Radiologic Investigation of Prevalence, Associated Pathologies and Dental Anomalies of Non-third Molar Impacted Teeth in Turkish Oral Patients

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Objective: *To investigate the prevalence and associated pathologies of impacted teeth in Turkish oral patients.*
Methods: *A retrospective survey was carried out in 12,129 patients who visited the Department of Oral Diagnosis and Radiology, Ondokuz Mayıs University, Faculty of Dentistry, Turkey, from January 2003 to December 2007. The minimum age for inclusion was 14 years and third molar impactions were excluded from the study. To be enrolled in the study, the patient's chart had to contain a panoramic radiograph with supplemental periapical radiographs. One radiologist examined all radiographs to determine the number, orientation and types of impacted teeth and the presence of associated pathologies and developmental dental anomalies associated with this phenomenon.*
Results: *Of the 12,129 patients, 1117 (9.2%) patients aged 14 to 80 years had one or more dental impactions (in total 1356 impacted teeth). The male to female ratio was 1:1.4 (457:660). The maxillary canine teeth were the most commonly encountered (71.5%), followed by the mandibular premolars (8.6%). The analysis of the orientation of the impacted teeth showed that 480 impacted teeth were in a mesioangular position (35.4%), followed by vertical (28.9%), distoangular (18.9%), horizontal (16.5%) and buccolingual (0.3%) orientations.*
Conclusion: *The prevalence of non-third molar impacted teeth was 9.2% among Turkish oral patients. The maxillary canines were the most frequent impacted teeth. The most common orientations of impacted teeth were the mesioangular position and vertical orientation. The most frequent associated pathologic change was cystic change.*

Key words: *canine, impacted teeth, panoramic radiograph, prevalence, radiology*

Dental impaction is defined as cessation of eruption of a tooth caused by a physical barrier in the eruption path or the abnormal position of the tooth[1]. The causes of eruption disturbance and displacement of the tooth impaction have been of interest to researchers for many years. However, studies of the prevalence and distribution of impacted teeth in different regions of the jaw have found considerable variation[2-20]. Factors affecting the prevalence include the selected age group, the timing of dental eruption and the radiographic criteria for dental development and eruption[20].

In the permanent dentition, third molars are the most commonly affected, accounting for over 80% of all impacted teeth[16,21]. Maxillary canines are the second most frequently impacted teeth, followed by second premolars. Many studies have been performed with impacted third molars and the associated pathologies[1-20]. However, there is still only limited information on the prevalence of non-third molar impacted teeth and associated pathologies. The purpose of this study was to investigate the prevalence and associated pathologies of non-third molar impacted teeth in a large population of Turkish oral patients.

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Materials and methods

A retrospective survey was carried out in 12,129 patients who had visited the Department of Oral Diagnosis and Radiology, Ondokuz Mayıs University Dentistry Faculty, Turkey, from January 2003 to December 2007. The minimum age for inclusion was 14 years because the accepted view is that the eruption time of a maxillary canine ranges from 9.3 to 13.1 years. To be enrolled in the study, the patient's chart had to contain a panoramic radiograph with supplemental periapical radiographs. All periapical radiographs were taken using the paralleling technique. All radiographs were taken and processed at the same radiology centre. The Planmeca Proline PM 2002 CC (Helsinki, Finland) and Siemens panoramic roentgen units (Erlangen, Germany) and Trophy Trex X-ray (Croissy, Beaubourg, France) periapical radiography unit were used to take radiographs. One radiologist examined all radiographs on standard light boxes to determine the number, orientation and types of impacted teeth and the presence of associated pathologies. In this study, an impacted tooth was defined as when the tooth was covered fully or partially by mucosa or bone. Orientation of impacted teeth was assessed according to Winter's[2] classification, described as follows: angulation type of the tooth was classed as inverted when the angle was less than 0 degrees, horizontal when 0 to 30 degrees, mesioangular when 31 to 60 degrees, vertical when 61 to 90 degrees and distoangular when greater than 90 degrees.

When an impacted tooth was identified, the presence/absence and development/eruption of the patient's other teeth were also assessed. Pathologies associated with impacted teeth included: caries of the impacted and/or adjacent teeth; root resorption of the adjacent tooth; an increase in the pericoronal space of the dental follicle of more than 4 mm around the impacted tooth (from the widest points of the pericoronal space), accepted as a cyst; impaction of the adjacent tooth; and intracoronal resorption.

Data collected were entered into a spreadsheet (Excel 2000, Microsoft, Redmond, WA, USA) and analysed subsequently using the Statistical Package for Social Sciences (Windows version 13.0; SPSS, Chicago, IL, USA).

