Judgement on removal of asymptomatic mandibular third molars: influence of position, degree of impaction, and patient's age

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Our aim was to study general dental practitioners' (GDPs') and oral surgeons' judgement of the need for removal of asymptomatic mandibular third molars, described by three cues. The judges were also asked to estimate the development of pathologic conditions. There was considerable variance with regard to the individual judgements. As a group, GDPs estimated the need for removal to be higher for patients less than 40 years than those more than 40 years old. The oral surgeons estimated the need to differ for three different age groups. The GDPs estimated the need to be highest for distoangular molars and lowest for vertical molars, whereas the oral surgeons estimated these positions to be equal. Molars partially covered by soft tissue were given the highest priority for removal by both groups of judges. The mean proportion of variation explained by the three cues was high, except for tumor development, indicating that the judges used the cues and the combination of them to a great extent in their judgement of the risk for development of pathologic conditions. □ *Decision-making; impacted tooth; judgement, linear models; third molar; tooth extraction*

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There is a substantial variation among dentists in their clinical decisions with regard to different treatments (1–6). In studies on the treatment of asymptomatic mandibular third molars general dental practitioners (GDPs) (7) and oral surgeons (8) displayed a substantial variation. When asked to judge 36 asymptomatic mandibular third molars, the number of molars proposed for removal ranged from 0 to 26 among the GDPs and from 3 to 21 among the oral surgeons. There are doubtless several explanations of this variation in decisions on whether to intervene. The information used by the individual dentist for the identification of risk of disease can differ, and such differences may be a source of variation in treatment decision. However, the results of our studies (7, 8) indicated that less variation occurred in the treatment decision for some of the molars. About three times as many judges, among both GDPs and oral surgeons, proposed removal of molars partially covered by soft tissue as compared with molars with other degrees of impaction. Oral surgeons were unanimous on the decision not to remove 11 of the 36 molars, all of them completely covered by soft or by bone tissue and belonging to patients in the oldest age groups. Thus, it seems as if the judges focused on some cue information in connection with the decision on treatment of asymptomatic mandibular third molars.

The aim of this study was to analyze how GDPs and oral surgeons judged the influence of three cues on the need for removal of 36 asymptomatic mandibular third molars. The three cues were the patient's age, the angular position, and the impaction status of the mandibular third molar. Another aim was to study the extent to which the variation in the judgement of the risk for development of six specific diseases was explained by these three cues.

Materials and methods

Cases

Asymptomatic mandibular third molars were selected so as to represent an equal distribution of male and female patients, age groups, angular positions, and degrees of impaction. Thus, half of the subjects were female patients. Three age groups were selected: 19–25 years, 26–40 years, and 41–60 years. The angular position was classified as vertical, mesioangular, distoangular, or horizontal on the basis of the criteria presented by Winter (9). The degree of impaction was divided into three categories: 1) partially covered by soft tissue, 2) completely covered by soft tissue and 3) completely covered by bone tissue. Thus, to obtain 1 molar to represent each age group, each angular position, and each degree of impaction, 36 molars were selected.

Case presentation

Each of the cases was presented as a radiograph and a questionnaire, as shown in the Appendix. A short text informed the judges about the sex and age of the patient and the degree of impaction of the molar. The judges

were also informed that there were no symptoms. Besides being asked to decide whether to remove the illustrated third molar, the judges had to establish the degree of confidence with which they judged the need for removal (the indication index) on a 100-mm visual analogue scale (VAS). They were also asked to estimate the development of pathologic conditions in general and the development of six diseases, also on the 100-mm VAS. The diseases were caries in the second molar, root resorption of the second molar, pericoronitis, periodontitis, cyst, and tumor.

Judges

The information on the cases was sent to 30 GDPs and to 10 oral surgeons. The selection of GDPs was as described by Knutsson et al. (7), and the selection of oral surgeons has been described in another study by the same authors (8).

Analysis

The response on each VAS was measured to the nearest millimeter. The 0- and 100-mm end points of the VAS represented the lowest and highest indication index for removal and the lowest and highest estimation of the development of pathologic conditions, respectively. The difference in the indication index between the subgroups of the cues was tested, using an analysis of variance with repeated measurements. The level of significance was set at $P < 0.05$.

