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Influence of Angular Position and Degree of Impaction of Third Molars on Development of Symptoms: Long-Term Follow-up under Good Oral Hygiene Conditions

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Sasano, T., Kuribara, N., Iikubo, M., Yoshida, A., Satoh-Kuiriwada, S., Shoji, N. and Sakamoto, M. *Influence of Angular Position and Degree of Impaction of Third Molars on Development of Symptoms: Long-term Follow-up under Good Oral Hygiene Conditions.* Tohoku J. Exp. Med., 2003, **200** (2), 75–83 —— To determine the risk of developing symptoms due to the presence of maxillary and mandibular third molars, we analyzed a reliable population sample by age, and according to third-molar position and impaction level using long-term follow-up data under conditions of good oral hygiene. Of 308 graduates from our dental school, a total of 776 third molars were followed up for periods of 11 to 27 years by means of intraoral radiographs. The development of symptoms, the participant's age, and third-molar angular position and degree of impaction were investigated. For both maxillary and mandibular third molars, the risk of developing a symptom correlated neither with angular position nor with impaction level. The first symptom associated with a third molar developed most frequently in their 20's for both maxilla (16.2%) and mandible (17.5%), with the next highest frequency being in their 30's (12.6%, maxilla; 13.0%, mandible). The status of third molars shows no relation to the subsequent development of symptoms if good oral hygiene is maintained. The low rates of symptom-development do not support removal of asymptomatic third molars. ———— third molar symptoms; criteria for third molar extraction; long-term follow-up

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Deciding whether an asymptomatic third molar should be electively removed is one of the most common problems encountered in dental practice. Some authors (Ventä et al. 1993; Penarrocha et al. 2001) recommend elective prophylactic early removal on the grounds that patient morbidity and surgical risks increase with age, while others (Maine and Goldberg 2001; van der Sanden 2002) advise periodic review and cite the lack of valid indicators for the removal of an asymptomatic third molar.

Studies (Knutsson et al. 1992a, b; Lysell et al. 1993) of the decisions made by general dental practitioners and oral surgeons have demonstrated the absence of consistent judgment policies with respect to asymptomatic third molars. These studies also showed that to reach a treatment decision, the clinician uses the information available at the time -such as the patient's age, the third molar's angular position and degree of impaction- to assess the risk of third-molar pathoses developing. Indeed, some authors have reported a close correlation between the risk of acute disease and the status of third molars (i.e., angular position and degree of impaction) (Ventä et al. 1993; van der Linden et al. 1995; Knutsson et al. 1996). Nevertheless, the fact remains that treatment policy varies considerably among dentists, probably due to the paucity of scientific evidence in this area, in particular, the lack of long-term follow-up information and uncertainty about the importance of oral hygiene.

The purpose of this study is to estimate the risk of the patient developing a symptom of any kind when he or she has a third molar in a given position or impaction state under conditions of good oral hygiene. For this, we made use of the long-term follow-up information (range from 11 to 27 years) that could be obtained for a total of 776 third molars.

Material and Methods

Subject

A total of 308 persons participated in our project. All of them had graduated from Tohoku University School of Dentistry more than 11 years previously, and each had had at least one third molar with an adjacent second molar as a sixth year student. First, we checked the intraoral radiographs of all the graduates (total, 790 persons) who had taken a course in clinical discipline when they were clinical trainees (as sixth year students). Then, we distributed questionnaires to the 308 persons who matched our requirements under informed consent. The ages of the participants when they were sixth year students ranged from 23 to 29 years old, and at present they are in the 30's (140 persons), 40's (131 persons), or 50's (37 persons).

On the basis of the past radiographs, the angular position of each third molar was classified as vertical (Fig. 1A), mesioangular (Fig. 1B), distoangular (Fig. 1C), or horizontal (Fig. 1D), use being made of a modification of Winter's classification. The degree of impaction of the third molar within the alveolar bone gave us four levels: the highest part of the erupted third molar was either on the same level or above the occlusal plane of the adjacent second molar (i.e., complete eruption; Fig. 2A), one third or two thirds of the tooth crown was impacted (i.e., one-third; Fig. 2B or two-thirds; Fig. 2C partial impaction), and the third molar was completely covered by bone tissue (i.e., complete impaction; Fig. 2D).

