Validation of the Eichner Index in Relation to Occlusal Force and Masticatory Performance

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Purpose: Eichner Indices (A, B, and C), especially the Eichner subgroups (A1–A3, B1–B4, C1–C3), have not been validated in relation to oral functions. The purpose of this study was to investigate the association of posterior occlusal contact loss with occlusal force and masticatory performance in subjects who had a normal dentition or partially edentulous arches restored with removable prostheses. ***Materials and Methods:*** The study sample consisted of 1,288 independently living patients over the age of 60 years. Subjects were grouped into 10 subgroups by posterior occlusal contacts according to the Eichner Index. Bilateral maximum occlusal force in the intercuspal position was measured using pressure-sensitive sheets. Masticatory performance was determined by the concentration of dissolved glucose obtained from comminuted gummy jellies. ***Results:*** Occlusal force and masticatory performance were significantly associated with posterior occlusal contacts. Occlusal force measured in subgroups A2 to B2 and B3 to C3 did not differ statistically, although overall occlusal force decreased significantly as the loss of occlusal contacts increased. Similarly, masticatory performance was reduced with decreasing occlusal contact, although the decline was more gradual. Masticatory performance among subgroups A1 to B1, A3 to B2, B2 to B3, B4 to C2, and C1 to C3 did not differ significantly. ***Conclusions:*** The Eichner Index subgroups were significantly associated with reduced oral functions, even if the teeth were restored with removable prostheses. Preservation of occlusal contacts of the bilateral (B2) and unilateral (B3) premolars was critical for occlusal force and masticatory performance, respectively. *Int J Prosthodont 2010;23:521–524.*

The primary goal of dental treatment is to restore oral function, especially mastication. Loss of posterior occlusal support has been reported to affect occlusal force and masticatory performance. The Eichner Index[1] has been used widely to classify posterior occlusal contacts based on existing natural or restored tooth contacts between the maxilla and mandible in the bilateral premolar and molar areas. Three classifications of the Eichner Index were reported to relate to occlusal wear,[2] temporomandibular disorder,[3] and subjective[4] and objective[5] chewing ability, as well as oral health–related quality of life.[6] However, the 10 classifications of the Eichner Index, especially the subgroups, have not been validated in relation to oral function; therefore, its clinical significance has not yet been demonstrated clearly.

It was hypothesized that a loss of posterior occlusal contacts classified by the Eichner Index would be associated with a reduced occlusal force and a decline in masticatory performance, even if partially edentulous arches were restored with removable prostheses. To test this hypothesis, a cross-sectional study with a large number of participants was conducted.

Materials and Methods

Subjects were drawn from participants of the Senior Citizens' College of Osaka prefecture and were community-dwelling, independently living individuals over the age of 60 years. This college, which enrolled volunteers for a period of 1 year and was supported by the government of Osaka prefecture, is part of the adult education system for those over the age of 60.

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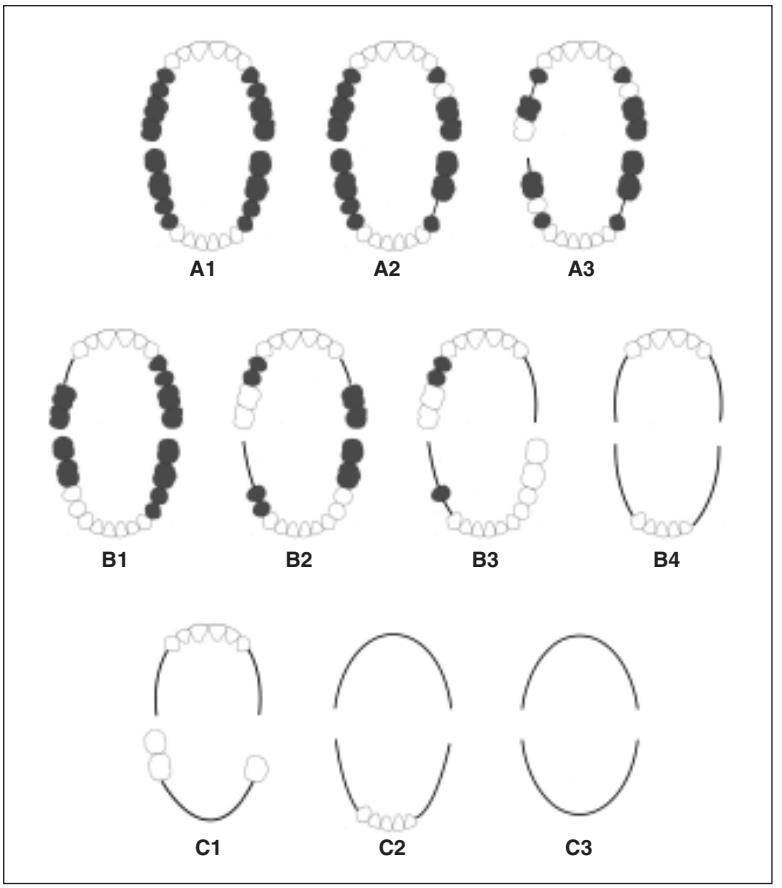

