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Complete dentures in the prosthetic rehabilitation of elderly persons: five different criteria to evaluate the need for replacement

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SUMMARY The purpose of this study was to examine the condition and functional properties, as well as adjustment and replacement needs, of 288 complete dentures worn by 144 inhabitants of Helsinki over 75 years old. Five different criteria to evaluate the need for replacement were used: (I) criteria based on Oral Health Surveys – Basic Methods (WHO, 1987); (II) criteria based only on the clinical data collected during the examination; (III) criteria based only on examiners’ subjective opinion of the condition of the dentures; (IV) criteria based on clinical data as well as examiners’ experience and consultation with the patient; (V) criteria based only on patients’ subjective opinion. Depending on the evaluation method used, 10–84% of the dentures were judged to be in need of replacement. Strict objective evaluation methods produced the highest figures for replacement need, and method (I) (WHO, 1987) the lowest. The most justifiable replacement percentage (26%) was achieved when the dentist assessed treatment need together with the patient. This study documents the multiple subjective and objective difficulties related to the wearing of complete dentures. The study also highlights the well-recognized importance of regular annual re-examinations for those wearing complete dentures and the assessment of need for adjustment of the dentures. It also demonstrates that successful treatment decisions cannot be made solely on the basis of clinical examination or a dentist’s subjective opinion, but should be formulated in close consultation with the patient.

Introduction

Todd & Lader (1991) estimated that total edentulousness will disappear in the United Kingdom by the year 2038. Comparable improvement of dental health among the elderly population in other industrialized countries has not, however, ended the need for complete denture rehabilitation (Ainamo & Österberg, 1992). The ill-fitting denture will thus continue to cause problems for dentists in the foreseeable future.

After only five years of use, roughly 50% of complete dentures may need replacement (Hoad-Reddick, 1989). Despite this fact, removable dentures have often been found to be worn for a remarkably long time (Grabowski & Bertram, 1975; Mäkilä, 1977; Ranta, 1987). Complete-denture wearers may be handicapped, either socially or functionally, by day and night use of dentures, by dentures in poor condition or by the rocking, incorrect contour, poor occlusion or poor articulation of old dentures (Bergman, Carlsson & Ericson, 1971; Helöe, 1973; Mäkilä, 1974, 1977; Bastiaan, 1976; Smith & Sheiham, 1979; Tervonen, 1988; Hoad-Reddick, 1989). This creates a need for denture replacement (Ritchie, 1973; Mäkilä, 1979).

Several different methods have been created for the evaluation of the condition of dentures and the need for
prosthetic treatment (Bergman, Carlsson & Hedegård, 1964; Kapur, 1967; Rayson et al., 1971; Helöe, 1973; Ritchie, 1973; Grabowski & Bertram, 1975; Bernier, Shotwell & Razzoog, 1984; WHO, 1987; Hoad-Reddick, 1989). Because these evaluation methods are still, to some extent, intricate, the popular term 'ill-fitting dentures' has remained undefined. By using and comparing five different evaluation methods, the present study attempts to assess the soundness and functional condition of the complete dentures worn by elderly residents in Helsinki.

Patients and methods

Study group

Between 1989 and 1991, a general health examination was carried out involving elderly residents of Helsinki (Helsinki Aging Study, HAS) who were born in 1904, 1909 and 1914. In 1990 and 1991, the dental examination was completed for 364 of these subjects. Detailed information concerning the size and age distribution of these basic, medical and dental study groups is given elsewhere (Närhi et al., 1992; Nevalainen et al., 1996). For the present study, 144 totally edentulous subjects with both upper and lower complete dentures were drawn from the basic dental study group (Table 1). The subjects' interviews and clinical examinations were performed at the Department of Prosthetic Dentistry, University of Helsinki, or in some cases, when the subjects were unable to move about, at their homes.

Evaluation of dentures

The 288 complete dentures from the 144 edentulous subjects were first divided into five groups according to their age: 0–5 years old; 6–10 years old; 11–20 years old; 21–30 years old; and ≥31 years old. This distribution of dentures by their age is shown in Table 2. Patients were also asked when they had purchased their first complete dentures. Respondents were asked to select one of the following time categories: 0–10 years ago; 11–20 years ago; 21–30 years ago; 31–40 years ago; 41–50 years ago; ≥51 years ago.

