Chewing ability in relation to dental and general health

Analyses of data obtained from a questionnaire

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Agerberg, G. & Carlsson, G.E., Chewing ability in relation to dental and general health. Analysis of data obtained from a questionnaire. *Acta Odontol. Scand.* 1981, 39 147 – 153

Answers were obtained from 1106 (91 %) of a randomly selected sample of persons, aged 15 – 74 years, who were sent a questionnaire on chewing ability, chewing habits and some general and oral disorders. The questionnaire revealed that chewing ability was closely correlated to the number of residual teeth, but a loss of up to 7 teeth did not seem to entail an assessment of impairment. One fourth of the complete denture wearers reported that they could not chew all sorts of food. Unilateral chewing was reported by about one third, was more frequent in individuals with an unequal distribution of teeth and was correlated to impaired chewing ability. Both reduced chewing ability and unilateral chewing was closely correlated to increasing number of symptoms of dysfunction of the masticatory system. In all age-groups reduced chewing ability and unilateral chewing were reported more frequently by people who considered their general state of health impaired than by the healthy subjects.

Key-words: Mastication; epidemiology; temporo-mandibular joint syndrome

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One of the main reasons for prosthodontic treatment is to improve the masticatory function. It is in fact the second most frequent patient-expressed reason (after the cosmetic factor) for such prosthetic treatment (22). It is also asserted in practically all textbooks, although it is now acknowledged that modern, often industrially manufactured diets, do not require an intact dentition to be triturated.

In spite of the often emphasized importance of masticatory function, the question whether or not dental status is correlated to general health has not been clearly answered. Relatively little research has been devoted to developing suitable methods for clinical examination of chewing efficiency (6). The patient's own evaluation of his chewing ability therefore deserves attention.

The purpose of this study is to relate chewing ability, as reported in a questionnaire, to some dental and functional factors, concerning the masticatory system and to the subjects' own opinions of their general state of health.

Received for publication, June 26, 1980

MATERIAL AND METHODS

The investigation was carried out on 15–74 year-old residents of the city of Umeå, Sweden. 1215 persons were randomly selected and invited to take part in a questionnaire survey of functional disorders of the masticatory system. The questionnaires were filled in and 1106, or 91 %, were returned. The design and performance of the investigation have been described previously (1, 2). In this paper the interest will be focused on analysing answers to the following questions concerning chewing ability and chewing habits: How well can you chew your food? (Well, fairly well, badly). Can you chew all sorts of food (Yes/no). Do you usually chew on one or on both sides? (Both/right/left). *Chewing ability* is the term used for the individual's own assessment of his/her masticatory function.

Statistical methods

In addition to tests used and described previously (1, 2) stepwise multiple regression analysis was made in an attempt to rank the effect of some selected factors on the variation in chewing ability. Seventeen variables were selected for the analysis: age, general health, general joint and muscle symptoms, frequency of headache, medication because of headache and facial pain, pain on opening the mouth wide, TMJ sounds, previous care for TMJ pain or dysfunction, clenching and grinding of teeth, number of teeth, and some indices of mandibular dysfunction, parafunction and headache described earlier (2). The selected variables were introduced in the regression equations in order of their importance as predictors for the variance of the dependent variable.

RESULTS

56 % of the individuals aged 50–74 years considered their chewing ability to be good, compared with 89 % in the youngest age-group. Practically all subjects up to the age of 50 said they could chew all sorts of food while 15 % of those above 50 could not (Table 1). Chewing ability was closely correlated to the number of teeth (Table 2). No subject with more than 20 teeth said his or her chewing ability was poor, while this was stated by 15 % of those with very few teeth (1–7) and 8 % of the denture wearers. One fourth of the edentulous persons (most of whom had complete dentures) and 17 % of those wearing removable partial or complete dentures reported that they could not chew all sorts of food. Individuals with a denture in only one jaw and natural

Table 1. *Chewing ability and unilateral chewing in different age groups. Percentage of answers from 1106 individuals*

Age group	How well can you chew your food?			Can not chew all sorts of food	Unilateral chewing
	Well	Fairly well	Badly		
15–29	89	10	1	2	34
30–49	81	18	2	4	30
50–74	56	38	7	15	33
Total	78	20	2	6	32

teeth in the other considered their chewing ability reduced to the same extent as complete denture wearers did (Fig. 1).

Unilateral chewing reported by about one-third of the subjects, irrespective of age and dental status (Tables 1 and 2), was more frequent in individuals with an unequal distribution of residual teeth on both sides of the mouth (49 %) than in those with an even distribution (24 %). Individuals with unilateral chewing reported impaired chewing ability more often than those who chewed on both sides.

