Relationships between Oral Health-Related Quality of Life and Objective and Subjective Masticatory Ability in Geriatric Patients: A Pilot Study

Abstract

Aim: The aim of this pilot study was to investigate relationships between the distribution of occlusal contacts, oral health-related quality of life and subjective masticatory ability in geriatric patients.

Methods: A sample (n=30, median age 84.5) of geriatric patients enrolled at Karolinska University Hospital Huddinge was successively recruited for this clinical cross-section pilot study. A clinical examination was followed by a questionnaire including the Geriatric Oral Health Assessment Index (GOHAI) to examine oral health-related quality of life (OHRQoL) and subjective masticatory ability. The distribution of occlusal contacts classified each subject according to the Eichner Index to estimate objective masticatory ability. It contains three main groups (A, B, C) and seven subgroups, ranging from fully dentate to edentulous. Each group equals a numeric value called an Eichner Score.

Results: The ranking of the self-estimated ability to chew, correlated with the Eichner Index (r=0.60/p=0.0005). Subjects with a higher Eichner Score reported better perceived masticatory ability. The median score for subjective masticatory ability did not differ between the two main groups with the highest number of remaining teeth or fixed restorations, in contrast to subjects in the third group who reported poorer subjective masticatory ability. The number of teeth or fixed prosthetic restorations correlated positively with the perceived ability to bite or chew certain kinds of food, such as firm meat or apples, although missing teeth in some cases had been replaced with removable prosthetics (p=0.01). The three Eichner Index main groups A, B and C showed intergroup differences (p = 0.009) regarding OHRQoL.

Conclusions: The presence of at least one posterior occlusal zone was the single factor that most strongly influenced perceived masticatory ability and OHRQoL. Neither the occurrence of multiple support zones, nor whether or not the chewing function was achieved by dentures, automatically improved these subjective variables. This indicates that perceived masticatory ability and OHRQoL relate to several factors that need to be clarified by further research.

Keywords: Oral health-related quality of life, Geriatric Oral Health Assessment Index, masticatory ability, posterior occlusal contacts, Eichner Index.

Introduction

Oral health among the elderly population in Sweden has improved in recent decades [1]. The proportion of edentulous 80-year-olds has been reduced from 56% in 1983 to about 3% by 2010 even if higher numbers has been reported in nursing-dependent and ill elderly, with 32% edentulous 85-year-olds [2]. However, to be dentate at this age often means to be partially dentate with a variety of tooth replacements, both fixed and removable. Many elderly have oral cavities that harbor a complicated mix of reconstructions that is a challenge to keep in good condition, both for the dental profession and regarding daily oral hygiene. Oral dryness and increasing functional limitations make the older person more susceptible to oral diseases. There has been a report about compromised dental health with an increased dependency and need of daily support [2] as well as unacceptable oral hygiene in nursing home and geriatric patients [3]. With an aging population there is a greater need for oral and dental care to maintain the health of remaining teeth and conditions of prosthetic restorations in these patient groups. In this perspective, it is useful to know how various residual dentitions affect the older individual’s masticatory ability.
and quality of life. Masticatory ability has attracted increasing interest in recent years. A Swedish study found that people with an impaired masticatory ability have significantly elevated risk of impaired cognitive ability [4] but the correlation between number of teeth and cognitive function was not that evident. Impaired cognitive ability is associated with malnutrition [5] and impaired masticatory ability is a risk factor for malnutrition [6]. Previous assessments of masticatory ability related to quality of life suggest that occlusal contacts in the posterior segments indicate good objective and subjective masticatory ability [7-10]. In contrast, a low number of occlusal contacts do not necessarily mean that the patient experiences the ability to chew foods as unsatisfactory. Other factors, as being healthy, has been significantly associated with self-assessed chewing ability. It is possible to adjust the choice of food and all individuals do not expect a good masticatory ability in old ages. There is need to define masticatory ability from the patient's perspective and carefully consider that it affects the oral aspects of quality of life [11,12]. The scientific methods are more conducive to identifying subjects who consider themselves to have an acceptable or good masticatory ability than to identifying individuals with low subjective masticatory ability [9]. Different instruments to measure quality of life have been developed but we do not know which dimensions or items that best picture the subjective masticatory ability. El Osta et al has pointed to that further studies exploring factors affecting nutrition in the elderly should take into consideration Geriatric Oral Health Assessment Index (GOHAI) score, designed to measure oral health-related quality of life (OHRQoL) [13,14].

