Short Communication

Number of Occlusal Units Estimated from Number of Present Teeth

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Abstract

The aim of this study was to determine the relationship between number of present teeth (PT) and number of occlusal units (OUs). The data were obtained from a periodontal disease examination based on the health promotion law in Tokyo, Japan in 2005. Data from a total of 1,549 (524 male and 1,025 female) 60-year-old people were analyzed in this study. The number of OUs was counted by analyzing their dental charts. Any pair of opposing teeth of the same type was counted as one OU. The maximum number of OUs in a 28-tooth dentition was therefore 14. Our study revealed that the mean number of OUs decreased along with the number of PT. The OUs of the molars were lost first, followed by those of the premolars. The anterior OUs were last to be lost. The mean number of OUs was always lower than half the number of PT: 10.4 at 24 PT, 7.2 at 20 PT, 4.4 at 16 PT, and 1.3 at 10 PT. In the posterior region (premolars and molars), the mean number of OUs was 4.7 at 24 PT, 2.6 at 20 PT, and 1.0 at 16 PT. For molars, there were 1.4 OUs at 24 PT, 0.6 at 20 PT, and 0.4 at 16 PT. Participants with fewer than 20 PT had fewer than two OUs in the posterior region. This research demonstrates that the number of OUs can be estimated from the number of PT. This knowledge can be used to reveal more detailed information about the oral health status of a given population.

Key words: Occlusal units—Present teeth—Adults

Introduction

Number of present teeth (PT) has been used to set target values for oral health improvement goals by several institutions, including

the Japan Dental Association and the World Health Organization (WHO). In Japan the 8020 campaign, which encourages the elderly to retain at least 20 teeth until the age of 80, has been in place since 1989⁷⁾. The WHO

Table 1 Percentage of persons with PT by type of tooth (n = 1,549, 60 years old)

Maxilla	17	16	15	14	13	12	11	21	22	23	24	25	26	27
%	68.6	71.7	77.0	81.4	90.3	85.2	84.3	84.6	85.8	90.5	81.9	79.8	73.7	69.6
Mandible	47	46	45	44	43	42	41	31	32	33	34	35	36	37
%	64.7	57.9	78.5	89.9	96.1	94.0	92.9	93.0	93.2	96.6	88.8	77.9	56.4	63.3

stated in 1992 that throughout life, the retention of a functional, aesthetic, natural dentition of 20 teeth, without prosthesis, should be the treatment goal for oral health¹¹⁾. While it is true that number of PT directly influences masticatory function²⁾, little consideration has been given to the effect of occlusal status. The Survey of Dental Diseases in Japan⁹⁾ provides important data concerning oral health status, but it does not include any data on occlusal condition.

Occlusal units (OUs) have been used to assess oral health status for the past three decades²⁾. A number of studies have demonstrated a relationship between OUs and masticatory efficiency, masticatory ability, oral health-related quality of life, dental arch stability, temporomandibular disorders, and nutrition-related psychosocial factors such as satisfaction²⁾.

There is likely to be a direct relationship between the number of PT and OUs, since a decrease in PT would cause a decrease in OUs. However, there has been no research investigating this. Our hypothesis in this study was that the mean number of OUs would be lower than half the number of PT, because it is not likely for teeth to be lost in matching maxillary/mandibular pairs. The aim of this study was to estimate the number of OUs from the number of PT.

Methods

This study reviewed data collected from a periodontal disease examination targeting people aged 40, 50, or 60 yr, based on the

health promotion law in Tokyo, Japan in 2005. Data from 1,549 60-year-old people (524 male and 1,025 female) were selected for the analysis as tooth loss increases rapidly from around age 60 in Japan⁹⁾. Completely and partially erupted permanent teeth were defined as “present teeth” (*i.e.*, existing teeth) in this study. Supernumerary teeth, third molars, pontics of bridge prostheses, and implant-supported superstructures were not counted as PT.

The number of OUs was determined by analyzing the dental records of the above-mentioned subjects. Any opposing pair of maxillary and mandibular teeth with the same tooth number was counted as one OU, so that the maximum of number of OUs in a 28-tooth dentition was 14.

Results

Table 1 shows what percentage of persons had how many PT, by tooth type. Mandibular first molars had the lowest number of PT, followed by mandibular second molars, maxillary second molars, and then maxillary first molars. More than 90% of anterior teeth were present in the mandibular dentition.

