, 12 and 24 months after the baseline examination, the control patients were recalled to the public dental health clinic for examination and to receive whatever dental treatment the examining dentist found indicated. During this treatment, there was no discussion about oral hygiene methods and the patients were not encouraged to improve their oral hygiene habits.

The *test* group participants, on the other hand, were given an entirely different type of treatment. Once every 2 months throughout the first 2 years, these patients were given (1) instruction and practice in oral hygiene techniques and (2) a proper oral prophylaxis. During the third year, the preventive treatment was provided once every 3 months.

Each prophylactic session was handled by a dental hygienist and required about 30 minutes. During these sessions, the dental plaque was first stained with a disclosing pellet, and the Bass method of toothbrushing demonstrated for each individual patient. In addition, the patient was told to use dental floss and toothpicks for interdental tooth cleaning. The patients oral hygiene technique was then checked and, if necessary, corrected. The oral hygiene

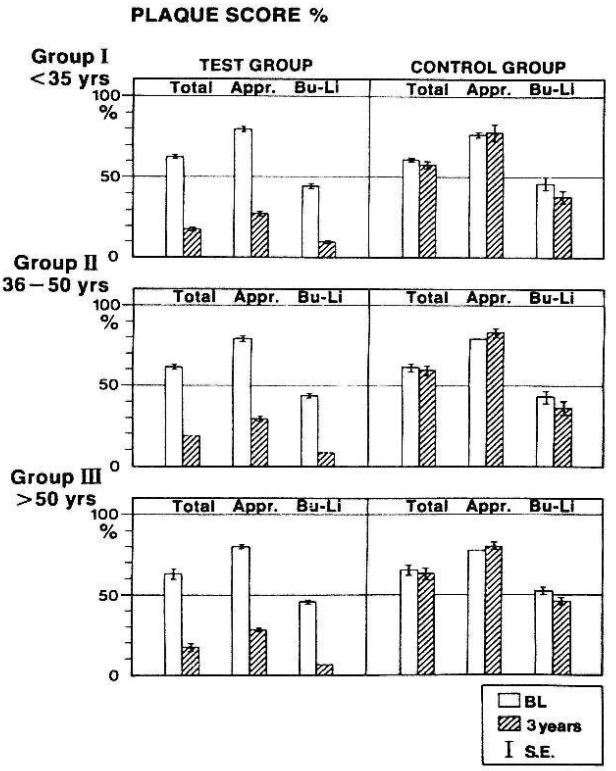


*Fig. 1.* Diagram showing the percentage of tooth surfaces harbouring plaque at the baseline examination (BL) and at the re-examination 3 years later (3 years). The patients of the test group were subjected to regularly repeated oral hygiene instruction and prophylaxis (once every second month during the first 2 years and once every 3 months during the third year), whereas the controls were given traditional, symptomatic dental care once every 12 months. Note the marked improvment of the oral hygiene status of the test patients and the unchanged plaque scores in the controls.

*Das Diagramm zeigt den prozentuellen Anteil durch Plaque verunreinigter Zahnoberflächen bei der Ausgangsuntersuchung (BL) und bei der Kontrolluntersuchung 3 Jahre später (3 years). Die Patienten der Testgruppe erhielten regelmässig wiederholte Instruktionen über die Technik oraler Hygiene sowie Prophylaxebehandlung (während der ersten beiden Jahre einmal jeden zweiten, und während des dritten Jahres einmal jeden dritten Monat). Die Kontrollgruppe erhielt einmal jährlich traditionell-symptomatische Zahnbehandlung. Beachten Sie bitte die deutliche Verbesserung des Standes der oralen Hygiene bei den Patienten der Testgruppe und die unveränderten Plaque-Indexwerte bei der Kontrollgruppe.*

*Diagramme montrant le pourcentage des faces dentaires présentant de la plaque à l'examen initial (BL) et à l'examen final 3 ans plus tard (3 years). Les patients des groupes expérimentaux (Test) recevaient des séances régulièrement répétées d'instructions d'hygiène bucco-dentaire et de nettoyage dentaire professionnel (tous les deux mois pendant les 2 premières années et tous les trois mois pendant la troisième année), tandis que les patients des groupes témoins (Control) recevaient les traitements dentaires symptomatiques traditionnels tous les 12 mois. Noter l'amélioration marquée de l'hygiène buccale des patients expérimentaux et les valeurs inchangées pour la plaque chez les témoins.*

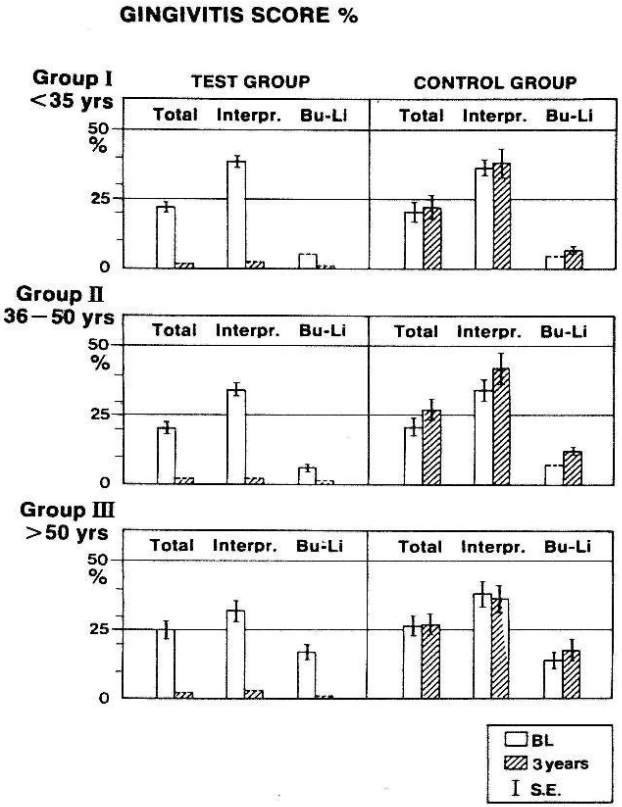


*Fig. 2.* Diagram showing the percentage of gingival units that were bleeding on gentle probing at the baseline examination (BL) and the re-examination (3 years). Note that in the test group, at the re-examination, almost all gingival units were clinically healthy. In the control groups, there was no improvement of the gingival condition between the two examinations.