In the current study, we therefore wanted to see how the Swedish version of the GOHAI [15,13] correlated to the objective masticatory ability measured by Eichners index. We also studied the correlation between the masticatory related items in GOHAI to the index intotal. The aim was to investigate relationships between the number and distribution of occlusal contacts, OHRQoL and subjective masticatory ability in geriatric patients.

Material and Methods

Subjects

The study included 30 geriatric patients consecutively recruited during the period of data collection. All were enrolled at Department of Geriatrics Karolinska University Hospital Huddinge for short-term somatic care and care planning. Oral health was determined by number and positions of teeth and/or tooth replacements to objectively describe the masticatory ability. This clinical examination was complemented by a questionnaire regarding OHRQoL and perceived masticatory ability in order to understand the patient’s subjective perceptions and experiences.

Pfeiffer’s test (Short Portable Mental Status Questionnaire) was used to obtain an overall assessment of cognitive orientation and language skills [16]. Correct answers to six out of ten questions were required.

Data Collection

Questionnaire:

All subjects answered 14 orally asked questions, including the Swedish version of the GOHAI [15,13]. GOHAI is a validated 12-item questionnaire, used for assessment of the perceived OHRQoL in three perspectives:

- The perceived functional level of speech, eating and swallowing.
- Pain and discomfort, represented by use of analgesics for oral pain relief.
- Psychosocial and behavioral impacts of dissatisfaction with appearance and/or function, or concern about the oral health.

Responses were given as one of five possible answers on a Likert-type scale (always, often, sometimes, seldom, never). Each answer was assigned a numeric value of 1 to 5. The instrument was complemented by two additional questions constructed by the author J.O in order to give subjects a concrete opportunity to rate their masticatory ability and overall oral health. Responses were given as figures on a five-point rating scale. The assessment of the participants’ perceived quality of life related to oral health was based on the GOHAI score.

The questions were followed by a minor clinical examination where the following clinical data was collected:

- Presence and position of natural teeth.
- Fixed prosthodontic restorations (equated with natural teeth).
- Implant-supported prosthetic restorations (equated with natural teeth).
- Occluding teeth.
- Tooth mobility, assessed with a three-point scale [17].
- Removable dental prosthesis.

Eichner Index

Each subject was classified according to the Eichner Index [7] (Figure 1) based on the presence of occluding natural teeth.
or fixed prosthetic restorations in four posterior support zones. Removable prosthetic restorations were not counted. There were two zones per side: one premolar and one molar zone. Depending on the number of occluding zones, subjects were divided into three main groups: A, B and C. Subjects in group A had occlusal contacts in all four zones. Subjects in Group B had occlusal contacts in zone 1-3 or contacts in the front only. Subjects in group C had no occlusal contacts of natural teeth or fixed prosthetic restorations at all. Each main group contained 3-4 subgroups: A1 had fully dentate individuals, A2 had one missing tooth within the four posterior zones and A3 had missing teeth in two zones. B1 had occlusal contact in three zones, B2 in two zones, B3 in one zone and B4 had occlusal contacts in the anterior segment only. C1 had remaining teeth in both arches, but no occlusal contacts, C2 had remaining teeth in one arch only and C3 had totally edentulous individuals. Each subgroup equals a numeric value (9-0). A1=9, A2=8 and so on. Hereinafter, the numeric value is referred to as the Eichner Score.

Results

For description of the participants, see Table 1.

Objective and subjective masticatory ability

Correlation analysis between the questionnaire results and Eichner Score demonstrated positive correlations for five of the fourteen questionnaire items (Table 2), including all four items concerning subjective masticatory ability, i.e. subjects with a higher Eichner Score and more support zones reported better perceived masticatory ability. Figure 2 specifically illustrates the relationship between the Eichner Score and self-estimated ability to chew on a five-point scale, where 5 corresponds the ability to eat any kind of food and 1 corresponds with impaired chewing ability and special dietary needs. Median score for subjective masticatory ability did not differ between Eichner main groups A and B, in contrast to subjects in group C who reported poorer subjective masticatory ability.

