Mandibular third molars as mediated by three cues

Dentists' treatment decisions on asymptomatic molars compared with molars associated with pathologic conditions

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The aim was to study how three cues (patient's age and angular position and degree of impaction of the molar) were distributed among removed mandibular third molars associated with pathologic conditions and to compare these results with dentists' treatment decisions in another group of molars consisting of asymptomatic mandibular third molars, as mediated by the same cues. The overall agreement was fairly high between the dentists' treatment decisions and the removal rate among the molars subjected to removal. Thus, molars partially covered by soft tissue in patients aged 19 to 40 years had a high removal rate, and molars totally covered by bone tissue had the lowest removal rate in accordance with the dentists' treatment decisions. There were some exceptions. For example, molars partially covered by soft tissue in horizontal and mesioangular positions were rated higher by the dentists than the removal rates indicated. Distoangular molars in patients aged 26 to 40 years had the highest removal rate but a considerably lower order according to the dentists' decisions. Scientific evidence indicates that molars in mesioangular and horizontal positions present a low risk and molars in distoangular position present the highest risk of developing pathologic conditions, compared with other angular positions. □ *Decision making; impacted tooth; judgement; tooth extraction*

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Judgement analysis is a descriptive approach that focuses on the cognitive process involved in a judgement or a decision. A central question asked within judgement analysis is 'How do clinicians use information given to them to make a judgement about some criterion event, such as a diagnosis or treatment?' The Brunswik lens model is an important analytic tool to characterize judgements (1, 2). The lens model uses the analogy of rays of light passing through a convex lens to describe the relationship between the cues (pieces of information) and the true state—the optimal judgement or decision—and the relationship between the cues and the judged state. The lens model can be used to depict a clinician's judgement when examining a patient with a mandibular third molar and making a decision as to whether to remove the molar. A modified lens model applicable for such a judgement on mandibular third molars with certain cues is shown in Fig. 1.

There was a wide variation in the decision as to whether to remove asymptomatic mandibular third molars among Swedish general dental practitioners and among oral surgeons (3, 4). When general dental practitioners and oral surgeons were asked to judge 36 asymptomatic mandibular third molars, the number of molars proposed for removal ranged from 0 to 26 and from 3 to 21, respectively. The results of these studies (3, 4) indicate that the cues degree of impaction and angular position of the molar and patient's age influenced the treatment decision. About three times as many dentists, both among general dental practitioners and among oral surgeons, proposed removal of asymptomatic molars partially covered by soft tissue as compared with molars of other degrees of impaction. The dentists were also more inclined to remove molars in a distoangular position and molars in patients aged 19 to 25 years.

The aim of this paper was to study how three defined cues (patient's age, angular position and degree of impaction of the molar) were distributed among mandibular third molars subjected to removal and associated with pathologic conditions and compare these results with dentists' treatment decisions in another group of molars consisting of asymptomatic mandibular third molars, as mediated by the three cues.

Materials and methods

Questionnaires on surgically removed mandibular third molars with associated pathologic conditions

Questionnaires to be filled out for 100 consecutive patients who were subjected to surgical removal of a mandibular third molar were distributed in seven oral and maxillofacial surgery units in the southern region of the

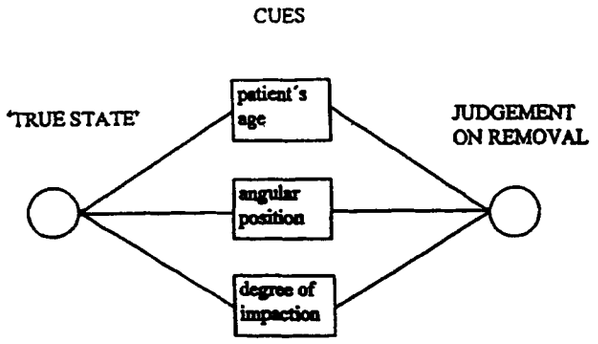

Fig. 1. Modified lens model for the judgement on mandibular third molars. Cues are pieces of information useful in making the judgement.