*Das Diagramm zeigt den prozentuellen Anteil gingivaler Einheiten, die bei der Ausgangsuntersuchung (BL) und der Kontrolluntersuchung (3 years) nach vorsichtiger Sondierung bluteten. Beachten Sie bitte, dass fast alle gingivalen Einheiten der Testgruppe bei der Kontrolluntersuchung klinisch gesund waren. In der Kontrollgruppe wurde keine Verbesserung des Zustandes der Gingiva zwischen den beiden Untersuchungen festgestellt.*

*Diagramme montrant le pourcentage des unités gingivales qui présentaient un saignement lors du sondage prudent, à l'examen initial (BL) et à l'examen final (3-years). Noter que, dans les groupes expérimentaux, presque toutes les unités gingivales étaient cliniquement saines à l'examen final. Dans les groupes témoins, il n'y avait pas d'amélioration de l'état gingival entre les deux examens.*

instructions were repeated and checked at each prophylactic session.

The teeth were then carefully scaled and the root surfaces planed. Since only 30 minutes were allocated for each session, subgingival scaling and root planing in most instances took three to four appointments to complete. Each prophylactic session was concluded with a professional tooth cleaning program. The vestibular and lingual

*Table 2.* Pocket depths assessed in the test and control groups at the baseline examination (1972)
*Taschentiefen der Test- und Kontrollgruppe bei der Ausgangsuntersuchung (1972)*
*Profondeur des culs-de-sac mesurées dans les groupes expérimentaux et dans les groupes témoins à l'examen initial (1972)*

| Group | | Pocket depths | | | |
|---|---|---|---|---|---|
| | | Test 1972 | | Control 1972 | |
| Surfaces | | $\bar{x}$ | S. E. | $\bar{x}$ | S. E. |
| I | Total | 2.0 | 0.11 | 1.7 | 0.10 |
| | Mesial | 2.6 | 0.10 | 2.2 | 0.11 |
| | Buccal | 1.4 | 0.05 | 1.1 | 0.06 |
| | Distal | 2.5 | 0.09 | 2.2 | 0.07 |
| | Lingual | 1.5 | 0.06 | 1.2 | 0.04 |
| II | Total | 3.1 | 0.10 | 2.9 | 0.09 |
| | Mesial | 3.7 | 0.12 | 3.4 | 0.13 |
| | Buccal | 2.5 | 0.04 | 2.2 | 0.06 |
| | Distal | 3.7 | 0.10 | 3.4 | 0.12 |
| | Lingual | 2.6 | 0.08 | 2.4 | 0.09 |
| III | Total | 3.2 | 0.10 | 3.4 | 0.09 |
| | Mesial | 3.8 | 0.10 | 3.8 | 0.13 |
| | Buccal | 2.6 | 0.11 | 2.9 | 0.06 |
| | Distal | 3.7 | 0.14 | 3.9 | 0.12 |
| | Lingual | 2.7 | 0.10 | 2.8 | 0.12 |

Mesial *(Mesial, mésiales)*, buccal *(Bukkal, vestibulaires)*, lingual *(Lingual, linguales)*

surfaces of all teeth were cleaned with the aid of a rotating rubber cup. A rotating, pointed bristle-brush was used to clean the occlusal fissures. Interdental cleaning was then carried out with dental floss and reciprocating, interproximal tips (Eva System®, Dentatus). Particular care was also taken to clean the interproximal contact areas. During the cleaning procedure, an abrasive paste containing sodium monofluorophospate (Pepsodent®) was used.

*Re-examination*

The patients were re-examined 3 years after the baseline examination. During the re-examination, the parameters studied at the baseline were recorded again.

*Methods of Observational Error*

In order to determine the observational error regarding the attachment level assessments, 10 randomly selected patients were examined twice by one dentist at both the baseline examination and the re-examination. At the re-examination, but not at the baseline examination, another 10 randomly selected patients were subjected to duplicate recordings of primary and secondary carious lesions. The duplicate recordings were always made 10–14 days after the first examination.

Differences between examinations and groups regarding plaque, gingivitis, pocket depth, attachment level, DMF-teeth and surfaces as well as recurrent caries, were analyzed using Student's t-test.

## Results

The results from the baseline examination revealed only minor differences between the various test and age-matched control groups regarding plaque and gingivitis scores (Figs. 1 and 2), pocket depths (Table 2), DMF-teeth (Table 3) and DF-surfaces (Table 4). The individual mean pocket depth tended to increase with increasing age. The pockets at the interproximal surfaces were consistently deeper than those at buccal and lingual surfaces. The total number of remaining teeth gradually decreased from around 26 in age group I ($<$ 35 years) to around 19 in age group III ($>$ 50 years). Furthermore, the number of intact (S) teeth decreased from around eight (7.9 test; 8.8 control) in age group I to around four (3.5 test; 4.2 controls) in age group III. The total number of DF-surfaces did not vary markedly between the different age and test/control groups. The approximal surfaces consistently re-

*Table 3.* Mean number (S. E.) of decayed, filled, missing (DMF) and sound teeth in the test an control groups at the baseline examination.
DF = decayed + filled, M = missing, S = sound, intact

*Durchschnittliche Anzahl (S. E.) der zerstörten, gefüllten, fehlenden (DMF) und gesunden Zähne in der Test- und Kontrollgruppe bei der Ausgangsuntersuchung.*
*DF = zerstörte + gefüllte, M = fehlende, S = gesunde, intakte Zähne*