Clinical examination and assessment were based on and modified according to earlier studies by Kapur (1967), Rayson et al. (1971) and Bernier et al. (1984). Stability, retention and vertical dimension of the dentures were categorized into three groups, occlusion and articulation into two groups. Five different methods were used to assess the need for prosthetic treatment. Adjustment needs were assessed by use of a questionnaire.

Stability. The stability of each denture was assessed on the following scale: good = slight or no rocking on denture-supporting structures when, under pressure; satisfactory = moderate rocking on supporting structures under pressure; poor = extreme rocking on supporting structures under pressure.

Retention. The retention of each denture was assessed on the following scale: good = good resistance to vertical pull, and sufficient resistance to lateral forces; satisfactory = slight to moderate resistance to vertical pull, and little to no resistance to lateral forces; poor = no resistance to vertical pull and lateral forces – the denture falls out of place.

Occlusion. Occlusion was categorized into the following two groups: good = muscular and intercuspal positions coincide with only slight variation (up to 0.5 mm); poor = more than 0.5 mm error between muscular and intercuspal positions.

Articulation. The articulation of the denture was assessed by asking the subjects to make lateral movements of about 5 mm with the mandible from the mid-line habitual centric occlusion. If the dentures remained in place, articulation was considered good; otherwise it was considered poor.

Vertical dimension. The vertical dimension of the denture was assessed on the following scale: satisfactory = a freeway space of 1–6 mm; too low = a freeway space of >6 mm; too high = a freeway space of <1 mm.

Table 1. Distribution of study group by age and gender

<table>
<thead>
<tr>
<th>Sex</th>
<th>Age (years)</th>
<th>0–5</th>
<th>6–10</th>
<th>11–20</th>
<th>All ages</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>Male</td>
<td>15 (28)</td>
<td>16 (33)</td>
<td>5 (12)</td>
<td>36 (25)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>39 (72)</td>
<td>32 (67)</td>
<td>37 (88)</td>
<td>108 (75)</td>
<td></td>
</tr>
<tr>
<td>Both sexes</td>
<td>54 (38)</td>
<td>48 (33)</td>
<td>42 (29)</td>
<td>144 (100)</td>
<td></td>
</tr>
</tbody>
</table>
Both ‘too low’ and ‘too high’ vertical dimensions were considered poor.

The need for prosthetic treatment. Five different methods were used to assess the need for prosthetic treatment.

Method I — if both upper and lower complete dentures had been used regularly during the previous six months (WHO, 1987), no replacement was needed.

Method II — if occlusion and articulation were good, stability and retention were good or satisfactory, vertical dimension acceptable, and the dentures were undamaged, they were classified as satisfactory. If any of these was deficient, the dentures were considered unsatisfactory and in need of replacement. This is a purely mechanical method based only on data collected during the clinical examination.

Method III — based on both the mechanical condition of the dentures (existing base fractures, fractured pieces of acrylic resin, loss of teeth, wear of teeth, etc.) and the dentist’s subjective opinion, dentures were categorized as ‘satisfactory’, ‘in need of repair’ or ‘in need of replacement’.

Method IV — examiner’s subjective judgement of the need for replacement of dentures based on clinical experience, examination of the patient, examination of the dentures and discussion with the patient. Categorized as ‘needs replacement’ or ‘does not need replacement’.

Method V — subjective opinion of the elderly person regarding their present dentures. This was assessed by asking whether they found their dentures ‘good’, ‘satisfactory’ or ‘poor’.

Adjustment needs. Adjustment needs, satisfaction and wearing problems related to different wearing periods of the dentures were assessed by use of a questionnaire.