Fig 1 Scheme of Eichner classification. The molar and premolar contacts define the classifications. Antagonistic contacts were registered either on natural teeth, crowns, or fixed partial dentures. Gray = contact with antagonist tooth; white = no contact with antagonist tooth.

The population comprised 1,288 subjects (640 men, 648 women) with a mean age of 66.2 ± 4.2 years (range: 60 to 84 years). The protocol of this study was approved by the institutional review board of the Osaka University Graduate School of Dentistry, Osaka, Japan.

In the Eichner classification, each posterior contact area, including both the premolar and molar regions, are counted as one zone, yielding a total of four supporting zones. The Eichner Index describes the existing posterior occlusal support zones by dividing the occlusal status into three main groups (A, B, and C) and further dividing each of these into three (A1–A3), four (B1–B4), and three (C1–C3) subgroups, respectively (Fig 1).[1,7] Individuals classified as Group A have occlusal contacts in all four posterior support zones, those in group B have occlusal contacts in three to one zone(s) of contact or in the anterior region only, and those in group C have no occlusal contact at all. Regarding the subgroups, group A1 has no missing teeth in the mandible and maxilla, group A2 has at least one missing tooth in either the mandible or maxilla, and group A3 has at least one missing tooth in both the mandible and maxilla. Groups B1, B2, and B3 have posterior occlusal contact(s) in three, two, and one zone(s), respectively; group B4 has occlusal contact(s) in the anterior region only. Group C1 has at least one tooth in both the mandible and maxilla without any occlusal contact, group C2 has at least one tooth in either the mandible or maxilla, and group C3 is fully edentulous in both arches.

Bilateral maximum occlusal force and masticatory performance were measured as described previously.[5,8] Bilateral maximum occlusal force in the intercuspal position was measured using pressure-sensitive sheets. Masticatory performance was determined by the concentration of dissolved glucose obtained from comminuted gummy jellies. Individuals having partially or fully edentulous arches without replacement of the missing teeth were excluded from the study. Removable denture wearers who felt pain in the residual teeth or the residual ridge during chewing or whose dentures were dislodged during mouth opening, speaking, or chewing were excluded from analysis. Participants who wore removable prostheses kept their dentures in place during all measurements.

Table 1 Occlusal Force and Masticatory Performance Associated with Posterior Occlusal Contacts

		Occlusal Force (N)		Masticatory Performance (mm^2)	
Eichner Index	No. of subjects	Mean	95% Confidence interval	Mean	95% Confidence interval
A	717	572	550–594	2,661	2,614–2,709
B	420	438	412–463	2,155	2,081–2,228
C	151	256	224–289	1,314	1,171–1,458