*Nombre moyen (erreur-type = S. E.) de dents cariées, obturées, absentes (CAO) et de dents saines dans les groupes expérimentaux et témoins à l'examen initial.*
*DF = cariées + obturées, M = absentes, S = saines, intactes*

| Group | | Test | Control | Difference |
|---|---|---|---|---|
| I | Total | 26.9 (0.4) | 26.7 (0.6) | NS |
| | DF | 19.0 (0.4) | 17.9 (0.8) | NS |
| | M | 1.1 (0.4) | 1.3 (0.5) | NS |
| | S | 7.9 (0.5) | 8.8 (0.7) | NS |
| II | Total | 25.5 (0.2) | 23.5 (0.9) | NS |
| | DF | 20.3 (0.3) | 17.9 (0.8) | $P < 0.05$ |
| | M | 2.5 (0.3) | 4.5 (0.9) | NS |
| | S | 5.2 (0.4) | 5.6 (0.8) | NS |
| III | Total | 19.3 (0.9) | 19.4 (1.3) | NS |
| | DF | 15.9 (0.7) | 15.2 (1.1) | NS |
| | M | 8.7 (0.9) | 8.7 (1.0) | NS |
| | S | 3.5 (0.4) | 4.2 (0.7) | NS |

*Table 4.* Mean number (S. E.) of decayed and filled (DF-s) tooth surfaces in the test and control groups at the baseline examination

*Durchschnittliche Anzahl (S. E.) zerstörter und gefüllter (DF-s) Zahnoberflächen der Test- und Kontrollgruppe bei der Ausgangsuntersuchung*

*Nombre moyen (erreur-type = S. E.) de faces dentaires cariées et obturées (DF-s) dans les groupes expérimentaux et témoins à l'examen initial*

| Group | | Test | Control | Difference |
|---|---|---|---|---|
| I | Total | 48.2 (3.7) | 41.3 (2.3) | NS |
| | Approximal | 25.4 (2.0) | 20.8 (1.9) | NS |
| | Bu + Li | 9.7 (0.7) | 7.3 (1.0) | NS |
| | Occlusal | 13.1 (0,2) | 13.2 (0.5) | NS |
| II | Total | 57.6 (3.4) | 47.9 (3.6) | NS |
| | Approximal | 31.1 (0.8) | 26.1 (2.0) | $P < 0.05$ |
| | Bu + Li | 13.8 (1.1) | 11.1 (1.3) | NS |
| | Occlusal | 12.8 (1.2) | 10.8 (0.9) | NS |
| III | Total | 51.8 (2.4) | 45.2 (4.3) | NS |
| | Approximal | 25.2 (1.3) | 22.7 (2.3) | NS |
| | Bu + Li | 17.4 (1.0) | 14.7 (1.7) | NS |
| | Occlusal | 9.2 (0.5) | 7.8 (0.9) | NS |

ceived higher DF-values than the buccal and lingual surfaces. The number of smooth surface lesions (DF) was larger in age groups II and III than in group I. There was a tendency for the control individuals of age group II to have a smaller number

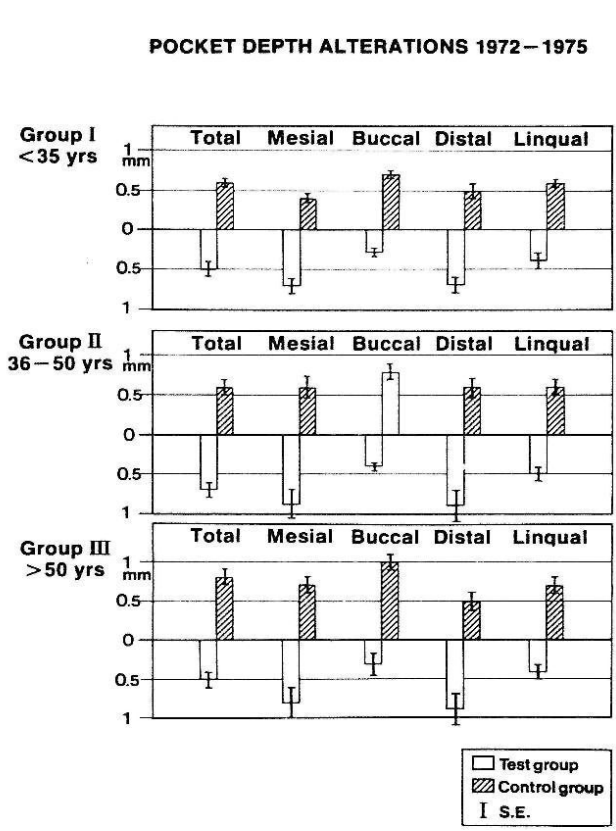


*Fig. 3.* Diagrammatic representation of pocket depth alterations between the baseline examination and the re-examination. In the test groups, a reduction in pocket depth occurred, while in the control group, pocket depth increased.

*Das Diagramm veranschaulicht die Veränderungen der Taschentiefen zwischen Ausgangs- und Kontrolluntersuchung. Bei der Testgruppe kam es zu einer Reduktion der Taschentiefen, während bei den Messungen der Taschentiefen der Kontrollgruppe erhöhte Werte festgestellt wurden.*

*Diagramme représentant les altérations de la profondeur des culs-de-sac entre l'examen initial et l'examen final. Dans les groupes expérimentaux (Test), il s'est produit une réduction de la profondeur des culs-de-sac, tandis que, dans les groupes témoins (Control), la profondeur des culs-de-sac avait augmenté.*

of DF-teeth and approximal DF-surfaces than the test patients of the same age group (Tables 3 and 4).

The results of the baseline examination thus revealed that the oral hygiene status, the incidence of gingivitis and the caries experience were similar among the test and the control participants prior to the start of the preventive programs.