Table 1 Prevalence of impacted teeth in different age groups of patient

Age group (years)		Impacted teeth count (ITC)					Total
		1	2	3	4	5	
14–20	Count	350	63	4	4	1	422
	% of total	31.3	5.6	0.4	0.4	0.1	37.8
20–30	Count	240	54	6	1	1	302
	% of total	21.5	4.8	0.5	0.1	0.1	27.0
30–40	Count	151	27	0	1	0	179
	% of total	13.5	2.4	0.0	0.1	0	16.0
40–50	Count	104	25	2	0	0	131
	% of total	9.3	2.2	0.2	0	0	11.7
50–60	Count	51	12	1	0	0	64
	% of total	4.6	1.1	0.1	0	0	5.7
60–70	Count	12	3	0	0	0	15
	% of total	1.1	0.3	0	0	0	1.3
70–80	Count	1	3	0	0	0	4
	% of total	0.1	0.3	0%	0	0	0.4
Total	Count	909	187	13	6	2	1117
	% of total	81.4	16.7	1.2	0.5	0.2	100.0

Table 2 Distribution of impacted teeth (IT)

			Mandible	Maxilla	Total
	Canine	Count	86	970	1056
		% of total	6.3	71.5	77.9
	Premolar	Count	116	73	189
		% of total	8.6	5.4	13.9
	Central incisor	Count	3	42	45
		% of total	0.2	3.1	3.3
	Lateral incisor	Count	4	9	13
		% of total	0.3	0.7	1.0
	Molar	Count	28	25	53
		% of total	2.1	1.8	3.9
Total		Count	237	1119	1356
		% of total	17.5	82.5	100.0

Results

Of the 12,129 patients, 1117 (9.2%) patients aged 14 to 80 years had one or more dental impactions (a total of 1356 impacted teeth). The male to female ratio was 1:1.4 (457:660). The 14 to 20 years age group had the highest prevalence of tooth impaction (37.8%), but the prevalence decreased with increasing age. Of the 1117 patients with impacted teeth, 909 patients (909/1117, 81.4%) presented one impacted tooth, 187 patients (16.7%) with two, 13 patients (1.2%) with three, 6 patients (0.5%) with four and 2 patients (0.2%) with five (Table 1).

Of the 1356 impacted teeth, maxillary canine teeth were most commonly encountered (71.5%), followed by mandibular premolars (8.6%) (Table 2). There was no difference in distribution of impacted teeth between the left and right sides (671:685 ($P > 0.05$). Analysis of the orientation of the impacted teeth showed that the greatest number of impacted teeth (480) were in a mesioangular position (35.4%), followed by vertical (28.9%), distoangular (18.9%), horizontal (16.5%) and buccolingual (0.3%) (Table 3). Approximately 21.2% of impacted teeth had persistent primary teeth, and this was found to be the most common associated dental anomaly. Persistent teeth were also most commonly found with canine teeth (19.9%) (Table 4).

Of the 1356 impacted teeth, 5.6% had cystic changes; cystic changes were most commonly found in canine teeth (55/76, 72.4%), followed by premolars (10/76, 13.2%) and molars (9/76, 11.8%). Interference with the eruption of the adjacent tooth (1.6%) was the second most observed associated pathology; the teeth most frequently affected by interference were molars (13/22, 59.1%), followed by premolars and central incisors (4/22,18.2%). Root resorption of an adjacent tooth was rare (0.1%) (Table 5).

Discussion

The aetiology of tooth impaction is related to several local and systemic factors[9,10,12,13]. Common local causes include one or a combination of the following: overlying cysts or tumors[9], supernumerary teeth[9-11], loss of arch space[12], over-retained primary teeth[10-13], ankylosis[12,13], root dilacerations[11], trauma[9-12], reconstructive surgery for cleft lip/palate repair[15,17], thickened overlying bone or soft tissue[27], missing adjacent lateral incisor[10] or idiopathic[9-13]. Generalised tooth impaction has been associated with certain host systemic disorders, including endocrine disorders[28], febrile illness[29], irradiation[30], Gardner syndrome[31], cleidocranial dysostosis[32] and Yunis-Varon syndrome[33].

To determine the appropriate age group for this study, it was deemed necessary to take into account the eruption ages of the Turkish population specifically. Wedl et al[22], who researched this subject, found that that eruption time of permanent teeth except the third molars in a Turkish subpopulation varies from 5.94 to 12.33 years. However, no other studies on the eruption time of the permanent teeth in the Turkish population were found in the literature. Therefore, the age of 14 years was set as the lower limit of the study.

