Prevalence and Pattern of Impacted Teeth in the North-East China

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Authors’ contributions

This work was carried out in collaboration between all authors. Authors NBF, SIB, EKK and DF designed the study, wrote the protocol and the first draft of the manuscript. Authors CMM, PBA and JBI managed the literature searches and analyses statistics data. Authors PMM, GJ and AMM reviewed the manuscript and managed the final version by all verification. All authors read and approved the final manuscript.

ABSTRACT

Aims: To investigate the prevalence and pattern of impacted teeth in the sample of North-East China.

Study Design: Descriptive and Retrospective study.

Place and Duration of Study: School of Stomatology, Department of oral and maxillofacial surgery, Second Affiliated Dental Hospital of Jiamusi University Between Jun 2013 to October 2015.

Methodology: Orthopantomogram radiographs and clinical dental records are used to determine
the impacted teeth in Five thousand seven hundred and eighty four randomly selected patients. All of 5784 patients were examined (3754 males, 2030 females), with an age range of 7-76 years and a mean age of 23±4 years. The minimum age for inclusion was 7 years. The data was entered into the computer and analyzed using the Statistical Package for Social Sciences (version 20. Inc. Chicago, USA). The Pearson’s Chi-square was used to determine the differences in the distribution of impacted teeth between genders. The significant level was tested at the 5%.

**Results:** Out of 5784 patients, a total of 1342 (23.2%) presented an impacted tooth, 701 (52.2%) were male and 641(47.8%) were female. Among them, 1485 were the number of impacted teeth. The prevalence of impacted teeth was 23.2%; third molars were the most common (11.70%; n=677), followed by canines (5.55%; n=321), incisor and premolars (2.92%; n=169 and 2.82%; n=163). The impacted teeth were mostly seen in the age group between 17-26 years old (43.8%; n=774). No significant relationship between impacted teeth among the gender was found (p=0.22).

**Conclusion:** The prevalence of impacted teeth was 23.2% in this research and the patients aged between 17 to 26 years were most affected. The minimum age of 7 years must be an inclusion criteria study for to assess the real prevalence of incisor impaction.

**Keywords:** Prevalence; pattern; impacted teeth.

**1. INTRODUCTION**

Impacted teeth or unerupted teeth are those teeth that have failed to erupt completely or partially in the dental arch according to clinical and radiographic evaluation. Any permanent tooth can become impacted. The main causal factors are local like supernumerary teeth, dense overlying bone, deciduous tooth retention, arch-length deficiency, odontogenic tumors, cleft lip and palate. Also have systemic and genetic disorders such as Cleidocranial dysostosis syndrome, Down, Gardner’s, and Gorlin-Sedano syndrome were reported [1-3].

The prevalence of impacted teeth in different populations and ethnic groups has been the subject of several studies. However, there is a discrepancy in the prevalence of teeth impaction in different population and ethnic groups, as well as variation in the prevalence and distribution of impacted teeth in different regions of the jaw itself [4-9]. The selected age group, eruption time of teeth, the racial differences and difference methodology of the study and radiographic criteria are some of the factors that affect the prevalence. According to literature, the most pattern impacted teeth are the mandibular third molars followed by the maxillary third molars, the maxillary canines, the mandibular premolars and mandibular incisors [9,10,11,12,13].

Assessing the prevalence of impacted teeth in population is important for the establishment of parameter data as well as for the planning of preventive and therapeutic strategies aimed at this population and with a direct influence on the management of the patient and clinical decision-making [1].

There are currently no study found on the prevalence and pattern of impacted teeth in Chinese patients of the North–East China. The purpose of this study was to investigate the prevalence and pattern occurrence of impacted teeth in the sample of North- East China.

**2. MATERIALS AND METHODS**

The Orthopantomogram (OPG) radiographs and clinical dentals records of 5784 Chinese patients attending the department of Oral and Maxillofacial Surgery, in the School of Stomatologist, Second Affiliated Dental Hospital of Jiamusi University, Between Jun 2013 to October 2015 were examined for this retrospective study. All OPG were taken with the Dentsply Gendex Orthoralix 9200 (Dentsply Asia, Milford, US), and the magnification factor was 1.23.