At the *re-examination* 3 years later, the oral hygiene status of all three test group patients (Fig. 1) had markedly improved by comparison with the baseline data. Thus the total mean plaque scores had decreased from 62.4 % to 17.4 % (I), 61.9 % to 19.1 % (II) and from 63.0 % to 17.8 % (III). This decrease of the plaque scores was statistically significant ($P < 0.001$) for

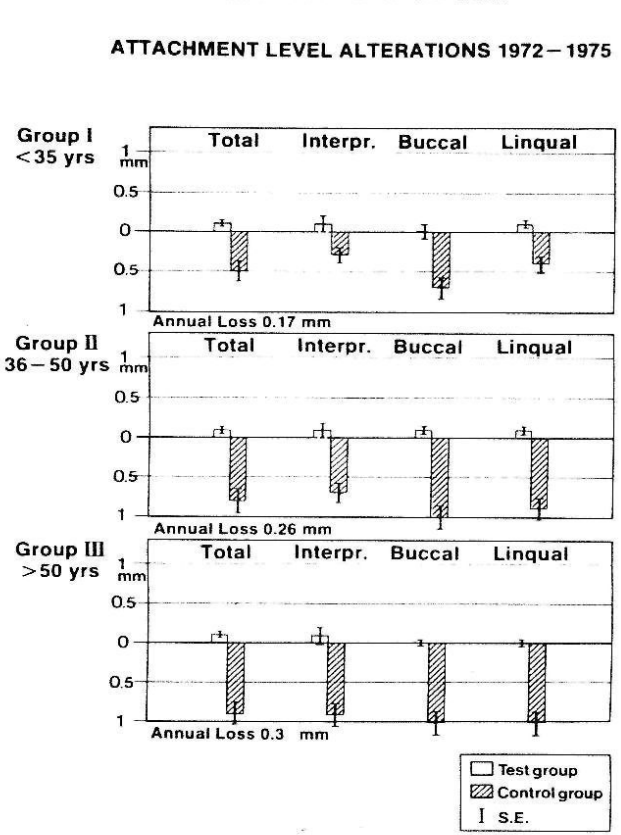


*Fig. 4.* Diagrammatic illustration of attachment level alterations between the examinations in 1971–72 and 1974–75. Note that the attachment level remainded more or less unchanged in the test group patients who regularly received oral hygiene instructions and prophylaxis, but increased significantly in the control groups which were given traditional, symptomatic dental care.

*Das Diagramm veranschaulicht die Veränderungen des Attachment-Niveaus zwischen den Untersuchungen 1971–72 und 1974–75. Beachten Sie bitte, dass das Attachment-Niveau der Testgruppe, die regelmässige Instruktionen und prophylaktische Behandlung erhielt im allgemeinen unverändert verblieb. Bei der Kontrollgruppe, die traditionell-symptomatische Zahnbehandlung erhielt, wurde eine signifikante Senkung des Attachmentniveaus festgestellt.*

*Diagramme représentant les altérations du niveau de l'attachement entre les examens de 1971–72 et de 1974–75. Noter que le niveau de l'attachement restait plus ou moins inchangé chez les patients des groupes expérimentaux, recevant régulièrement des instructions d'hygiène buccale et des nettoyages dentaires professionnels, mais que le retrait était significatif dans les groupes témoins qui recevaient les soins dentaires symptomatiques traditionnels.*

each group. In the control groups there was no obvious improvment in oral hygiene between the initial and final examination.

In accordance with the improved oral hygiene of the three test groups at the re-examination the gingival inflammation scores were markedly reduced (Fig. 2). The frequency of inflamed gingival units had decreased between the *baseline* examination and the *re-examination* from 22.2 % to 1.7 % (I), 20.6 % to 1.3 % (II), and 24.7 % to 2.0 % (III). The degree of

*Table 5.* Attachment level alterations 1972–1975
*Änderungen des Attachment-Niveaus 1972–1975*
*Modifications du niveau de l'attachement 1972–1975*

| Group | | Test | | Control | | |
|---|---|---|---|---|---|---|
| | | $\bar{x}$ | S. E. | $\bar{x}$ | S. E. | Difference |
| I | Total | + 0.1 | 0.05 | − 0.5 | 0.12 | $P < 0.001$ |
| | Interprox. | + 0.1 | 0.1 | − 0.3 | 0.1 | $P < 0.001$ |
| | Buccal | ± 0 | 0.1 | − 0.7 | 0.14 | $P < 0.001$ |
| | Lingual | + 0.1 | 0.05 | − 0.4 | 0.09 | $P < 0.001$ |
| | | Annual Loss 0.17 mm | | | | |
| II | Total | + 0.1 | 0.05 | − 0.8 | 0.16 | $P < 0.001$ |
| | Interprox. | + 0.1 | 0.1 | − 0.7 | 0.12 | $P < 0.001$ |
| | Buccal | + 0.1 | 0.05 | − 1.0 | 0.15 | $P < 0.001$ |
| | Lingual | + 0.1 | 0.05 | − 0.9 | 0.13 | $P < 0.001$ |
| | | Annual Loss 0.26 mm | | | | |
| III | Total | + 0.1 | 0.05 | − 0.9 | 0.15 | $P < 0.001$ |
| | Interprox. | + 0.1 | 0.1 | − 0.9 | 0.13 | $P < 0.001$ |
| | Buccal | ± 0 | 0.05 | − 1.1 | 0.14 | $P < 0.001$ |
| | Lingual | ± 0 | 0.05 | − 1.1 | 0.16 | $P < 0.001$ |
| | | Annual Loss 0.3 mm | | | | |

Annual loss *(Jährlicher Verlust, retrait annuel)*

improvement of the gingival condition was similar in all three groups of patients and highly significant ($P < 0.001$). In fact, the gingival bleeding scores of around 1–2 % indicated that the test group patients had clinically healthy gingivae. In the control groups, during the observation period, there were no obvious changes in the number of gingival units which bled following gentle probing.

In the test groups there was a significant reduction of clinical *pocket depth* between the *baseline examination* and the *re-examination* (Fig. 3). The mean pocket depths decreased from 2.0 to 1.5 mm (I), 3.1 to 1.4 (II) and from 3.2 to 1.5 mm (III). In all age groups the pocket depth reduction was most pronounced in the interdental areas. In the control groups there was a corresponding slight increase of pocket depth (0.5 mm: I, 0.6 mm: II, 0.5 mm: III) between the two examinations.