National Health Service in Sweden. Two to five certified specialists were working in each clinic, and the questionnaires were to be compleated by the oral surgeon who examined and treated the patient. The patient's sex and age were recorded. The angular position of the mandibular third molars was classified as vertical, mesioangular, distoangular, or horizontal in accordance with criteria presented by Winter (5). The degree of impaction was classsified as: 1) totally erupted, 2) partially covered by soft tissue, 3) completely covered by soft tissue, and 4) completely covered by bone tissue. Criteria for the angular position and degree of impaction were described in the questionnaire.

The oral surgeons were asked to record whether there was a pathologic condition associated with the molars. When this was the case, one or more of seven specific pathologic entities were to be recorded. The questionnaire presented definitions of the pathologic entities as described in a previous study (6).

Questionnaires with data on 668 patients were returned. To make a comparison with 'paper cases' of asymptomatic mandibular third molars described below, only patients aged between 19 and 60 years and patients with molars with associated pathologic conditions were included. Totally erupted molars were excluded from further analysis.

Judgement of cases with asymptomatic mandibular third molars

Judges. Thirty general dental practitioners (GDPs) and 10 oral surgeons participated as judges. The selection of judges has been presented in previous studies (3, 4). The length of the professional experience of the GDPs varied from 1 to 30 years (mean, 12 years). The oral surgeons had been certified as oral surgeons for 3 to 30 years (mean, 17 years).

Cases of asymptomatic mandibular third molars. Thirty-six radiographs were selected from mandibular third molars without associated pathologic conditions, referred for removal. The molars were selected so as to present an equal distribution of women and men, patients' ages, and angular position and degree of impaction of the molars. The three age groups were 19–25 years, 26–40 years, and 41–60 years. The angular position was classified as presented above in accordance with Winter (5). The degree of impaction was classified as: 1) partially covered by soft tissue, 2) completely covered by soft tissue, and 3) completely covered by bone tissue. Thus, the mandibular third molars were described by three cues: the patient's age, the angular position, and the degree of impaction. All the possible combinations of age, angular position, and degree of impaction (36 combinations) appeared only once.

Case scenario

Each of the cases was presented to the 40 judges with a radiograph and a brief text informing them about the sex and age of the patient and the degree of impaction of the molar. They were also informed that the teeth were asymptomatic. Besides being asked to decide whether to remove the illustrated molar, the judges had to make their

Table 1. Number of surgically removed mandibular third molars with associated pathologic conditions (n = 454). The molars are described by three cues: patient's age group (years), angular position, and degree of impaction

Degree of impaction	Angular position	Age group (years)			Total
		19–25	26–40	41–60	
Partially covered by soft tissue	Vertical	38	48	8	94
	Mesioangular	52	45	6	103
	Horizontal	20	14	6	40
	Distoangular	42	57	7	106
Completely covered by soft tissue	Vertical	6	8	2	16
	Mesioangular	18	17	0	35
	Horizontal	10	19	6	35
	Distoangular	4	9	2	15
Completely covered by bone tissue	Vertical	0	0	0	0
	Mesioangular	0	2	0	2
	Horizontal	4	1	1	6
	Distoangular	0	1	1	2
Total		194	221	39	454

Table 2 Judgement of 36 cases of asymptomatic mandibular third molars. Perceived need for removal expressed as mean indication index (millimeters on visual analogue scale (mm VAS)) and mean predicted risk of development of pathologic conditions (mm VAS) as judged by 30 general dental practitioners and 10 oral surgeons. The 0 and 100-mm endpoints of the VAS represented the lowest and highest indication for removal and the lowest and highest risk for development of pathologic conditions, respectively. The molars are described by three cues: patients' age group (years), angular position, and degree of impaction