In the three-way analysis of variance, the coefficient of determination (R^2) was the proportion of the variation in the judgement accounted for by the cues and the interaction between the cues (10). Thus, R^2 indicated the extent to which the variation in the judgement of the development of the six diseases was explained by the above-mentioned cues and the interaction between the cues.

Results

Table 1 shows the GDPs' and the oral surgeons' estimated mean indication index for removal of asymptomatic third molars. According to the GDPs' estimations, they were more inclined to remove molars of patients in the two youngest age groups than those of patients of the oldest age group. The oral surgeons estimated the indication indices of all three age groups to differ. The highest mean indication index was found for the youngest age group and the lowest for the oldest age group. The mean indication index also differed for the angular positions when estimated by both the GDPs and the oral surgeons. The GDPs gave the highest priority to removal of distoangular molars and the lowest priority to vertical molars. The oral surgeons, on the other hand, were most inclined to remove molars in vertical and distoangular positions and least inclined to remove molars in either horizontal or mesioangular position. For molars of different degrees of impaction, the mean indication index was highest for molars partially covered by soft tissue when estimated by both the GDPs and the oral surgeons. For molars completely covered by soft tissue or completely covered by bone tissue, GDPs and oral surgeons differed in their estimation. GDPs presented a higher indication index for molars completely covered by soft tissue than for those covered by bone tissue, whereas oral surgeons' indication index of the two molar groups did not differ.

Table 1. Mean indication index in millimeters on the visual analog scale (0 represents very weak and 100 very strong indication for removal) of 30 general dental practitioners (GDPs) and 10 oral surgeons for the removal of 36 asymptomatic mandibular third molars described by the cues age group (years), angular position, and degree of impaction. The square bracket (]) to the right of the figures indicates statistical significance. The rounded bracket ( ) between the figures indicates *no* statistical significance. The level of significance was set at $P < 0.05$

	GDPs		Oral surgeons	
	Mean	*s*	Mean	*s*
Age group (years)				
19–25	(38	13	38]	17
26–40	36]	10	25]	12
41–60	28]	8	19]	8
Angular position				
Horizontal	(35	13	(24	13
Mesioangular	33]	11	25]	12
Vertical	28]	10	(29]	12
Distoangular	39]	11	(32	12
Degree of impaction				
Partially covered by soft tissue	43]	16	40]	17
Completely covered by soft tissue	32]	11	(24]	13
Completely covered by bone tissue	26]	9	(18	10

Fig. 1 presents the individual judges' mean estimates of the indication index for removal for the different age groups (Fig. 1a), angular positions (Fig. 1b), and degrees of impaction (Fig. 1c). Both in the group of GDPs and in the group of oral surgeons there was considerable variation in the estimation of the mean indication index among the individual judges. Fig. 1a indicates that the variation decreased somewhat with increasing age of the patients. The indication index for the youngest age group ranged between 11 and 70 for the GDPs and between 17 and 75 for the oral surgeons, compared with 14 and 43 and 7 and 29, respectively, for the oldest age group. The range of the individual estimates of the indication index was comparable for molars in different angular positions (Fig. 1b). For molars partially covered by soft tissue the indication index of both GDPs and oral surgeons varied more than for molars completely covered by soft or by bone tissue (Fig. 1c).

Table 2 presents the mean proportion of the variation explained by the cues and the interaction between the cues which had an influence on the judges'