Fig. 4 and Table 5 give the alteration in clinical *attachment levels* between the *baseline examination* and the *re-examination* 3 years later. In the test groups, there were no alterations of the attachment level. In all three control groups, however, the clinical attachment level had shifted apically. In age group I, the loss of attachment amounted to 0.5 (± 0.12) mm (buccal 0.7, lingual 0.4, mesial 0.3). The corresponding figures for age groups II and III were 0.8 (± 0.16) mm (buccal 1.0, lingual 0.9, mesial 0.7) and 0.9 (± 0.15) mm (buccal 1.1, lingual 1.1, mesial 0.9). This means that, whereas the test group patients were able to maintain the level of their periodontal tissue support, the control patients, during the observation period, lost some of their attachment apparatus. There was a tendency among control patients for older individuals to lose attachment at a faster annual rate than younger individuals. In

*Table 6.* Mean number (S. E.) of new decayed and filled tooth surfaces in the test and control groups between the baseline examination and re-examination 3 years later.
(Bu – Li = Buccal and Lingual

*Durchschnittliche Anzahl (S. E.) von neuen zerstörten und gefüllten Zahnoberflächen zwischen der Ausgangsuntersuchung und der Kontrolluntersuchung 3 Jahre später bei Test -und Kontrollgruppe.*
*(Bu – Li = bukkal und lingual)*

*Nombre moyen (erreur-type = S. E.) de nouvelles faces dentaires cariées et obturées dans les groupes expérimentaux et témoins entre l'examen initial et l'examen final 3 ans plus tard.*
*(Bu – Li = Buccal et lingual)*

| Group | | Test | Control | Difference |
|---|---|---|---|---|
| I | Total | 0.1 (0.1) | 4.6 (0.8) | $P < 0.001$ |
| | Approximal | 0.1 (0.1) | 2.8 (0.4) | $P < 0.001$ |
| | Bu – Li | 0 | 1.7 (0.3) | $P < 0.001$ |
| | Occlusal | 0 | 0.1 (0.1) | NS |
| II | Total | 0 | 2.7 (0.5) | $P < 0.001$ |
| | Approximal | 0 | 1.7 (0.3) | $P < 0.001$ |
| | Bu – Li | 0 | 1.1 (0.3) | $P < 0.001$ |
| | Occlusal | 0 | 0 | NS |
| III | Total | 0 | 0.4 (0.1) | $P < 0.001$ |
| | Approximal | 0 | 0.2 (0.1) | NS |
| | Bu – Li | 0 | 0.3 (0.2) | NS |
| | Occlusal | 0 | 0 | NS |

this context it should also be realized that, among the control patients, the majority lost between 1–2 mm of attachment. In age group I, 42.1 % lost on the average between 1–2 mm of attachment. None lost more than 2 mm. In age group II, 50 % lost between 1–2 mm of attachment and 23.3 % lost more than 2 mm. The corresponding figures for age group III were 69.5 % (1–2 mm) and 21.7 % (> 2 mm).

The mean number of new *clinical* and *radiological* carious surfaces plus *filled* surfaces (DF), that were detected at the *re-examination*, is presented in Table 6. Except for the patients of age group I, who developed 0.1 new DF-surface, the test group participants did not develop any new carious lesions during the 3 years that they were subjected to intense preventive care. During the same 3-year period, the controls developed 4.6 ± 0.8 (I), 2.7 ± 0.5 (II) and 0.4 ± 0.1 (III) new DF-surfaces. It should be observed that the number of new DF-surfaces was markedly lower in the older age group than in the younger, and that in age groups I and II the majority of new lesions appeared on approximal tooth surfaces. In an adult population, recurrent caries is an important problem. The incidence of *recurrent caries* was more or less negligible in all test groups (total mean = 0.2 ± 0.1) but in the control groups 5.3 ± 1.2 (I), 5.7 ± 0.9 (II) and 4.8 ± 0.4 (III) recurrent carious surfaces were observed at the re-examination (Table 7). Most of the recurrent carious lesions occurred on approximal tooth surfaces. If the mean number of DF-surfaces and recurrent carious surface are added, the control patients during the 3 years of observation developed 9.9 ± 1.2 (I), 8.4 ± 1.6 (II) and 5.2 ± 0.4 (III) caries attacks. The corresponding figures for the test group patients were 0.1 (I), 0.3 ± 0.1 (II) and 0.2 ± 0.1 (III).

Tables 8 and 9 show that the attachment

*Table 7.* Mean number (S. E.) of tooth surfaces which displayed signs of recurrent caries during the 3 years of trial

*Durchschnittliche Anzahl (S. E.) der Zahnoberflächen mit Anzeichen von wiederauftretender Karies während der 3 Versuchsjahre*

*Nombre moyen (erreur-type = S. E.) de faces dentaires présentant des signes de récidive de carie pendant les 3 années de l'expérience*

| Group | | Test | Control | Difference |
|---|---|---|---|---|
| I | Total | 0 | 5.3 (1.2) | $P < 0.001$ |
| | Approximal | 0 | 3.0 (0.6) | $P < 0.001$ |
| | Bu + Li | 0 | 0.9 (0.3) | $P < 0.001$ |
| | Occlusal | 0 | 1.5 (0.4) | $P < 0.001$ |
| II | Total | 0.3 (0.1) | 5.7 (0.9) | $P < 0.001$ |
| | Approximal | 0.2 (0.1) | 3.0 (0.7) | $P < 0.001$ |
| | Bu + Li | 0.1 (0.1) | 1.2 (0.2) | $P < 0.001$ |
| | Occlusal | 0 | 1.5 (0.3) | $P < 0.001$ |
| III | Total | 0.2 (0.1) | 4.8 (0.4) | $P < 0.001$ |
| | Approximal | 0.1 (0.1) | 2.5 (0.6) | $P < 0.001$ |
| | Bu + Li | 0 | 1.4 (0.4) | $P < 0.001$ |
| | Occlusal | 0.1 (0.1) | 0.9 (0.3) | $P < 0.001$ |