Although this study does not represent the Turkish population as a whole, the results are useful for primary health workers because the patients studied represent the range of dental patients presenting to a dental faculty. In this study, clinical data were collected from the only dental teaching hospital in Turkey, which has a policy of using panoramic radiography for all new patients. Many authors have used panoramic radiography to determine impacted teeth[2,4,15,18,20]. In this study, to protect the patients from exposure to radiation, periapical radiographs were taken in the areas suspected of having impacted teeth. To visualise deeply impacted teeth and in patients with a gag reflex and trismus, panoramic radiography was thought to be suitable. Unlike some previous studies that investigated specific age groups only, this study sampled patients across a range of ages, and the age distribution of study group was consistent with that of the Turkish population overall.

Table 3 Orientation of impacted teeth

Impacted teeth		Impacted orientation					Total
		Vertical	Horizontal	Mesioangular	Distoangular	Buccolingual	
Anterior	Count	42	2	11	3	2	60
	% of total	3.1	0.1	0.8	0.2	0.1	4.4
Premolar	Count	126	21	30	6	1	184
	% of total	9.3	1.6	2.2	0.4	0.1	13.6
Molar	Count	38	2	7	3	1	51
	% of total	2.8	0.1	0.5	0.2	0.1	3.8
Canine	Count	186	199	432	244	0	1061
	% of total	13.7	14.7	31.9	18.0	0	78.2
Total	Count	392	224	480	256	4	1356
	% of total	28.9	16.5	35.4	18.9	0.3	100.0

Table 4 The distribution of dental anomalies associated with impacted teeth

		Dental anomalies							Total
Impacted teeth		Tooth count	Dilaceration	Hipodontia	Odontoma	Persistent primary tooth	Ectopic tooth	Other dental anomalies	
Canine	Count	626	14	23	13	270	24	87	1057
	% of total	46.1	1.0	1.7	1.0	19.9	1.8	6.4	77.9
Premolar	Count	133	2	10	1	14	16	13	189
	% of total	9.8	0.1	0.7	0.1	1.0	1.2	1.0	13.9
Central incisor	Count	22	2	0	6	1	2	12	45
	% of total	1.6	.1%	.0%	.4%	.1%	.1%	.9%	3.3
Lateral incisor	Count	6	1	1	2	3	0	0	13
	% of total	0.4	0.1	0.1	0.1	0.2	0.0	0.1	1.0
Molar	Count	46	0	0	3	0	2	1	52
	% of total	3.5	0	0	0.2	0	0.1	0.1	3.9
Total	Count	833	19	34	25	288	44	113	1356
	% of total	61.4	1.4	2.5	1.8	21.2	3.2	8.3	100.0

The pattern of impacted tooth types found in this study was similar to those in previous reports[2,6,9,12], with maxillary canines being the most frequently impacted teeth, followed by mandibular premolars. The number of impacted maxillary canines accounted for 71.5% of all impacted canines in this study.

The orientation of the impacted teeth showed that 480 impacted teeth were in a mesioangular position (35.4%). This was followed by vertical (28.9%), distoangular (18.9%), horizontal (16.5%) and buccolingual (0.3%). However, no studies were found in the literature about the orientation of the impacted teeth in the Turkish population.

In studies of the incidence and complications of impacted teeth, different authors have suggested different results[23]. Impacted canine teeth are often retained and moved into place in the dental arch because of their important roles in aesthetics, strength and function[24,25].

Table 5 Pathologies associated with impacted teeth (IT)

Impacted teeth		Associated pathology				Total
		None	Cyst	Root resorption of adjacent tooth	Interfered with the eruption of the adjacent tooth	
Canine	Count	998	55	2	1	1056
	% of total	73.6	4.1	0.1	0.1	77.9
Premolar	Count	175	10	0	4	189
	% of total	12.9	0.7	0	0.3	13.9
Central incisor	Count	39	2	0	4	45
	% of total	2.9	0.1	0	0.3	3.3
Lateral incisor	Count	13	0	0	0	13
	% of total	1.0	0	0	0	1.0
Molar	Count	31	9	0	13	53
	% of total	2.3	0.7	0	1.0	3.9
Total	Count	1256	76	2	22	1356
	% of total	92.6	5.6	0.1	1.6	100.0

Untreated partially erupted or impacted canines may result in several complications, such as formation of follicular cysts, canine ankylosis, recurrent infections, recurrent pain, internal resorption, external resorption of the canine and the adjacent teeth, or combinations of these factors[4,23]. The external resorption of the adjacent teeth is a major concern, and the most common sequela of impacted canines can potentially result in tooth loss[24,25]. Proper diagnosis and early intervention will have an influence on any further treatment strategy or final outcome. This process often remains asymptomatic. In the present study, 5.6% of impacted teeth had cystic changes, and root resorption and interference with the eruption of an adjacent tooth was rare.

Conclusion

The prevalence of non-third molar impacted teeth was 9.2% among Turkish oral patients. The maxillary canines were the most frequent impacted teeth. The most common orientations of impacted teeth were the mesioangular position and vertical orientation. The most frequent associated pathologic change was cystic change.

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