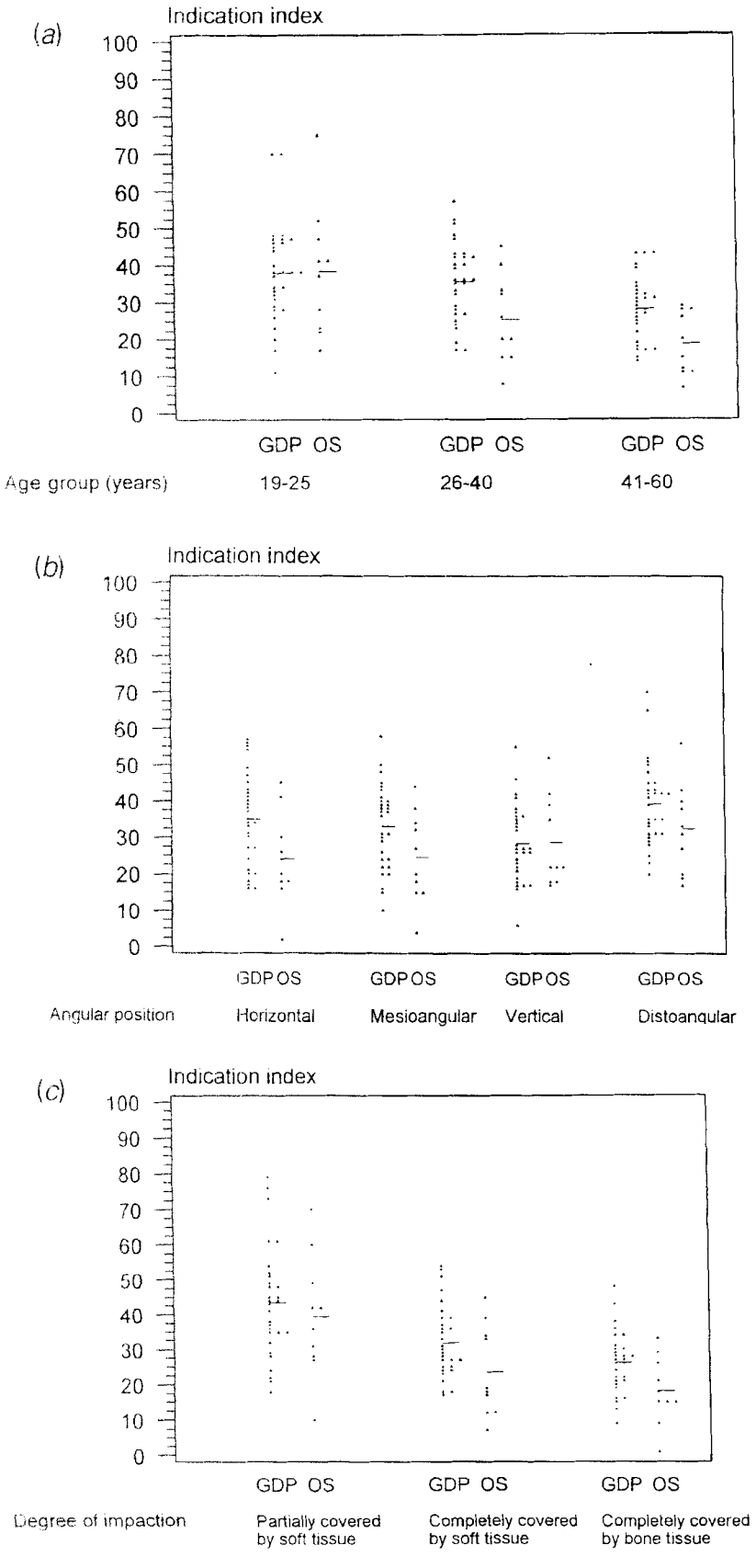

Fig. 1. Individual mean estimates of the indication index for removal of 36 asymptomatic mandibular third molars judged by 30 general dental practitioners (GDP) and 10 oral surgeons (OS), respectively. 0 represents very weak and 100 very strong indication for removal. The horizontal lines indicate the mean estimation of the observer group. 1a. Individual mean indication index for third molars in patients aged 19–25, 26–40, and 41–60 years. 1b. Individual mean indication index for molars in different angular positions. 1c. Individual mean indication index for molars of different degrees of impaction.

estimation of the development of the six diseases. R^2 ranged between 61% and 91%, being highest for pericoronitis and cyst. For the judgement of the development of a tumor, R^2 was only 61% for the oral surgeons and 71% for the GDPs.

Table 2. Mean proportion of the variation estimated by 30 general dental practitioners (GDPs) and 10 oral surgeons for 6 diseases, explained (R^2) by the cues age group, angular position, degree of impaction, and the interaction between these cues of 36 asymptomatic mandibular third molars

	R^2			
	GDPs		Oral surgeons	
Disease	Mean	*s*	Mean	*s*
Caries in second molar	0.84	0.11	0.78	0.17
Root resorption of second molar	0.80	0.15	0.79	0.19
Pericoronitis	0.91	0.09	0.82	0.14
Periodontitis	0.80	0.17	0.76	0.17
Cyst formation	0.87	0.09	0.85	0.13
Tumor development	0.71	0.16	0.61	0.21