*Table 8.* Errors inherent in the clinical attachment level assessments. The differences noted were calculated from duplicate assessments of the attachment levels made at the baseline examination (I) as well as at the re-examination (II)

*Irrtümer bei der klinischen Bestimmung der Attachment-Niveaus. Die festgestellten Messunterschiede wurden aus Doppelbestimmungen der Attachment-Niveaus während sowohl der Ausgangs- (I) als auch der Kontrolluntersuchung (II) errechnet*

*Erreurs inhérentes à la mesure du niveau clinique de l'attachement. Les différences notées ont été calculées à partir de doubles mesures du niveau de l'attachement, effectuées lors de l'examen initial (I) ainsi que lors de l'examen final (II)*

| | | Surface | s. d. of a single estimation | $\bar{x}$ diff. |
|---|---|---|---|---|
| I | (10 patients | Mesial | 0.42 | 0.005 |
| | 3×196 surfaces) | Buccal | 0.38 | 0.031 |
| | | Lingual | 0.38 | 0.020 |
| | | Total | 0.39 | 0.019 |
| II | (10 patients | Mesial | 0.49 | 0.005 |
| | 3×209 surfaces) | Buccal | 0.47 | − 0.033 |
| | | Lingual | 0.54 | 0 |
| | | Total | 0.50 | − 0.010 |

Surface *(Oberfläche, face)*, s. d. of a single estimation *(SD der einzelnen Bestimmung, ecart-type d'une seule estimation)*, 10 patients 3×196 surfaces *(10 Patienten 3×196 Oberflächen, 10 patients 3×196 faces)*

level assessments were carried out with a high degree of reproducibility and that the percentage of concordant measurements were between 85 and 75 %. In this context it should also be stressed that all discordant measurements remained within the 1-mm range.

Table 10 shows that the consistency in

*Table 9.* Errors inherent in the clinical attachment level assessments. Number of concordant and discordant attachment level measurements carried out in 10 randomly selected patients at the baseline examination (I) and the re-examination (II). None of the duplicate recordings differed more than 1 mm

*Irrtümer bei der klinischen Bestimmung der Attachment-Niveaus. Anzahl übereinstimmender und nicht-übereinstimmender Messungen der Attachment-Niveaus bei 10 zufällig ausgewählten Patienten, anlässlich der Ausgangs- (I) und der Kontrolluntersuchung (II). Keiner der Doppelbestimmungen wich mehr als 1 mm ab*

*Erreurs inhérentes à la mesure du niveau clinique de l'attachement. Nombre de mesures concordantes ou discordantes effectuées chez 10 patients choisis par tirage au sort, à l'examen initial (I) et à l'examen final (II). Aucune des doubles mesures ne divergeait de plus d'1 mm*

| | | Concordant measurements | Discordant measurements | | Agreement % |
|---|---|---|---|---|---|
| | | | 1 | 2 | |
| I | Mesial | 161 | 18 | 17 | 82.1 |
| | Buccal | 168 | 17 | 11 | 85.7 |
| | Lingual | 168 | 16 | 12 | 85.7 |
| | Total | 497 | 51 | 40 | 84.5 |
| II | Mesial | 160 | 25 | 24 | 76.6 |
| | Buccal | 162 | 20 | 27 | 77.5 |
| | Lingual | 157 | 25 | 27 | 75.1 |
| | Total | 479 | 70 | 78 | 76.4 |

Concordant measurements *(Übereinstimmende Messungen, mesures concordantes)*, discordant measurements *(Nicht-übereinstimmende Messungen, mesures discordantes)*, agreement % *(Übereinstimmung %, accord %)*

*Table 10.* Reproducibility in caries diagnosis. Number of concordant (agreement) and discordant (nonagreement) carious surfaces calculated from duplicate recording of 10 randomly selected patients from the control groups at the re-examination

*Wiederholbarkeit der Kariesdiagnostik. Anzahl übereinstimmender und nicht-übereinstimmender Registrierung von Doppelbestimmungen bei 10 zufällig ausgesuchten Patienten der Kontrollgruppe, anlässlich der Kontrolluntersuchung*

*Reproductibilité du diagnostic de la carie. Nombre de faces cariées concordantes (accord) ou discordantes (désaccord), calculé à partir des doubles mesures faites chez 10 patients choisis par tirage au sort parmi les groupes témoins à l'examen final*

| | Agreement | Non agreement | | Agreement % |
|---|---|---|---|---|
| | | 1st | 2nd | |
| Secondary lesions | 29 | 2 | 1 | 90.6 |
| Primary lesions | 60 | 4 | 0 | 93.8 |

Agreement *(Übereinstimmung, accord)*, nonagreement *(Nicht-Übereinstimmung, désaccord)*, agreement % *(Übereinstimmung %, accord %)*, secondary lesions *(Sekundäre Läsionen, lésions secondaires)*, primary lesions *(Primäre Läsionen, lésions primaires)*

the assessment of caries was high, 93.8 % for primary lesions and 90.6 % for secondary lesions.

## Discussion

The results of the present clinical trial have clearly shown that it is possible, with reg-

ularly repeated tooth cleaning instruction and prophylaxis, to stimulate adults, young as well as old, to adopt proper oral hygiene habits. The findings also demonstrate that persons who utilize proper oral hygiene techniques during a 3-year period have negligible signs of gingivitis, display no loss of periodontal tissue attachment, and develop practically no carious lesions. Age-matched persons who did not receive preventive but merely symptomatic treatment during the same 3 years, suffered from gingivitis, lost periodontal tissue support and developed several new as well as recurrent, carious lesions.