Table 2. *Chewing ability and unilateral chewing in relation to dental status. Percentage of answers from 1106 individuals (= N)*

		How well can you chew your food?			Can not chew all sorts of food	Unilateral chewing
	% of N	Well	Fairy well	Badly		
All teeth present	23	92	8	0	0	32
21–27 teeth	39	91	9	0	1	34
16–20 teeth	8	72	27	1	6	33
8–15 teeth	8	54	45	1	6	32
1–7 teeth	4	50	35	15	13	35
No teeth	17	50	40	9	24	28
Removable *denture* (complete and/or partial)						
Yes	29	53	39	8	17	32
No	71	88	11	1	1	32

Table 3. *General state of health in relation to chewing ability and chewing side. Percentage distribution in 1106 subjects (= N)*

Age group	General health	% of N	How well can you chew your food?			Can not chew all sorts of food	Unilateral chewing
			Well	Fairly well	Badly		
15–29	Good	95	91	9	1	1	33
(N = 443)	not so good	4	63	26	11	21	42
	poor	1	50	50	–	–	100
30–49	Good	91	82	17	1	3	29
(N = 348)	not so good	8	66	25	9	13	48
	poor	1	100	–	–	–	–
50–74	Good	65	62	36	2	9	28
(N = 279)	not so good	31	44	42	14	26	43
	poor	4	50	33	17	33	42

Table 4. *Correlation between chewing ability (well, fairly well, badly) and some single symptoms of mandibular dysfunction and parafunction*

Symptom	p
difficulty in opening the mouth wide	***
difficulty in taking a large bite	***
pain in the face in the morning	***
pain when opening the mouth wide	**
pain when chewing	**
TM joint sounds	*
unilateral chewing	***
clenching of teeth	***
grinding of teeth	NS

p denotes level of significance:
***$p \leq 0.001$;** $0.001 < p \leq 0.01$;
*$0.01 < p \leq 0.05$
NS = not significant

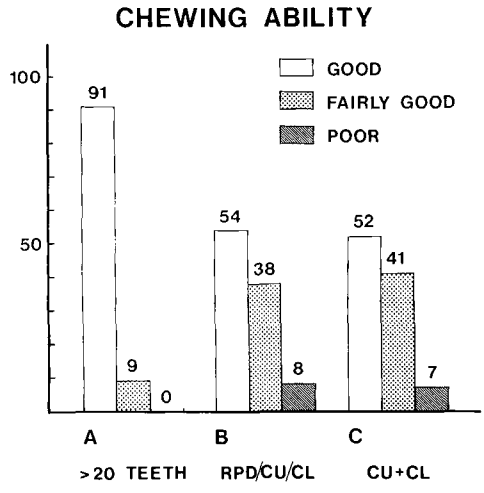

Fig. 1. Chewing ability (subject's own evaluation: good, fairly good or poor) in relation to dental status. A. denotes subjects with more than 20 natural teeth; B. subjects with a removable denture (partial or complete denture) in one of the jaws; C. subjects with complete dentures in both jaws.

Reduced chewing ability and unilateral chewing was reported more frequently by those who considered their general state of health impaired than by the healthy subjects (Fig. 2). This was true for all age-groups (Table 3).

Increasing number of symptoms of mandibular dysfunction was correlated to reduced chewing ability (Fig. 3) and increasing frequency of unilateral chewing in all age-groups. Chewing ability was also significantly correlated to many single symptoms of dysfunction (Table 4).

Stepwise multiple regression analysis

The number of teeth showed the highest multiple correlation coefficient, viz. $R = 0.39$ ($R^2 = 0.15$). Only one further variable, age, gave a significant increase of the multiple ($R = 0.44$). This means that the number of teeth and age could explain 19 % ($R^2 = 0.19$) of the variance of chewing ability.

DISCUSSION

The correlation between *chewing ability*, defined here as the individual's own assessment of his/her masticatory function, and *chewing efficiency*, usually defined as the capacity to comminute a test food, is probably not very close. These parameters would, however, certainly be significantly correlated if studied experimentally (6). Tests of chewing efficiency are time-consuming and usually require laboratory equipment (14), which makes them impracticable in extensive population investigations. This is the main reason why chewing ability was in this study assessed by means of answers to a questionnaire. The motivation for the use of a simple question on general health was similar. It has been extremely difficult to find a formula for general health even when extensive medical examinations have been included in epidemiological surveys (14, 20). It therefore seemed justified to use the individual's own opinion of his/her general health

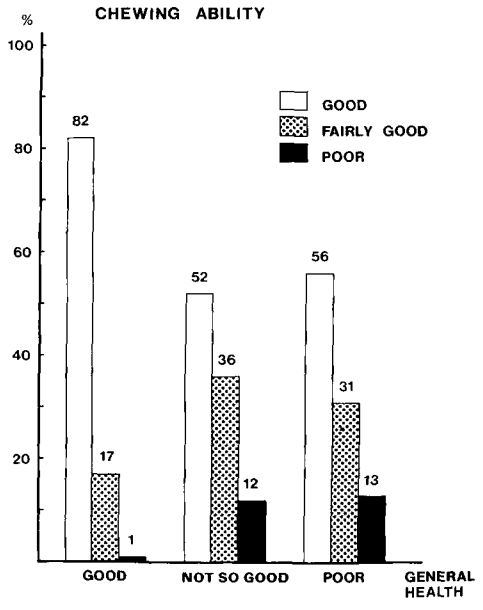

Fig. 2. Chewing ability (good, fairly good or poor) in relation to the subject's own opinion of his or her general state of health.