Number of teeth

The number of natural teeth or fixed prosthetic restorations correlated positively with the perceived masticatory ability, even though missing teeth in some cases had been replaced with removable prosthetics (Table 3).

OHRQoL and masticatory ability

The three Eichner Index main groups – A, B and C – were compared regarding GOHAI total score (Kruskal-Wallis ANOVA test). This showed intergroup differences (p=0.009). Figure 3 illustrates the large variation of GOHAI total scores in group C in contrast to

![Figure 2: The scatterplot illustrates the relationship between Eichner Score and questionnaire item nr.13: If you would estimate your ability to chew on a scale of 5-1, where 5 means the ability to eat all food and 1 corresponds with impaired chewing ability and special dietary needs, what number do you think applies to you? The vertical axis shows how the subjects estimated their perceived masticatory ability. The horizontal axis shows the objective masticatory ability estimated through the Eichner Index.](image)

![Figure 3: Boxplot of GOHAI total score comparison between the three main groups of the Eichner Index: A, B and C.](image)
groups A and B, which showed less fluctuation. No significant correlation could be demonstrated between Eichner Score and GOHAI total scores at the individual level. To investigate the impact of different GOHAI items on OHRQoL, a correlation analysis was done between total GOHAI score and score on single GOHAI items. Analysis showed positive correlations for items regarding: Functional aspects (3 items), psychosocial (2 items) (Table 4).

Table 3: Results of correlation analysis (Spearman Rank Order Correlation) between score of single items in oral health questionnaire and number of remaining teeth and/or fixed prosthetic restorations. \(r_s^n = \) correlation coefficient.

<table>
<thead>
<tr>
<th>Question</th>
<th>p-value</th>
<th>(r_s^n )</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 1 (GOHAI) How often do you limit the kinds or amounts of foods you eat because of problems with your teeth or dentures?</td>
<td>0.05</td>
<td>0.35</td>
</tr>
<tr>
<td>No. 2 (GOHAI) How often do you have problems biting or chewing certain kinds of foods, such as firm meat or apples?</td>
<td>0.01</td>
<td>0.45</td>
</tr>
<tr>
<td>No. 11 (GOHAI) How often do you feel uncomfortable eating in front of people because of problems with your teeth or dentures?</td>
<td>0.03</td>
<td>0.41</td>
</tr>
</tbody>
</table>

Table 4: Results of correlation analysis (Spearman Rank Order Correlation) between GOHAI total score and score on single GOHAI items. \(r_s^n = \) correlation coefficient.

<table>
<thead>
<tr>
<th>Question</th>
<th>p-value</th>
<th>(r_s^n )</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 1 (GOHAI) How often do you limit the kinds or amounts of foods you eat because of problems with your teeth or dentures?</td>
<td>0.0009</td>
<td>0.65</td>
</tr>
<tr>
<td>No. 2 (GOHAI) How often do you have problems biting or chewing certain kinds of foods, such as firm meat or apples?</td>
<td>0.0001</td>
<td>0.65</td>
</tr>
<tr>
<td>No. 9 (GOHAI) How often have you been worried or concerned about problems with your teeth, gums or dentures?</td>
<td>0.0005</td>
<td>0.60</td>
</tr>
<tr>
<td>No. 10 (GOHAI) How often have you felt nervous or uncertain because of problems with your teeth, gums, or dentures?</td>
<td>0.002</td>
<td>0.63</td>
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Discussion

This pilot study of 30 geriatric patients enrolled for short-term somatic care at Karolinska University Hospital Huddinge showed that the individuals with a higher level of objective masticatory ability experienced both a higher level of subjective masticatory ability and a better OHRQoL. The presence of at least one support zone of posterior occlusal contacts affecting proper chewing with the molar or premolar teeth on at least one side is of high value for the masticatory ability and OHRQoL. Additional support zones did not automatically improve these variables.