In general, the observations made in this trial confirm and extend those presented by Lövdal et al. (1961) and Suomi et al. (1971). Lövdal et al. (1961) showed that oral hygiene instructions, combined with subgingival scaling twice a year during a 5-year period, were effective in reducing gingival inflammation. Suomi et al. (1971) showed that individuals instructed in good oral hygiene practice and given frequent oral prophylaxis (at 2-, 3- and 4-month intervals) had cleaner teeth, less gingival inflammation and "a slower rate of apical migration of the epithelial attachment" than individuals who during the observation period were not receiving these benefits. The present trial, however, goes a step further by demonstrating that maintenance of proper plaque control procedures is also effective in preventing caries from developing. The findings of this study, therefore, also confirm results from clinical trials by, e. g. Lindhe & Axelsson (1973), Poulsen et al. (1976), Karlsson & Larsson (1976), Klock (1976) and Axelsson & Lindhe (1977) who showed that young individuals (schoolchildren, aged 7–17 years) maintained free from plaque infections by mechanical means had only occasional signs of gingivitis and practically no caries.

The results of this and the previous studies referred to are encouraging because they not only reveal the decisive role played by bacterial plaque in the etiology and pathogeneis of periodontitis and caries, but also demonstrate that, in children as well as in adults, a prophylactic program based on mechanical plaque control may successfully prevent the two major dental disorders from recurring. The significance of plaque control in periodontal disease treatment and prevention has been recognized for many years (for review see Loesche 1976). Conflicting results have been presented, however, regarding improved oral hygiene as a caries preventive measure (for review see, e. g. Bibby 1966, McHugh et al. 1964, Gülzow 1965, Berenie et al. 1973, Sutcliffe 1973). An expert committee (WHO scientific group 1972) recently concluded, "Brushing of the teeth and other aids to oral hygiene are only likely to be effective as a caries preventive measure to the extent – as yet undefined – that they are able to control the accumulation of dental plaque. For this reason, their efficacy as a public health measure to prevent caries should not be overemphasized". It is important, however, to realize that tooth-brushing is not synonymous with proper tooth cleaning. On the contrary, in many instances only buccal and lingual tooth surfaces are properly cleaned by tooth brushing leaving plaque on approximal surfaces untouched. In such cases, interproximal caries and gingivitis develop. A proper plaque control program, however, includes measures which remove plaque on *all* tooth surfaces. The present study and findings reported earlier clearly demonstrate that proper plaque control measures (mechanical or chemical) are also highly effective in the prevention of caries.

It should not be inferred that the preventive measures utilized in the present trial are the only or best means of preventing periodontitis and caries. Undoubt-

edly the procedures applied in this study may be simplified and improved in several ways. With the present rapid development of new, potent antimicrobial compounds, it is likely that within a few years selective measures, which are directed only against caries- and periodontitis-inducing bacteria in plaque, may be successfully used. Already today considerable information exists with regard to the toxicity, effectiveness and characteristics of some drugs which may provide a basis for proper chemical plaque control programs.

The observations made in the control group patients at the re-examination in 1975 demonstrate that traditional dental care, i. e. symptomatic treatment, mainly of caries, neither prevents the recurrence of these lesions nor terminates the progression of periodontitis. This finding is in close accordance with data presented by Björn (1974). In 1965 and 1971 Björn examined the dental health status of individuals, aged 25–65 years, who between 1965 and 1971 had sought dental treatment on a yearly or sporadic basis. She found that the "sporadic dental care" group in 1971 had developed slightly more recurrent caries than the "yearly dental care" group. She also noted that there was no difference between the groups regarding the incidence of primary caries during the observation period. Furthermore, she reported that the proportion of individuals with calculus was similar in the two groups, and that during the 6-year period, a significant reduction of the periodontal bone height had occurred which was of the same magnitude in both groups. Björn (1974) also concluded that "the incidence of dental disease was about the same in the yearly and sporadic dental care groups". The findings presented by Björn and those reported in this study, therefore, imply that symptomatic treatment has limited, if any, impact on the recurrence and progression of the two major dental disorders. Similar results have recently been presented from an examination of a Danish population (Christensen 1976). Taken together, these findings must lead to the following question: Can traditional dental care still be regarded as proper treatment? The facts seem to indicate that symptomatic dental treatment is a highly ineffective means of curing caries and periodontal disease.

The patients in the control groups of the present study lost around 0.17–0.3 mm periodontal tissue attachment per tooth surface and year during the 3-year interval between the two clinical examinations. In this context it should be realized that loss of periodontal tissue support was assessed by clinical measurements and by the use of a graduated probe. Recent reports (Caton & Zander 1976, Armitage et al. 1977, Lindhe, Hamp & Schroeder 1977) have revealed that clinical assessment of the attachment level does not necessarily reflect the true location of the marginal termination of the connective tissue attachment. Hence, loss or gain of clinical attachment, assessed by clinical methods, must be interpreted with great caution. The annual attachment loss noted in this material is somewhat larger than that reported by Suomi et al. (1971) (0.1 mm/year) but substantially smaller than the periodontal tissue breakdown observed by Rosling et al. (1976) in patients who did not carry out proper oral hygiene following periodontal surgery (around 1 mm/year during the first 2 years following treatment). The differences in degree of attachment loss between the three studies, however, are most likely explained by differences in (1) composition of patient material, (2) type of treatment delivered and (3) methods used to determine attachment levels. In the present trial the control patients were between 20 and 71 years old whereas, in the study by Suomi et al., the participants were

between 18 og 43 years. Since in the present study the annual attachment loss tended to be larger in the older than in the younger age group, one may speculate that the progression of periodontitis is more rapid in older than in younger plaque-infected individuals. Similar observations were reported by Björn (1974) who noted that during a 6-year period the rate of alveolar bone loss was more rapid in the old than in the younger age groups. If the attachment loss of the control patients in group I of this study (i. e. $<$ 35 years) is compared with the corresponding figure reported by Suomi et al., it becomes obvious that in both samples the average attachment breakdown during a 3-year period was similar, i. e. 0.3 mm. In the study by Rosling et al. (1976) the patients, aged 29–68 years, were recruited because they had advanced periodontal breakdown and "because each of them had multiple osseous defects", i. e. they were all individuals who were highly susceptible to periodontitis. Rosling et al. postulated that surgical pocket elimination in a plaque-infected dentition will promote periodontal tissue breakdown, possibly beyond the rate which is normal for untreated patients of this age group.