### Table 2. Age of the complete dentures

<table>
<thead>
<tr>
<th>Location</th>
<th>Age (years)</th>
<th>0-5</th>
<th>6-10</th>
<th>11-20</th>
<th>21-30</th>
<th>≥31</th>
<th>All ages</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>(%)</td>
<td>n</td>
<td>(%)</td>
<td>n</td>
<td>(%)</td>
<td>n</td>
</tr>
<tr>
<td>Maxilla</td>
<td>50</td>
<td>(35)</td>
<td>24</td>
<td>(17)</td>
<td>31</td>
<td>(21)</td>
<td>15</td>
</tr>
<tr>
<td>Mandible</td>
<td>54</td>
<td>(37)</td>
<td>25</td>
<td>(18)</td>
<td>32</td>
<td>(22)</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>104</td>
<td>(36)</td>
<td>49</td>
<td>(17)</td>
<td>63</td>
<td>(22)</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>46</td>
</tr>
</tbody>
</table>

### Table 3. Distribution of 144 subjects (%) according to years elapsed since the purchase of their first complete dentures

<table>
<thead>
<tr>
<th>Years elapsed</th>
<th>0-10</th>
<th>11-20</th>
<th>21-30</th>
<th>31-40</th>
<th>41-50</th>
<th>≥51</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of subjects in category</td>
<td>3</td>
<td>14</td>
<td>19</td>
<td>23</td>
<td>22</td>
<td>19</td>
</tr>
</tbody>
</table>

The elderly persons were asked to evaluate their last dentures during the first months of wearing and how they found them today. The following statements were given for them either to agree or disagree with: ‘my dentures cause pain’; ‘my dentures do not stay in place’; ‘my dentures rock’; ‘I cannot speak well with my dentures’; ‘I cannot eat well with my dentures’; ‘I have no problems with my dentures’.

### Statistical analysis

The findings concerning occlusion, articulation, stability, retention, vertical dimension, soundness and replacement needs of the dentures were compared separately with the age of the dentures using the contingency table analysis of the StatView+™ program*. Differences at the 5% level were accepted as significant.

### Results

Distribution of subjects according to years elapsed since first complete dentures is shown in Table 3.

*BrainPower, Calabasas, CA, USA.
Stability, retention and soundness of dentures

The stability and retention of the 288 complete dentures are shown in Figs 1 and 2. The mechanical condition of the dentures is shown in Fig. 3.

In the maxilla, the stability was good for 38% of the dentures, satisfactory for 36% and poor for 26%. In the mandible, the figures were 19%, 31% and 50%, respectively. The age-related impairment of stability of the maxillary dentures was statistically highly significant ($P < 0.001$).

In the maxilla, retention was satisfactory for 38% and poor for 24% of the dentures. In the mandible 29% were satisfactory and 65% poor. Only 6% of the lower dentures had good retention. There was a highly significant statistical relationship between decreasing retention and ageing of the dentures in the maxilla ($P < 0.001$).

Fifty per cent of the maxillary dentures and 49% of mandibular dentures were sound. The damage was usually minor (small base fractures, fractured pieces of acrylic resin or a lost single tooth) and repairs needed were less extensive. The older dentures had more faults than did the more recent ones (maxilla: $P < 0.01$; mandible: $P < 0.05$).

Occlusion, articulation and vertical dimension

Dentures with a poor occlusion, articulation and vertical dimension are shown in Fig. 4. All the properties became less satisfactory with increasing age of the dentures (occlusion: $\chi^2 = 12.4$, $P < 0.05$; articulation: $\chi^2 = 9.2$, $P > 0.05$; vertical dimension: $\chi^2 = 17.0$, $P < 0.01$). Occlusion was good in 53% of the dentures, and articulation in 43%. Vertical dimension was satisfactory in 49%, too low in 44% and too high in 7% of the cases.

Need for prosthetic treatment by method of assessment

Method I. All the subjects had dentures that had been worn during the past six months at least and were thus acceptable according to WHO (1987).
Fig. 3. Repair and replacement needs based on examiners' evaluation of dentures' medical condition according to dentures' age.

Fig. 4. Percentage distribution of dentures as related to poor occlusion, poor articulation and poor vertical dimension.

Method II. Based on the dentists' objective evaluation of both mechanical and functional properties of the dentures (using data collected during the clinical examination), 84% of the elderly wore inadequate and poor dentures in need of replacement. The need for replacement increased with the age of the dentures: 10% of the 0–5-year-old and 53% of the 21–30-year-old maxillary dentures needed replacement. In the mandible the figures were 15% and 45%.