The study had a limited number of participants, a fact that makes it a pilot study of geriatric patients seeking somatic care. Further studies would need to include a larger sample size and comparison of the different Eichner subgroups. However, the findings correspond with other findings [11]. They describe that in a sample of 708 Japanese independently living elderly subjects, the subjective masticatory ability is generally dependent on the objective ability, and they are both associated with posterior occlusal contacts. The current study uses the Eichner Index supported by previous research to approximate objective masticatory ability [11,7,18]. Ikebe, et al. reported that participants who were satisfied with their masticatory ability were found in greater proportion in Eichner Index group A than in the two other groups, B and C [11]. The current study found no difference between Eichner Index group A and B regarding subjective masticatory ability, in contrast to subjects in group C who reported poorer subjective masticatory ability using the validated and widely spread index GOHAI with two additional questions [15,13]. The results suggest that the presence of at least one supporting zone is sufficient for the perceived masticatory ability and that the contribution of additional zones may be less important. This ought to be considered in decision making for patients with compromised health where treatment possibilities are often limited and acceptable levels of OHRQoL and perceived masticatory ability is the prime objective. Even though the shortened dental arch concept is widely accepted in these cases, there is limited research on its impact on OHRQoL [19-21]. There could be other factors to consider in the concept of masticatory ability, such as motoric function, hyposalivation, choice of food or simply what level of masticatory ability you expect to retain in old age and under certain living conditions. These factors were not specifically investigated in the current study and further investigation among the elderly is warranted and planned, these factors will be considered. Besides edentulous individuals and individuals with only a few teeth, individuals with severe periodontal disease or subjective oral dryness have reported problems according to the OHRQoL instrument OHIP-14 often or very often. In the present study we used GOHAI which is recommended to use in geriatric populations.

We also studied the individual's perception and satisfaction with their living conditions and functional abilities. Diseases and disabilities do not necessarily mean a lower quality of life as long as these do not present an obstacle to living the way the individual pleases [22]. We chose to use the instrument GOHAI to measure OHRQoL, which has been shown to play a part in the overall health and affect the overall quality of life [23,24]. The current study showed correlations between objective masticatory ability and OHRQoL by intergroup differences (\(p=0.009\)) in Eichner Index main groups A, B and C compared with total GOHAI score (Figure 3). This suggests that the presence of at least one supporting zone is of high value for both a satisfactory OHRQoL and for the subjective masticatory ability. When we looked at the correlation between single masticatory related GOHAI items and the total GOHAI score, we could also see that subjective masticatory ability affects OHRQoL (Table 4). Perceived limitations to choose food type was a factor that correlated with OHRQoL as well as with both Eichner score and number of teeth, a finding that has also been observed in some previous research [7,12,25]. Of the three dimensions of GOHAI (functional, pain and discomfort and psychosocial), items of the functional and psychosocial aspect, correlated with Eichner score, number of teeth and GOHAI total score (Tables 2, 3 and 4). An impact of masticatory ability was expected on functional aspects but correlation between objective masticatory ability and psychosocial items has not been reported elsewhere [26]. According to the present study this aspect seems to be very important in geriatric patients, even more than pain and discomfort and maybe reflects a wish of not becoming alone and isolated.

Conclusion

For geriatric patients under short-term somatic care, the presence of at least one support zone of posterior occlusal contacts was the single factor that most strongly influenced perceived...
masticatory ability and OHRQoL. Neither the occurrence of multiple support zones, nor whether or not the chewing function was achieved by dentures, automatically improved these subjective variables. Whether this chewing function and OHRQoL in some ways affect food preferences or nutritional status is still to be discovered. This indicates that perceived masticatory ability and OHRQoL relate to several factors, such as hyposalivation, oral motor function, oral diseases and the impact of oral rehabilitation, that need to be clarified by further research.

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Compliance with Ethical Standards
The study was approved by the Ethical Review Board in Stockholm (EPN) reg.nr. 2012/2116-32/2. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Written informed consent was obtained from all subjects before inclusion in the study.

Competing Interests
None of the authors have any competing interests to declare.

Authors’ Contributions
Study design, data collection and compilation was performed by main author J.O Project initiation and supervision: I.W
O.L and P.S has made substantial contributions to the preparation of the manuscript.
- Ann Odlund Olin is a co-supervisor for the manuscript.

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