Questionnaire

The participants were asked whether there had been any symptoms associated with the third molar. If they answered "yes", they were asked when the symptom first developed, what the diagnosis of the pathosis was, and whether the adjacent second molar was involved in the trouble with the third molar (*e.g.*, caries in the

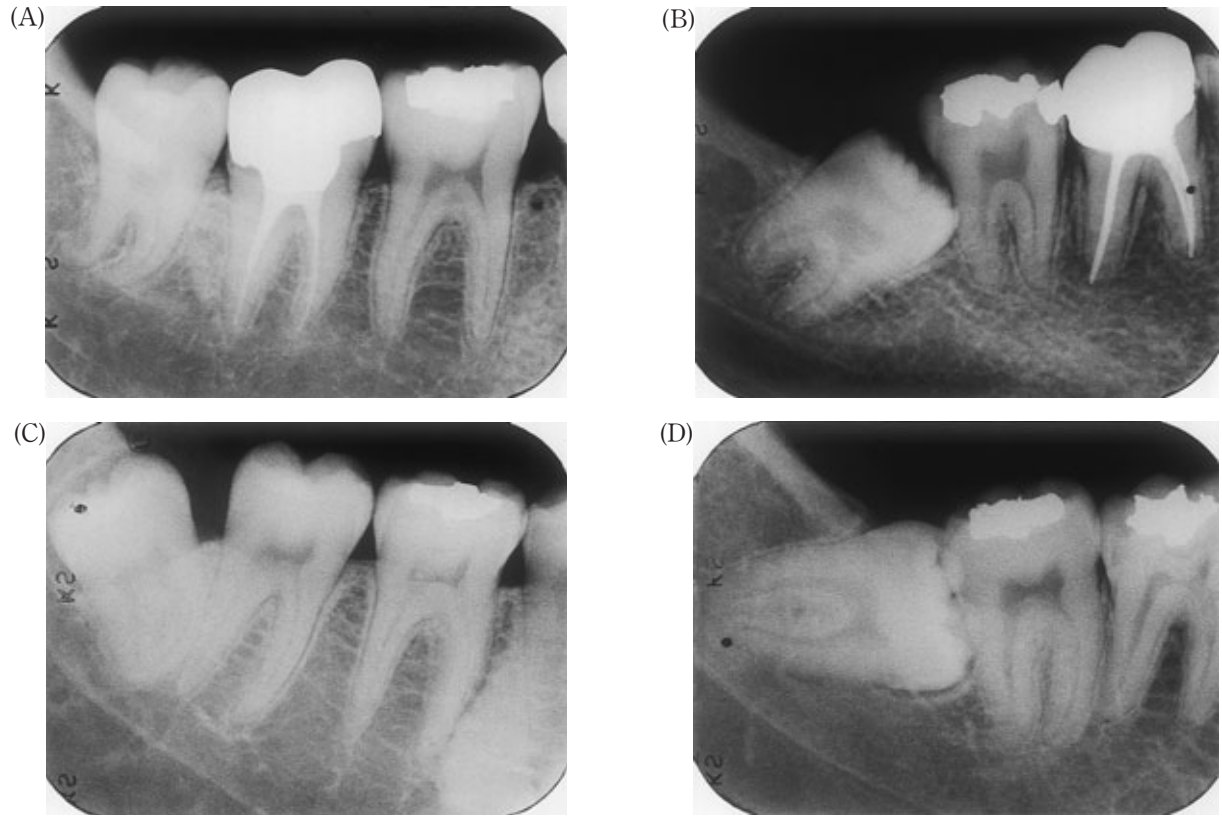

Fig. 1. The angular position of the third molar.
A: vertical, B: mesioangular, C: distoangular, D: horizontal.

distal surface or distal alveolar bone loss due to periodontitis; Fig. 3).

Statistics

The data were statistically analyzed using StatView software Version 5.0 (SAS Institute Inc., Cary, NC, USA). The risk of developing a symptom was calculated for each third-molar category by dividing the number of symptomatic third molars by the total number in that category. The significance of differences among the third-molar categories was evaluated by assessing the goodness of fit in a chi-square test. A p-value of less than 0.05 was considered as statistically significant.

RESULTS

Among the 308 persons, there were actually a total of 776 third molars (maxilla 370, mandible 406). There were no statistically significant differences in incidence or type of third molar between females and males and between left and right sides, so the data were pooled irrespective of gender and side.