Discussion

Previous studies on judgement analysis (11, 12) show that judges as a rule use few cues and that there are wide interindividual differences with regard to all characteristics of policies. We therefore restricted the number of cues to three: the patient's age, the degree of impaction, and the angular position of the mandibular third molar. The selection of cues and of subgroups within each cue was based on a review of the literature on mandibular third molars (13–24). The lower limit of the youngest age group was chosen on the basis that the root formation of most molars should be completed (16). The upper limit of the youngest age group, 25 years, was based on the results of three studies. First, 95% of third molar eruption has been completed before the age of 25 years (16). Secondly, postoperative morbidity is commoner in patients older than 25 years than in younger patients (14). Thirdly, the healing of periodontal bony defects on the distal aspect of the second molars after third molar removal was better in patients less than 24 years than in older age groups (19). As the prevalence of associated pathologic conditions has been shown to depend on the angular position of the molar (20–23), the angular position was also selected as a cue. The subgroups were defined as described in Winter's classical work (9), as this has been normative for many subsequent studies. The three degrees of impaction were selected so that the results of previous studies on mandibular third molars (13, 20, 22–24) could be used for validation of the dentists' judgements. There might be other cues that can explain the development of associated pathology around the mandibular third molar. Such cues might be the overall oral hygiene, the patient's overall status with regard to caries and periodontitis, and the ecologic balance between the microorganisms in the molar region and the immunologic resistance factors of the individual patient. The latter two cues are, however, difficult to define for an individual patient and have not been elucidated in the scientific literature on third molars.

We are fully aware that judgement analyses are no substitute for a trustful dialogue between dentist and patient preceding the clinical decision in the individual case. However, judgement analyses in which more than one dentist's recommended treatment can be analyzed yield new knowledge on the clinicians' use of certain information in a specific judgement setting. Besides, assessments based on 'simulated patients' have proved to correlate highly with those made on equivalent real patients in studies on restorative treatment recommendations (25) and in judging disease activity in rheumatoid arthritis (26, 27).

There are several possible sources of differences in the treatment alternatives that are suggested for a condition by different dentists. When clinicians have to decide on prophylactic intervention for a mandibular third molar, beliefs about risk factors for disease development and how the diagnostic cues are used may differ among the clinicians. The individual judges of our study had a considerable variation in the mean indication indices for one and the same cue, indicating a difference in their perception of the cue. One explanation for the considerable variation in the indication index and in their use of the cues is probably that the scientific basis for the treatment decision with regard to asymptomatic mandibular molars is sparse. Instead, opinions on the treatment of asymptomatic mandibular third molars and the risk of pathologic conditions associated with these molars have been largely formed from case reports and observations in non-random groups of referred patients (28–31). In contrast to earlier support for a widely advocated preventive indication (32–35), there is now evidence in favor of a restrictive policy towards the removal of an asymptomatic mandibular third molar. In an evaluation of the costs and relative effectiveness, Tulloch et al. (36) showed that extracting only those molars that remain impacted and become pathologically involved is always associated with less expected costs and disability than prophylactic removal. In studies on decision analysis, Mercier & Precious (37) and Brickley et al. (38) also concluded that surgery should be restricted to molars with diagnosed abnormalities. Furthermore, the results of follow-up studies demonstrated that long-standing retention of mandibular third molars is associated with a low incidence of pathologic conditions (17, 18, 39, 40). The considerable interindividual variation in the indication index for removal might reflect the fact that some judges were influenced by the strong preventive philosophy emerging in dentistry during the sixties, whereas other judges might have been impressed by the

critical outcome studies recently presented in the literature (36–38, 41, 42).