Method III. Dentures were assessed according to the examiners' subjective assessment of the mechanical condition of dentures, the possibility of repair and the replacement needs; results are shown in Fig. 3.

Method IV. According to the subjective opinion of the examiners (based on their clinical experience, examination of the patient, especially considering the patient's age and general health and dentures, and discussion with the patient), 26% of the dentures needed replacement (25% of the maxillary and 27% of the mandibular dentures).

Method V. According to the subjective opinion of the elderly persons, 69% had good or satisfactory dentures and 10% poor dentures, with 21% of the elderly not able to formulate an opinion. Men (51%), more often than women (42%), found their dentures to be good, but for both sexes, 10% of the dentures were classified as poor.

Replacement needs according to these five different evaluation methods are shown in Fig. 5.

Subjective satisfaction with dentures
Subjective opinions of the elderly persons are listed in Table 4.

Discussion
In this study we tested and compared five different evaluation criteria used to assess the need for complete denture therapy. The World Health Organization's basic survey instructions (WHO, 1987) define the need for prosthetic rehabilitation only by considering total edentulousness requiring treatment with complete dentures. There are no further instructions on how to assess the need for prosthetic treatment in other cases. According to this method (Method I in this study), 100% of the elderly persons would be classified as
having satisfactory rehabilitation because all had worn their dentures regularly for at least six months. It is, however, clear that no evaluation method designed for epidemiological studies on a population level only, is applicable to a general practitioner facing variable individual needs.

Assessment Method II, which was based on a strictly objective evaluation of detailed functional properties of the dentures alone, appears to be too meticulous. According to this inspection procedure, almost all the dentures examined could be categorized as unacceptable; for our subjects, 74% of maxillary dentures and 84% of mandibular dentures were classified as in need of replacement; overall, 84% of the subjects had at least one objectively poor denture. These findings parallel those of Hoad-Reddick (1989).

Based on the mechanical condition of the dentures and examiners' subjective opinions (Methods III and IV), roughly one-fourth of the complete dentures needed replacement. Among denture wearers, broken dentures may be the most common reason to visit the dentist. Because of this, general practitioners often evaluate replacement need by using Method III only. A dentist's subjective decision can, however, be somewhat influenced by multiple factors such as the sex, age, environment and complementary studies of the dentist (Rantanen, 1976). Thus, a subjective evaluation by one dentist can be rather unreliable (Rayson et al., 1971). According to Method IV, however, the dentist consults the patient before making the replacement decision. In our study all the subjects were old (aged 76–86 years), had several systemic diseases and used medications that may diminish salivary flow rate (Närhi et al., 1992). Their denture hygiene was often improper, and the mechanical and functional properties of the dentures were only satisfactory. If the patient was personally satisfied with the dentures, and oral health was otherwise good, no need for replacement was recorded, and only the need for oral and denture hygiene instruction was recognized.

That there is often disagreement between a dentist's objective opinion and the patient's subjective opinion concerning the need for denture replacement (Tervonen, 1988) was also evident in our study. Although in the present study the dentures were rather old, only 10% of the elderly people found them to be poor (Fig. 5). This supports an earlier conclusion that the longer the denture has been worn, the better it is usually accepted and tolerated by the patient (Todd & Lader, 1991; Muller, Wahl & Fuhr, 1994). In our study population, 64% of the subjects (Table 4) had a denture-wearing history of over 30 years. This time period had given the subjects the opportunity to become trained and experienced complete-denture wearers with very few complaints. Older denture wearers thus seem to manage subjectively well with their dentures and are often reluctant to obtain new ones (Muller et al., 1994). Despite the large number of functional faults and an objectively recognized need for replacement, only 10% of the dentures were found to be poor by the elderly themselves; this finding is consistent with the findings of Langer, Michman & Seifert (1961). These authors reported that patients' satisfaction with complete dentures was closely related to the successful use of the lower denture and to their chewing ability, but not related to the clinical fit of the dentures. From the point of view of our examiners, our study population's complete dentures had been worn for too long in general. The older the dentures, the greater the number of objective functional faults they had. This is also in accordance with earlier findings (Bergman & Carlsson, 1985).