Frequency rates for the various angular positions and impaction levels are listed in Tables 1 and 2, respectively, data being shown separately for maxillary and mandibular third molars. In the maxilla, the vertical position was the most common angular position (84.4%), followed by the distoangular position (9.7%), and complete eruption was the most frequent impaction level (61.9%), followed by two-thirds partial impaction (15.1%). In the mandible, vertical (46.0%) and horizontal (34.0%) were most common angular positions, while complete eruption (39.4%) and two-thirds partial impaction (34.3%) were the most frequent impaction levels.

Symptoms in all cases were related to pain

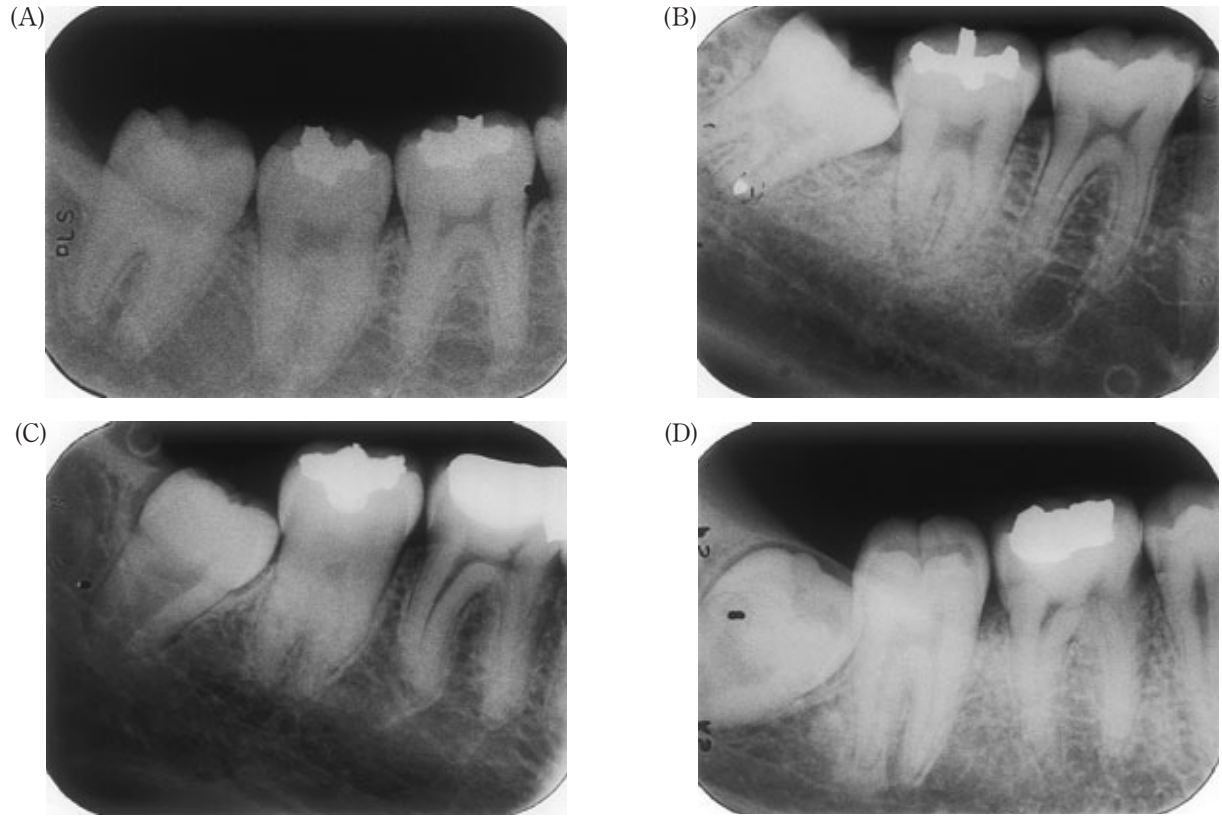

Fig. 2. The degree of impaction of the third molar within the alveolar bone.
A: complete eruption, B: one-third partial impaction, C: two-thirds partial impaction, D: complete impaction.