Age influenced the clinicians' estimation of the indication for removal of asymptomatic mandibular third molars. The GDPs as a group estimated the indication index of patients less than 40 years old to be higher than that of those more than 40 years, whereas the oral surgeons distinguished between all three age groups. One may suspect that abnormalities like follicular cysts will develop more rapidly in younger patients and more slowly in older patients. However, the oral surgeons' estimation of a higher indication index for patients aged 19–25 years than for those aged 26–40 years may also be based on the assumption that surgery should be performed when a pathologic condition makes its first appearance, or even before it develops. It can also be based on the assumption that older patients who have mandibular third molars removed are more likely to have a higher postoperative morbidity than younger patients (14, 43). With such a philosophy, there might be a risk that the treatment alternative of no intervention is not tested and that the risk of pathologic conditions for patients of different ages will not be fully understood. The oral surgeons might also have been influenced by the results of the study by Kugelberg (44) on periodontal healing after mandibular third molar surgery. Four years after surgery remaining intrabony defects exceeding 4 mm distal to the second molar was found in 4% in patients 25 years or younger and in 44% in patients 26 years or older. It is not possible to elucidate, with the design of the present study, whether the individual estimates of the indication index for removal of the molar were based on biologic/clinical or surgical/technical considerations. Thus, the high indication index for the younger patients and for molars partially covered by soft tissue might be an estimate of higher disease risk, but it might also include expectation of easier therapeutic intervention than for molars completely covered by bone tissue in individuals aged more than 40 years.

The GDPs and oral surgeons, as groups, were not homogeneous in their judgements of the cue angular position. This finding is not surprising, since the risk of pathologic conditions associated with mandibular third molars in different angular positions has not been described. Recent results indicate that molars of different angular positions present different odds ratios—that is, different risks for development of abnormalities. Thus, molars in a distoangular position presented the highest risk (45, 46), and molars in a mesioangular position presented the lowest risk of development of abnormalities (46). Both groups of judges estimated the need to remove distoangular molars to be higher than for mesioangular and horizontal molars. The GDPs also distinguished between distoangular and vertical molars, the latter actually presenting a lower risk for pathologic conditions (46).

Both groups of judges estimated the indication index of molars partially covered by soft tissue to be higher than that of molars completely covered by tissue. This judgement is supported by findings in patients subjected to removal of mandibular third molars (13, 46). More molars partially covered by soft tissue gave rise to subjective symptoms than molars of other impaction states (13). Leone et al. (22) found, by applying stepwise discriminant analysis, that the most important factor predisposing to the development of pericoronitis was partial encapsulation. Moreover, in a recent study (46) the risk of development of pathologic conditions of molars partially covered by soft tissue was calculated to be 22 and 34 times higher than for molars completely covered by soft and bone tissue, respectively. Considering the groups of molars completely covered by soft or bone tissue, the oral surgeons estimated the need for removal not to differ. This judgement is supported by the comparable estimated odds ratio for development of pathologic conditions: 0.3 for molars completely covered by soft tissue and 0.2 for molars completely covered by bone tissue (46).

The mean proportion of variation explained by the three cues was high, indicating that the GDPs and the oral surgeons used the three cues and the combination of them to a large extent in their judgement of the risk for development of different diseases. However, the estimation of tumor development presented lower values. In a previous study on beta weights of different diseases (47), the judges presented a low reliability and high standard deviation for the relative weight of tumor development. The judges seem, in other words, to be unable to establish a consistent judgement policy for this disease, probably because the prevalence is extremely low.

What can be learned from this study on the use of three cues for the estimation of the need for removal and of the development of disease around asymptomatic mandibular third molars? First, there is a substantial variation among the individual judges in their estimations of the need for preventive surgery. Secondly, the oral surgeons and the GDPs, as groups, rated mandibular third molars partially covered by soft tissue to have a higher need for removal, compared with other degrees of impaction, which is in accordance with evidence in the scientific literature on the risk for development of pathologic conditions. For the other degrees of impactions the oral surgeons' estimate was closer to the scientific evidence than the GDPs' estimate. The opposite relationship existed when the clinicians judged angular positions; the GDPs' estimate of the need for removal was then closer to the calculated risk for development of pathologic conditions than that of the oral surgeons.

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Appendix

Case 22
Male 37 years.
The mandibular third molar is partially covered by soft tissue.

A. Do you consider that this molar should be removed? ☐ YES ☐ NO

B. How strong is the indication for removing this third molar?

Very weak ——— Very strong

C. How strongly do you feel that pathology is likely to develop associated with this third molar?

Very weak ——— Very strong

D. How strongly do you feel that pathology is likely to occur concerning each of the following specific conditions?

	Very weak	Very strong
Caries in second molar	———	
Root resorption of second molar	———	
Pericoronitis	———	
Periodontitis	———	
Cyst formation	———	
Tumour development	———	