		Age group (years)					
		19–25		26–40		41–60	
Degree of impaction	Angular position	Indication index	Risk of pathology	Indication index	Risk of pathology	Indication index	Risk of pathology
Partially covered by soft tissue	Vertical	46	49	35	38	21	22
	Mesioangular	45	46	48	48	37	36
	Horizontal	56	56	53	54	38	39
	Distoangular	51	54	50	50	32	34
Completely covered by soft tissue	Vertical	31	34	37	40	26	28
	Mesioangular	32	32	22	23	27	27
	Horizontal	31	30	29	26	17	18
	Distoangular	28	30	30	30	51	50
Completely covered by bone tissue	Vertical	51	54	5	9	8	8
	Mesioangular	33	31	23	23	14	15
	Horizontal	31	29	17	17	18	20
	Distoangular	23	23	48	50	28	27

own assessment in which they judged the need for removal (indication index) on a 100-mm visual analogue scale (VAS), where the 0 and 100-mm endpoints of the VAS represented the lowest and highest indication index for removal, respectively. They were also asked to predict the risk of development of a pathologic condition on a 100-mm VAS, where the 0 and 100-mm endpoints represented the lowest and highest risk of development of a pathologic condition, respectively.

Analysis

Each judge's response on the VAS was measured to the nearest millimeter. For each of the 36 asymptomatic mandibular molars, the indication index in millimeters on the VAS was compared with the judges' predicted risk of development of a pathologic condition, also in millimeters on the VAS (Table 2). The correlation between each judge's indication index and predicted risk for each molar was estimated with Pearson's correlation coefficient.

To compare surgically removed molars with a pathologic condition—the true state—and the judges' perceived need for removal of asymptomatic molars—the judged state—an order of priority was given to each mandibular third molar (Table 3). For the surgically removed molars with a pathologic condition the number 1 signified the most frequently occurring molar and the number 20 the most rarely occurring molar. For the cases with asymptomatic molars the number 1 implied that the highest number of judges proposed this molar to be removed, and the number 22 that the lowest number—that is, none of the judges—proposed this molar to be removed. Each molar was described by its three cues (patient's age, angular position, and degree of impaction of the molar).

Results

Surgically removed mandibular third molars with associated pathologic condition (Table 1)

A total of 454 patients with one molar each (257 women, 197 men) with a mean age of 28.6 years were treated. Table 1 shows the degree of impaction and the angular position of the molars and the age groups of the patients. Seventy-six per cent of the molars were partially covered by soft tissue, 22% were completely covered by soft tissue, and 2% were completely covered by bone tissue. Most of the molars were either in a mesioangular (31%) or in a distoangular (27%) position. About one-fourth of the molars were in a vertical position (24%), and 18% were horizontally positioned. Most molars (49%) were removed in patients aged 26–40 years, 43% in patients aged 19–25 years, and 9% in patients aged 41–60 years.

Judgement of cases with asymptomatic mandibular third molars (Table 2)

For each of the 36 molars, the judges' assessment of the need for removal (indication index) and their predicted risk of a pathologic condition developing were highly correlated (correlation coefficient between 0.73 and 1.00; $P < 0.0001$), with the exception of three judges presenting moderate correlation (correlation coefficient between 0.52 and 0.66; $P < 0.0001$). As shown in Table 2, the highest mean rating on both scales (56 mm) was presented for horizontal molars partially covered by soft tissue in patients of the youngest age group. Generally, the highest ratings were for molars partially covered by soft tissue in patients of the two youngest age groups, with indication

Table 3. True state—that is, surgically removed mandibular third molars with pathologic conditions—and judged state—that is, 30 general dental practitioners' and 10 oral surgeons' perceived need for removal of asymptomatic mandibular third molars. The molars are described by three cues: patient's age group (years), angular position, and degree of impaction. An order of priority is given to the molars. For the true state, 1 signifies the most frequently and 20 the most rarely occurring molar with associated pathologic conditions within the surgical material. For the judged state, 1 implies that the highest number of judges and 22 that no judges proposed this molar for removal. Some molars are given identical figures representing identical numbers within the surgical material or number of judges proposing removal