Questionnaire

A. Did you have any symptoms in your third molars?

If "YES";

B. Which tooth developed the symptom, upper or lower jaw, right or left side?

C. When did the symptom first develop?

D. What kind of symptom did you feel?

E. What caused the symptom?

F. Was the adjacent second molar involved in the trouble with the third molar?

Fig. 3.

including gingival swelling in some cases. The risk of developing a symptom of any kind is shown in Table 3 for the various angular positions, and in Table 4 for the various impaction levels. Of the 370 maxillary third molars, 96 (25.9%) were associated with symptoms, whereas the figure was 126 (31.0%) for the 406 mandibular third molars. The risk of developing a symptom was significantly higher for the mandible than for the maxilla ($p<0.01$). There was

TABLE 1. *Frequency rates: angular position of maxillary and mandibular third molars*

Angular position	Maxilla		Mandible	
	No.	%	No.	%
Vertical	312	84.4	187	46.0
Mesioangular	22	5.9	79	19.5
Distoangular	36	9.7	2	0.5
Horizontal	0	0	138	34.0
Total	370	100.0	406	100.0

TABLE 2. *Frequency rates: impaction levels of maxillary and mandibular third molars*

Impaction level	Maxilla		Mandible	
	No.	%	No.	%
Complete eruption	229	61.9	160	39.4
One-third partial impaction	44	11.9	68	16.7
Two-thirds partial impaction	56	15.1	139	34.3
Complete impaction	41	11.1	39	9.6
Total	370	100.0	406	100.0

TABLE 3. *Risk of developing a symptom for each angular position*

Angular position	Maxilla			Mandible		
	S	*A*	Risk (%)	*S*	*A*	Risk (%)
Vertical	78	234	25.0	64	123	34.2
Mesioangular	4	18	18.2	22	57	27.8
Distoangular	14	22	38.8	1	1	50.0
Horizontal	—	—	—	39	99	28.2
Total	96	274	25.9	126	280	31.0

S, number of symptomatic teeth; A, number of asymptomatic teeth.
Risk, percentage of total teeth that were symptomatic in each angular position $\left(\frac{S}{S+A}\times 100\right)$.

no statistically significant difference in the risk of developing a symptom (a) among the various angular positions for either maxillary ($p=0.15$) or mandibular ($p=0.089$) third molars or (b) among impaction levels for either maxilla ($p=0.28$) or mandible ($p=0.14$). The cause which developed any symptom is listed in Table 5. The most frequent cause of symptoms in the maxilla was pericoronitis (43.8%), followed by dental caries (41.6%), and then by adjacent second molar pathosis (i.e., caries in the distal surface or distal alveolar bone-loss due to periodontitis; 14.6%). In the mandible, the most frequent was again pericoronitis (80.2%), again

TABLE 4. *Risk of developing a symptom for each impaction level*

Impaction level	Maxilla			Mandible		
	S	*A*	Risk (%)	*S*	*A*	Risk (%)
Complete eruption	58	171	25.3	49	111	30.6
One-third partial impaction	14	30	31.8	26	42	38.2
Two-thirds partial impaction	16	40	28.6	44	95	31.7
Complete impaction	8	33	19.5	7	32	17.9
Total	96	274	25.9	126	280	31.0

S, number of symptomatic teeth; A, number of asymptomatic teeth.
Risk, percentage of total teeth that were symptomatic in each impaction level
$\left(\frac{S}{S+A}\times 100\right)$.

TABLE 5. *Cause of symptoms related to maxillary and mandibular third molars*

Cause of symptoms	Maxilla		Mandible	
	No.	%	No.	%
Pericoronitis	42	43.8	101	80.2
Dental caries	40	41.6	18	14.3
Adjacent second molar pathosis	14	14.6	7	5.5
Total	96	100	126	100

TABLE 6. *Age at which first symptom developed*

Age	Maxilla			Mandible		
	S	*A*	Risk (%)	*S*	*A*	Risk (%)
11–20	1	369	0.3	7	399	1.7
21–30	60	310	16.2	71	335	17.5
31–40	30	209	12.6	37	246	13.0
41–50	5	85	5.6	11	105	9.5

S, number of symptomatic teeth; A, number of asymptomatic teeth.
Risk, percentage of total teeth that were symptomatic
$\left(\frac{S}{S+A}\times 100\right)$.

followed by dental caries (14.5%) and adjacent second molar pathosis (5.5%). There was no cyst-or tumor-formation. Statistically, the prevalence of caries was higher in the maxilla than in the mandible ($p<0.01$), while pericoronitis was more frequent in the mandible than in the maxilla ($p<0.01$). The age at which the first symptom developed is listed by decade in Table 6. As described in Material and Methods, the oldest participants were in their 50's at the time of the study, so any symptoms occurring after that age remained unknown. As shown in Table 5, the first symptom associated with the third molar developed most frequently in their 20's for both the maxilla (16.2%) and the mandible (17.5%), with the next highest frequency being in their 30's (12.6%, maxilla; 13.0%, mandible).