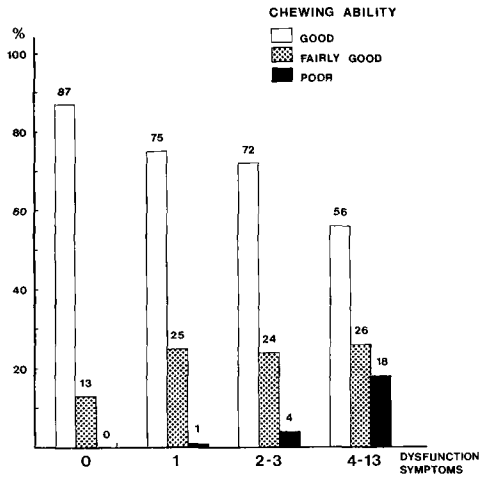

Fig. 3. Chewing ability (good, fairly good or poor) in relation to number of dysfunction symptoms.

in the present study. The problem of estimating the validity of the reported answers is difficult and has been discussed elsewhere (1, 15).

Limited chewing ability (inability to chew hard food as for instance hard bread and apples) was reported by 9 % of the population aged 16–74 in a nationwide survey of living conditions in Sweden (18). In a recent epidemiological study of dental health in Sweden (9), the answers to a question on chewing ability (Do you consider that you can chew well?) were very similar to those obtained in this investigation. For example, 8 % of the complete denture wearers in both samples considered their chewing ability poor. The same question as in the present study was used in an investigation of 70-year-olds and the answers were distributed in almost exactly the same way (20). Bite force measurements and other methods have shown that complete denture wearers are seriously handicapped in terms of masticatory function (10, 13). It is therefore probable that people's own assessment of their chewing ability in general is too optimistic compared to results of functional tests, and includes also other aspects of mastication, as e.g. adaptational and psychological ones.

The present study revealed that chewing ability was closely correlated to the number of teeth, but a loss of up to 7 teeth did not seem to entail an assessment of impaired chewing ability in this population. Laboratory tests have shown that loss of even single teeth reduces the capacity to pulverize food (19). Nevertheless, only 1 per cent of the individuals with 8–20 teeth in this population sample considered their chewing ability to be poor, while 6 per cent said that they could not chew all sorts of food. In this sample 20 well-distributed teeth seemed to give a satisfactory chewing ability. In a clinical study (16) it was found that people with shortened dental arches which included the second premolars, had sufficient teeth for chewing and acceptable function of their masticatory system.

The question of how many teeth we need for acceptable chewing is a com-

plicated one (6). Loss of molar support may have several unfavourable consequences for the function of the masticatory system and may lead to an increased risk for osteoarthrosis of the temporomandibular joints (17).

Complete denture wearers reported poor chewing ability less often than individuals with very few remaining natural teeth (Table 2). Pulverization tests have shown that most complete denture wearers have a poor chewing efficiency, often comparable to that in people with only a few remaining natural teeth (14). An adaptation to reduced chewing efficiency following gradual loss of teeth and denture treatment and wear is probably common and affects people's assessment of their chewing ability (11).

Chewing ability was also closely correlated to symptoms of mandibular dysfunction. According to these results, people who complain of poor chewing ability seem to have good reason for doing so. They had on an average fewer teeth and the remaining teeth were more often unevenly distributed between the two sides of the mouth, or they wore removable dentures. Furthermore they often had various dysfunction symptoms that could be related to the masticatory muscles and temporomandibular joints (TMJs). Patients with TMJ pain or dysfunction symptoms have been found to have a reduced bite force (12, 21), a factor that is certainly related to masticatory function. Many patients reporting impaired chewing ability seem to fit the broad concept of oral disability (8) and therefore deserve careful investigation and treatment to restore acceptable masticatory function.

One fourth of the edentulous persons (most of whom wore complete dentures) said that hey could not chew all sorts of food. This is a serious disadvantage and may involve risks of exclusion of essential foods from the diet. Preference for chewing on one side often seems to indicate a functional disturbance as it is associated with a difference between the number of remaining teeth on the two sides of the mouth and with impaired chewing ability. Unilateral chewing is also related to mandibular dysfunction, as has previously been observed (5, 7). The unfavourable long term consequences for the dentition of unilateral masticatory function have also been shown (4). These results indicate that an important objective of oral rehabilitation should be to restore and maintain bilateral masticatory function.

A significant correlation between the general state of health and chewing ability is shown in Fig. 2. This finding is based on reports by subjects, and if it also holds true in a clinical examination it is a serious finding, of great importance to both the dental and the medical profession. It is not possible from the present data to draw any definite conclusions of the cause-effect-relationship between these two variables (and other related factors). However, the number of teeth accounted for more of the variance of chewing ability than any of the other variables used in the regression analysis. As dental health is usually intertwined with medical and social problems (15), a reasonable interpretation is that impaired chewing ability is a consequence of the deterioration of the dentition (especially frequent in socially and medically disabled persons). If impaired chewing ability is a possible aggravating factor for the general state of health, it deserves to be further studied in broad surveys including both dental and medical disciplines.

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