		Age group (years)					
		19–25		26–40		41–60	
Degree of impaction	Angular position	True state	Judged state	True state	Judged state	True state	Judged state
Partially covered by soft tissue	Vertical	6	7	3	7	14	20
	Mesioangular	2	3	4	2	16	9
	Horizontal	7	1	11	2	16	10
	Distoangular	5	5	1	8	15	11
Completely covered by soft tissue	Vertical	16	15	14	14	18	16
	Mesioangular	9	11	10	19	20	17
	Horizontal	12	12	8	16	16	20
	Distoangular	17	12	13	13	18	6
Completely covered by bone tissue	Vertical	20	5	20	22	20	22
	Mesioangular	20	12	18	19	20	19
	Horizontal	17	12	19	20	19	21
	Distoangular	20	18	19	4	19	16

indices between 45 and 56 mm and corresponding figures of 46 and 56 mm for the risk of developing a pathologic condition. The molar in a vertical position in the age group of 26–40 years presenting a mean indication index of 35 mm and mean risk of developing a pathologic condition of 38 mm constituted an exception. Molars completely covered by bone tissue in a vertical position in the youngest age group or in a distoangular position in the middle age group also presented high ratings on both scales.

With the exception of molars in distoangular positions, the lowest indication index (between 5 and 23 mm) and the lowest rate of predicted risk of developing a pathologic condition (between 8 and 23 mm) was found for molars completely covered by bone tissue in the two oldest age groups. The molar completely covered by soft tissue in a horizontal position in patient in the oldest age group also presented a low index.

Surgically removed molars with a pathologic condition—true state—and the judges' perceived need for removal of asymptomatic molars—judged state—as mediated by three cues (Table 3)

Molars partially covered by soft tissue in patients aged 19 to 40 years were most frequent among the surgically removed molars with a pathologic condition. In general, the highest number of judges proposed removal of asymptomatic molars with the same cues. The most frequently occurring molars among the surgically removed molars were distoangular and partially covered by soft tissue in patients aged 26–40 years. Most judges, however, proposed that horizontal molars partially covered by soft tissue in patients aged 19 to 25 years or 26 to 40 years should be removed. These molars were only the 7th and 11th most frequently occurring molars among the surgically removed molars with a pathologic condition.

For molars completely covered by soft and bone tissue, the judges' perceived need for removal was, with a few exceptions, in accordance with the removal rates of molars with a pathologic condition. Thus, vertical molars completely covered by bone tissue in patients aged 26 to 60 years were least frequent among the surgically removed molars, and no judges proposed that these molars be removed. Among molars completely covered by bone tissue, distoangular molars in patients aged 26 to 40 years and vertical molars in patients aged 19 to 25 years were perceived by the judges as fourth and fifth order of priority, respectively. These molars presented very low removal rates among the surgical material, however.

Discussion

The true state of the present study, with regard to the results of the prospective analysis of the removed molars with pathologic conditions, could be disputed. A prospective study of pathologic conditions associated with molars in a general population—that is, the natural course of impacted molars in a general population—would be extremely valuable. There are, however, several difficulties in conducting such a study, which is probably one of the reasons why such a study has not been presented. A study of the incidence of pathologic conditions associated with third molars in a general population would not be that valuable, as molars with symptoms of pericoronitis have been treated with removal. Thus, the most prevalent disease will not show up in a general population. Furthermore, several molars without pathologic conditions

have been prophylactically removed in young individuals. Until now, the only prospective study of third molars in a general population is the one by Hugoson & Kugelberg (7), presenting the presence of molars, the patients' age, and the impaction status of the molars. The frequency of different angular positions was described for lower third molars together with upper third molars, which precludes an estimate of this cue in mandibular third molars. There are studies reporting on the long-term follow-up of asymptomatic mandibular third molars which indicate that the risk of developing a pathologic condition is low (8–15). However, the molars reported in these studies were not described with regard to cues used in the present study or other similar well-defined characteristics. In the absence of such data, the results of the analysis of the third molars that had developed a pathologic condition served as a description of the actual relationship of cues in the real world.

The judgements of asymptomatic mandibular third molars were performed on 36 molars presenting the three cues patient's age, angular position, and degree of impaction of the molars as unique intercorrelations. The mandibular third molars of both groups analyzed in the present study, the asymptomatic ones and the molars with pathologic conditions subjected to removal, were presented with the same cues, but the distribution of cues was different. A case in point is that of molars completely covered by bone tissue, representing only 2% of the removed molars. Extending the number of asymptomatic cases to represent a valid distribution would, however, result in the inclusion of so many cases that there would be a risk of overtiring the judges.