The mean number of OUs by PT is shown in Fig. 1. As can be seen, the mean number of OUs decreased as PT decreased. Molars were the first OUs to be lost, followed by premolars. The anterior OUs were the last to be lost. The mean number of OUs was less than half that of PT: 10.4 at 24 PT, 7.2 at 20 PT, 4.4 at 16 PT, and 1.3 at 10 PT. In the posterior teeth (premolar and molar), the

Fig. 1 Mean number of OUs by PT (n=1,549, 60 years old)

mean number of OUs was 4.7 at 24 PT, 2.6 at 20 PT, and 1.0 at 16 PT. For molars, there were 1.4 OUs at 24 PT, 0.6 at 20 PT, and 0.4 at 16 PT. When the number of PT was lower than 20, OUs in the posterior region dropped to fewer than two.

Discussion

There are no established rules concerning how to count OUs. In fact, although the term “occlusal units” is frequently used, there is no consensus on its definition. For example, Käyser⁴⁾ counted one pair of occluding premolars as one unit and one pair of occluding molars as two units. Lin *et al.*⁶⁾ included pontics of bridge prostheses in his count. Baba *et al.*¹⁾ counted OUs using dental charts. The number of OUs may also be influenced by occlusal status, but such malocclusion is rare enough to be ignored in this case, due to the large sample size.

The Survey of Dental Diseases in Japan in 2005⁹⁾ presented percentages of persons with PT by tooth type in the 55–59 age group that are comparable to the data in this study. In addition, the results of both studies showed the same sequence of tooth loss, *i.e.* first molars were the first teeth to be lost, followed

by mandibular second molars, maxillary second molars, and then maxillary first molars in people around 60 years of age. This tendency has a strong impact on OUs.

A number of studies have reported that a decreasing number of OUs or PT affects the maintenance of a healthy oral environment. Helkimo *et al.*³⁾ assessed the ability of 139 subjects to grind a given quantity of sample food within a specific time period. The number of occluding pairs of teeth was closely correlated with chewing efficiency, and individuals with fewer than 20 teeth had poorer chewing efficiency than those with more than 20 teeth. Käyser⁴⁾ suggested that chewing discomfort begins with fewer than four OUs with symmetrically shortened dental arches (SDAs), and six OUs with asymmetric shortening. Leake *et al.*⁵⁾ studied 338 people and found that people began expressing masticatory discomfort with zero to two posterior functioning units. Gotfredsen and Walls²⁾, conducted a review in which they concluded that masticatory efficiency and ability are both linked to the number of teeth. A minimum of 20 teeth with 9–10 pairs of contacting units (including anterior teeth) is associated with adequate efficiency and ability. Tooth numbers below that level cause impaired masticatory efficiency and are likely to result

in reduction in reported masticatory ability. Sarita *et al.*⁸⁾ studied a sample of 725 adults with SDAs in Tanzania, using 125 adults with complete dental arches as the control group. This study concluded that SDAs with intact premolar regions and at least one occluding pair of molars provide sufficient masticatory ability. Shortened dental arches with three to four pairs of occluding premolars and asymmetric arches with a long side result in some impairment of masticatory ability, whereas extreme SDAs comprising only zero to two occluding premolars result in severely impaired chewing ability.

A number of studies have confirmed a relationship between the number of OUs and dental arch stability^{4,8,10)}. Käyser⁴⁾ conducted a cross-sectional study of 118 subjects including 90 with SDAs. It was concluded that there was sufficient adaptive capacity to maintain adequate oral function in SDAs when at least four OUs remain, preferably in a symmetrical position. In a nine-year study by Witter *et al.*¹⁰⁾, 74 subjects with SDAs were compared with 72 subjects with complete dental arches. No differences between the two groups were observed in terms of overbite occlusal contact or lower marginal bone levels. Gotfredsen and Walls²⁾ also reported that for most people, occlusal support and stability are obtained with three to four functional posterior units with a symmetrical pattern of tooth loss, or five to six units with an asymmetrical pattern.

In the present study, persons with fewer than 20 PT had zero to two posterior OUs. In addition, four OUs correlated to around 15 PT, and six OUs translated to 19 PT.

This research demonstrates that the number of OUs can be estimated from the number of PT. The implication is that researchers can estimate occlusal status from past data such as the Survey of Dental Diseases in Japan. This knowledge can be used to reveal more detailed information about the oral health status of a given population.

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