Our findings concerning the qualities of stability, retention, occlusion, articulation and vertical dimension of the complete dentures, together with the observation that these features become impaired with the increasing age of the dentures, support the findings of Hoad-Reddick (1989). Comparison of these features with the age of the dentures caused some problems, however, because a number of the elderly people had difficulty in recalling the history of their dental treatment. Of course, this may result from their advanced age and/or the prevalence of mild dementia diagnosed in the

<table>
<thead>
<tr>
<th>Table 4. Complaints and satisfaction with their present dentures at different points in the wearing period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of subjects</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>A (%)</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>Dentures cause pain 5</td>
</tr>
<tr>
<td>Dentures do not hold their place 2</td>
</tr>
<tr>
<td>Dentures rock 1</td>
</tr>
<tr>
<td>'I cannot speak well with my dentures' 1</td>
</tr>
<tr>
<td>'I cannot eat well with my dentures' 1</td>
</tr>
</tbody>
</table>

A, wearing problems when dentures were new; B, wearing problems today; C, no problems at all.
medical examination of these subjects, which ranged from 5% in the youngest age group to 27% in the oldest (Juva et al., 1993).

The impairment in stability of the dentures was statistically more significant in the maxilla than in the mandible. This finding may be explained by the different original stability and retention states of the upper and lower dentures. In the maxilla the changes were usually larger, roughly from good to poor, but in the mandible the original stability was already rather poor, and thus changes ranged from poor to even poorer. Differences in upper and lower intra-oral anatomy (Mäkikäiä, 1975a), alveolar atrophy and other age-related tissue changes in the oral cavity may also contribute to these kinds of prosthetic problems (Watt & MacGregor, 1986).

In this study group, the main subjective complaint related to new dentures was pain (Table 3). After a longer wearing period, instability and poor retention of dentures increased and caused wearing problems for 25% of the elderly persons, thus creating the major adjustment needs. Our findings are in agreement with those of Mäkikäiä (1975b). In spite of these obvious wearing problems, 31% of the elderly people in our study population had most recently visited their dentist over six years before (Ainamo et al., 1993). This was, however, more frequently than in the United Kingdom, where only 5% of the adult complete-denture wearers over 75 years of age had plans to visit their dentist, although 34% of theirs dentures were over 20 years old (Todd & Lader, 1991). Avoiding re-call visits will lead to the inadequate maintenance of a denture's fit and condition (Cabot & Roberts, 1984), a fact that may further explain some of the existing wearing problems in our study group. Sometimes the elderly develop a suspicious attitude towards new dentures and would rather continue with the 'good' old ones (Mullee et al., 1994).

Overall, oral hygiene and denture-using habits, as well as attitudes towards the use of dental health services, or, most commonly, the poor financial state of the elderly, does not encourage frequent annual examinations or replacement of dentures (Ranta, 1987; Vehkalahtti et al., 1991).

The prosthetic rehabilitation in our study group should be considered far from the objective optimum. The evident need for prosthetic treatment, increasing with the age of the dentures (Figs 1–4), supports the views of other authors who have unanimously recognized prosthetic treatment as the most required type of treatment among all age groups (Bergman & Carlsson, 1985; Grabowski & Bertram, 1975; Helöe, 1973).

According to evaluation criteria other than wearing time (WHO, 1987), 25–84% of dentures needed replacement. Similar conflicting figures have been reported by other authors (Ritchie, 1973; Hoad-Reddick, 1989; Mäkikäiä, 1979). Our figures show that a combination of evaluation Methods III and IV, even when largely based on the examiners' subjective opinions, and the inclusion of consultation with the patient and consideration of his/her subjective fears, feelings and expectations, is the best way finally to decide whether to repair or replace old dentures.

Conclusion

There exists a clear need for prosthetic treatment among the elderly residents of Helsinki who wear complete dentures. Need for prosthetic treatment was, however, more often objective than subjective. Therefore, instead of treating these elderly people routinely by simply replacing their reasonably tolerated and accepted old dentures, it would in most cases be preferable to repair and readjust the old dentures for further use. Doing so would lower costs and eliminate problems encountered by elderly people adapting to new complete dentures.

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