The judges, consisting of oral surgeons and GDPs, were selected so as to form a group with high professional standards. It seemed important to include different groups of dentists as they probably have different experience with pathologic conditions associated with third molars and the clinical consequences and sequelae of third-molar surgery. A variation in therapeutic decisions and in the prediction of the development of pathologic conditions has been found for two groups of judges assessing cases of impacted third molars (4, 16). When comparing treatment decisions on third molars, GDPs were found to adopt a more conservative approach to removal than dental students. According to Berge (17), the students may have been influenced by textbooks in oral surgery and case presentations with pathologic conditions during their clinical education.

When deciding whether to remove asymptomatic molars, the judgement on the probability that a pathologic condition would develop is of interest. In a previous study by Lysell et al. (18) the number of molars proposed for removal and the assessment of need for removal (indication index) presented a high correlation. In the present study the correlation between each dentist's indication index and predicted risk of pathologic conditions was also high, even though there was a considerable variation among the individual assessments of the need for removal and estimations of the development of pathologic conditions (16). Such a substantial variation in judgements has also been observed for other dental treatments (19–24).

The overall agreement was fairly high between the judged state and the so-called true state; that is, the judgements presented a high degree of accordance with the removal rate in the surgical material as mediated by the three cues. Thus, molars partially covered by soft tissue in patients aged 19 to 40 years, which were most frequent among the surgically removed molars with pathologic conditions, were also suggested to be removed among the paper cases by most dentists. Doubtless, these two subgroups of cues signalled an increased risk of the development of pathologic conditions in asymptomatic mandibular third molars. However, some of the dentists' treatment decisions were not in accordance with the removal rates. Thus, the overall ratings based on the dentists' treatment decisions on molars partially covered by soft tissue in a horizontal position and in a mesioangular position were higher than the removal rates indicated. It seems likely that the close contact between the second molar and the third molar in horizontal and mesioangular positions led the dentists to perceive a higher risk of pathologic conditions than motivated in the literature (6, 8, 9, 11, 12, 25). The estimated risk (odds ratio) of mesioangular molars is only 0.5, and that of horizontal molars 1.3 (6). The dentists did not seem to take into account such base-rate frequencies. If the dentists, in their estimates, had used a representative or normative Bayesian approach, the prior subjective probabilities might have improved. Tversky & Kahneman (26) claim that when judgements are performed under uncertainty, as in the present study, people tend to rely on a limited number of heuristic principles such as availability and representativeness. These authors described availability as the judgemental heuristic in which people assess the frequency of a class or the probability of an event by the ease with which instances or occurrences can be brought to mind. Therefore, the profession might unduly be influenced by those third molars that cause problems and with ease can be brought to mind. According to Tversky & Kahneman (26) the representativeness heuristic implies that one evaluates subjective probability by the extent of correspondence between the sample and the population. In the present investigation the prior probability, or base-rate frequency, of different diseases, such as the low frequency of root resorption, which is about 1% (6, 8, 9, 11, 12, 25), should have a major effect on the prediction of the probability of development of pathologic conditions. According to Friedman (27), general dental practitioners 'have difficulty distinguishing between disease incidence and disease prevalence'.

The conclusion of this study is that the oral surgeons' and the general dental practitioners' decision on removal of asymptomatic mandibular third molars, as described by the patient's age group and the angular position and degree of impaction of the molar, when compared with mandibular third molars associated with pathologic

conditions, as mediated by the same cues, presented a fairly high overall agreement. There were some exceptions. For example, molars partially covered by soft tissue in a horizontal position and in a mesioangular position were rated higher by the dentists than the actual removal rates and also the scientific evidence indicated. Distoangular molars partially covered by soft tissue in patients in the age group 26 to 40 years had the highest rate among the removed molars but a considerably lower order according to the dentists' decisions. However, scientific evidence indicates that molars in the distoangular position have the highest risk of developing pathologic conditions compared with other angular positions. Thus, it should be borne in mind that molars in different angular positions have different risks of developing pathologic conditions, in accordance with evidence in the scientific literature.

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