DISCUSSION

A debate about the indications for removal of an asymptomatic third molar has been ongoing in the dental literature for many years. In studies of this subject, one difficulty lies in the

selection of a reliable population sample for the investigation of third molar pathoses. To determine the true rates at which various states or pathologic conditions associated with third molars occur, a random sample of the general population is required; however, such samples of young adults are difficult to obtain. A common method is to examine radiographs of selected populations such as dental students or patients in dental schools. All such samples, however, have some component of bias in them; further, the development of a symptom with age cannot be estimated from such "snap shot" data. In our study, a long-term follow-up period from 11 to 27 years was employed to create a reliable population sample. Since our sample consisted of graduates of our own dental school, all of whom are engaged in dental practice at the present time, the data obtained by questionnaire can be considered to be accurate, and they can be relied upon to practice good oral hygiene.

The reported frequency of occurrence of different angular positions of the third molar varies throughout the literature. The different characteristics of the populations studied or national differences may explain these variations. Our Japanese data shows that the vertical position is very frequent in the maxilla (84.4%), as in Finnish university students (Ventä et al. 1993), but unlike South African dental patients (van der Linden et al. 1995). In the mandibular, the vertical position (46.0%) and horizontal position (34.0%) were the most common in our sample, although in a number of other reports the mesioangular position was the most common (Stanley et al. 1988; Scherstén et al. 1989; van der Linden et al. 1995; Knutsson et al. 1996). Conflicting results also exist with respect to frequency of impaction. For example, the figures for prevalence of impactions in mandible and maxilla obtained by Mead (1930) were similar to ours (no significant difference), and while Bjork et al. (1956) noted a preponderance of impactions in the maxilla, Shah et al. (1978) reported a higher frequency in the mandible.

With regard to the relationship between the risk of acute disease and third-molar position, Ventä et al. (1993) reported that the risk was greatest for distoangular lower third molars, followed by vertical and mesioangular third molars. They explained this in terms of the likelihood of food particles accumulating in such third molars. Similarly, Knutsson et al. (1996) showed (a) that the higher percentage risk of developing a pathologic condition was associated with the presence of distoangular molar, but (b) that the highest absolute number of pathoses in the sample population was associated with the vertical and mesioangular position, because these positions occur much more frequently than the distoangular position. However, contrary to our expectations, our results showed no statistically significant difference in the risk of developing a symptom among the various angular positions (i.e., vertical, mesioangular, distoangular, or horizontal) either for the maxillary ($p=0.15$) or the mandibular ($p=0.089$) third molar. Moreover, our data also showed no statistical difference in the risk of developing a symptom among the various impaction levels (i.e., complete eruption, partial impaction, or complete impaction) either for the maxilla ($p=0.28$) or the mandible ($p=0.14$). In contrast, Knutsson et al. (1996) reported an odds ratio (risk) 22 to 34 times higher for partially impacted molars than for molars completely covered by soft or bone tissue. The discrepancies between our data and those reported by others may be due to differences in the population sample. Our participants are all currently in dental practice, and can be expected to have good oral hygiene. In other words, the status of the third molar may show no relation to the subsequent development of symptoms if good oral hygiene is maintained.

Our examination of the age at which the first symptom developed showed that the highest frequency was associated with their 20's, followed by the 30's and then the 40's.

This result is quite similar to that of Knutsson et al. (1996) who reported that most molars associated with pathoses were in patients aged 20 to 29 years. In this respect, our current long-term follow-up study supports the proposal made in a past report (AAOMS 1994) on the management of patients with third molar teeth: namely, that the decision as to whether a third molar tooth should be electively removed should be made by the middle of their 20's. In addition, the low rates of symptom-development in our study do not offer support for the notion that the likely presence of pathologic conditions is an indication for third- molar removal. Our view is supported by the reports from the United Kingdom, which concluded that there were no valid indications for removal in 30% to 50% of the referred third molars (Brickley et al. 1993; Lopes et al. 1995). This argues in favor a policy of removing only symptomatic molars and against the use of prophylactic removal of an impacted third molar that is as yet asymptomatic. This recommended shift in approach may also be supported by the evidence that long-standing retention of mandibular third molars is associated with a low incidence of pathoses (Stanley et al. 1988; Eliasson et al. 1989; Garcia and Chauncey 1989; Ahlqwist and Gröndahl 1991).

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