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**Zusammenfassung**

*Der Effekt kontrollierter oraler Hygienemassnahmen auf das Vorkommen von Karies und parodontalen Krankheiten beim Erwachsenen*
Die vorliegende Untersuchung wurde vorgenommen um festzustellen, ob das Vorkommen von Karies und die Weiterentwicklung der Parodontitis bei Erwachsenen verhindert werden kann. Durch sowohl regelmässig wiederholte Instruktionen in der Methodik oraler Hygiene als auch prophylaktische Behandlung wurden Voraussetzungen für einen hohen Stand oraler Hygiene geschaffen. Weiterhin wurde der Versuch unternommen die Progression von Zahnkrankheiten bei solchen Probanden zu studieren, die keinerlei besondere Instruktionen über orale Hygiene, jedoch regelmässige traditionelle Zahnbehandlung erhielten. Für diese Untersuchung wurden in den Jahren 1971–72 zwei Gruppen gebildet, deren Mitglieder aus der gleichen geographischen Region stammten.

375 Probanden bildeten die Test- und 180 Probanden eine Kontrollgruppe. Die Basisuntersuchung zeigte, dass der sozial-ökonomische Stand, der Standard der oralen Hygiene, das Vorkommen von Gingivitis und Karies vor dem Versuchsbeginn, bei Test- und Kontrollgruppe etwa gleich war. Während der dann folgenden 3-Jahresperiode wurden die Kontrollpatienten zu regelmässigen jährlichen Kontrollbesuchen bestellt und traditionelle zahnärztliche Behandlung wurde vorgenommen. Die Angehörigen der Testgruppe hingegen wurden während der ersten beiden Versuchsjahre jeden zweiten Monat und während des dritten Versuchsjahres jeden dritten Monat bestellt. Sie wurden individuell in gründlicher oraler Hygienetechnik instruiert und mit sorgfältiger prophylaktischer Therapie, die auch Zahnsteinentfernung und Wurzelplanung einschloss, behandelt. Die prophylaktische Behandlung wurden einem Dentalhygienisten überlassen. Gegen Ende des dritten Versuchsjahres wurden Kontrolluntersuchungen vorgenommen. Die Ergebnisse dieser Studie zeigten eindeutig, dass es durchaus möglich ist durch wiederholte Instruktion über die Technik der Zahnreinigung und durch Prophylaxebehandlungen, Erwachsene zu zweckmässigen oralhygienischen Gewohnheiten zu stimulieren. Weiterhin zeigen die Versuchsergebnisse, dass bei Personen die während einer 3-jährigen Periode zweckmässige orale Hygienetechnik angewendet haben nur unbedeutende klinische Zeichen von Gingivitis auftraten, dass kein Verlust an parodontal-geweblichem Attachment vorlag und dass praktisch keine neuen Kariesläsionen beobachtet wurden. Die Kontrollpatienten, die während des gleichen Zeitabschnittes eine mehr symptomatische Therapie erhielten, hatten Gingivitis, verloren gingivales Stützgewebe und entwickelten sowohl neue als auch sekundäre kariöse Läsionen. Diese Ergebnisse zeigen, dass reparative Zahnbehandlung als ein ineffektives Mittel zur Heilung der Karies- und

der Parodontalkrankheit angesehen werden muss.


### Résumé

*Action sur la carie dentaire et sur les affections parodontales de procédés d'hygiène bucco-dentaire avec surveillance, chez l'adulte*

La présente étude a été effectuée dans le but d'établir s'il est possible d'empêcher les caries dentaires et la progression des parodontites chez des adultes dont l'hygiène bucco-dentaire est maintenue à un niveau élevé grâce à la répétition régulière de séances d'enseignement et d'entraînement aux soins d'hygiène, et de nettoyage et polissage professionnels es dents. De même, une étude a été entreprise sur la progression des maladies dentaires chez des personnes ne recevant pas d'enseignement spécial des soins d'hygiène bucco-dentaire, mais recevant régulièrement des traitements dentaires du type habituel. Deux groupes de personnes appartenant à une même région géographique ont été recrutés pour les essais en 1971–1972; 375 sujets formèrent un groupe expérimental et 180 sujets un groupe témoin. Un examen initial a mis en évidence le fait que le niveau socio-économique, le niveau d'hygiène bucco-dentaire, l'incidence des gingivites et l'atteinte de la carie dentaire étaient semblables chez les participants des deux groupes avant le début de l'étude. Pendant la période des trois années suivantes, les patients du groupe témoin ont été vus régulièrement une fois par an et ont reçu des traitements dentaires de la manière qui se pratique habituellement. Les participants du groupe expérimental, par contre, étaient convoqués tous les deux mois pendant les deux premières années et tous les trois mois pendant la troisième année. Au cours de ces séances, ils ont reçu individuellement des instructions sur les procédés adéquats de soins d'hygiène bucco-dentaire, un entraînement pratique et un nettoyage dentaire minutieux, comprenant aussi l'ablation du tartre et le polissage des racines. Chacune de ces séances prophylactiques était menée par une hygiéniste dentaire. Un examen final a été effectué vers la fin de la troisième année de traitement. Les résultats de cette étude ont montré clairement qu'il est possible, par des séances répétées régulièrement d'instructions aux soins d'hygiène et de nettoyage professionnel des dents, d'inciter les adultes à adopter des habitudes adéquates d'hygiène bucco-dentaire. Les résultats ont aussi mis en évidence que les personnes qui, pendant une période de 3 ans, pratiquaient des techniques adéquates de soins d'hygiène, ont présenté des signes négligeables de gingivite, n'ont pas souffert de perte du tissu d'attachement parodontal et n'ont pratiquement pas été atteints de nouvelles caries. Les patients du groupe témoin, qui, pendant la même période, recevaient un traitement purement symptomatique, ont souffert de gingivites, de perte des tissus de soutien parodontaux et ont été atteints de plusieurs caries nouvelles ainsi que de récidives de caries. Ces résultats indiquent que les traitements dentaires constituent un moyen remarquablement inefficace de soigner la carie et les affections parodontales.


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