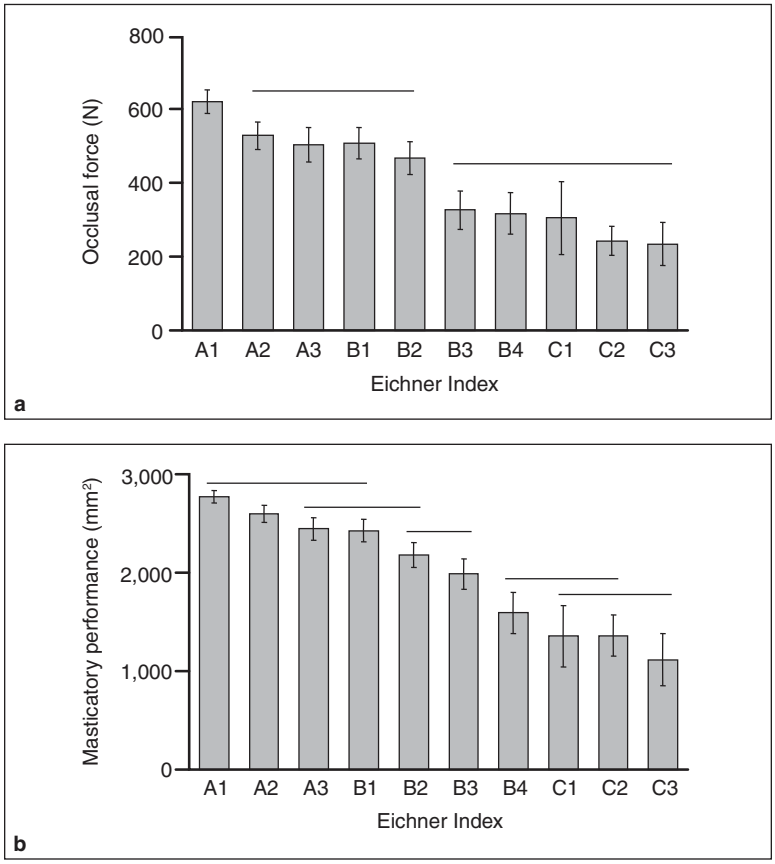

Fig 2 Association of the Eichner Index with **(a)** occlusal force and **(b)** masticatory performance (mean and 95% confidence interval). Crossbars identify homogenous subsets that are not statistically different from one another.

Data analyses were completed using SPSS software version 13.0 for Windows (SPSS). With regard to Eichner Index, masticatory performance and occlusal force were compared using a one-way analysis of variance, followed by a Tukey multiple range test to provide homogenous subsets that were not statistically different from one another. P values ≤ .05 were considered statistically significant.

Results

Occlusal force and masticatory performance were significantly associated with posterior occlusal contacts (Table 1). The occlusal force of subjects in groups B and C was found to be 76% and 45% of that of subjects in group A, respectively. Occlusal force among groups A2 to B2 and those among groups B3 to C3 did not statistically differ according to the Tukey multiple range test ($P < .001$, Fig 2a).

The masticatory performance of subjects in groups B and C was found to be 81% and 49% of that of subjects in group A, respectively. Similar to occlusal force, masticatory performance reduced with an increase in the loss of occlusal contacts, although the decline was more gradual. Masticatory performance among groups A1 to B1, A3 to B2, and B2 to B3 was not significantly different according to the Tukey multiple range test ($P < .001$, Fig 2b). Additionally, there were no significant differences in masticatory performance among groups B4 to C2 or C1 to C3.

Discussion

The classification of partially edentulous arches using the Eichner Index[1] is characterized by the number of occlusal contacts of the natural dentition. These groups represent the course of tooth loss with regard to functional value of the natural dentition. Thus, this classification provides a standard for the degree of morbidity of the dentition and is suitable for application in studies on morbidity statistics.

This study demonstrated that both occlusal force and masticatory performance are significantly associated with posterior occlusal contacts. Similar to occlusal force, masticatory performance reduced with decreasing occlusal contact, although the reduction was more gradual. This finding suggests that occlusal force is more strongly associated with posterior, especially premolar, occlusal contacts. However, masticatory performance is known to be more multifactorial because it includes oral sensory and motor functions, unlike occlusal force.[5,9–12]

Between adjacent subgroups, there was a significant discontinuity in occlusal force between groups B2 and B3 and in masticatory performance between groups B3 and B4. In this study, more than 80% of group B2 had bilateral premolar occlusal contacts. Similarly, almost all of group B3 had unilateral premolar occlusal contacts. Therefore, the findings suggest that the preservation of occlusal contacts of the bilateral premolars is a key predictor of occlusal force, and that of unilateral premolars is critical for masticatory performance. More specifically, although masticatory function of removable denture wearers is handicapped compared to individuals with a natural dentition, those with premolar occlusal contacts of the residual teeth can maintain better masticatory performance than those without occlusal contacts.[13] These findings also imply that shortened dental arches with premolar occlusal supports are clinically functional and effective.[14]

Conclusion

Loss of premolar occlusal contacts contributed markedly to a reduced occlusal force and a decline in masticatory performance, even if the tooth/teeth were replaced by removable prostheses. Preservation of occlusal contacts of the bilateral premolars (group B2) was a key predictor of occlusal force, and that of unilateral premolars (group B3) was critical for masticatory performance.

Acknowledgments

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