A tooth was considered to be impacted when it was obstructed on its path of the eruption by an adjacent tooth, bone, or soft tissue and/or failed to erupt fully into the oral cavity. According to the mean eruption time, the teeth were considered as impacted when they remained in the jaw for a minimum of 2 years after the corresponding mean age of eruption [14]. Therefore, the minimum age for inclusion was 7 years because the generally accepted view is that the first series of permanent teeth have erupted and remained 2 years in the jaw. Patients’ clinical dental records and OPG radiographs were examined in order to detect the impacted incisors, canines, premolars and impacted molars.

As well as group of researchers examined the OPG radiographs at the same time on X-ray
viewer to determine the number and the pattern of impacted tooth. If an impacted third molar was identified in a patient, the eruption of his/her’s remaining third molars were also assessed. The depth and orientation of impacted third molars were assessed without it’s associated pathologies. The depth of impacted teeth or third molar was documented based on Winter’s lines classification while the angulation of impacted teeth was measured using the long axis of the impacted and adjacent teeth as described by Schersten [15].

Even though the Orthopantomogram (OPG) radiograph is very simple and intuitive, but it cannot provide all the information regarding the impacted teeth. For to ensure diagnosis validity in the recent study, radiographic findings were verified with clinical dental records, which were collected on standard forms as part of the routine examination process. The patients who had participated in this study were essentially the Chinese persons from the Jiamusi city and from the small city around Jiamusi. All patients presenting with any pathological conditions including trauma or fracture of the jaw or any hereditary diseases or syndromes that might affect the normal growth of dentition were excluded from the study.

The data was entered into the computer and analyzed using the Statistical Package for Social Sciences (version 20. Inc. Chicago, USA). The Pearson’s Chi-square was used to determine the differences in the distribution of impacted teeth between genders. The significant level was tested at the 5%. Ethical approval was not received from the School of stomatology of Jiamusi University for the retrospective study because the patients were not exposed to additional radiation and not subjected to additional treatment. But a consent was obtained for to use the patients’ medical record data.

3. RESULTS AND DISCUSSION

In this analysis data, 1342 patients (23.2%) had impacted teeth; 701 (52.2%) were male and 641(47.8%) were female (Table 1) with an age range of 7-76 years. No statistically significant was found between impacted teeth and gender (P=0.22).

In Table 2, the prevalence of impacted teeth was 23.2% and impacted third molars was the most prevailing (11.7%; n=677), followed by impacted canines (5.55%; n=321), impacted incisors (2.92%; n=169) and impacted premolars (2.82%; n=163). Impacted first and second molars were the least prevailing teeth (0.21%; n=12). Impacted deciduous teeth were not noted in the present study. The pattern of impacted teeth were more occurred in the mandible than maxilla (51.9%; n=772 and 48%; n=713) with a ratio of 1.08:1 and the third molars was the most commonly impacted teeth (52.3%). The canine, incisor, first and second molar were mostly noted in the maxilla than in the mandible (22.2% and 1.5% for canines; 10.7% and 0.8% for incisor, and 0.6% and 0.2% for first-second molars) respectively. However, the Third molar and premolars were mostly occurred in the mandible than the maxilla with 42.6% and 9.7% for third molars; and 6.7% and 4.3% for premolars. The impacted teeth mostly occurred in the age group between 17-26 years (43.8%; n=774) (Table 3).

Table 4, showed that, impaction of impacted teeth were diagnosed in all permanent teeth. The impacted teeth were routinely classified according to the direction of the crown of the tooth and a vertical impaction was a common pattern of impaction (34.34%), followed by mesio-angular impaction (29.36%) and by horizontal impaction (24.44%). The distal-angular impaction, buccal-lingual-angular and inverted impaction occurrence were less by 6.46%, 2.82%, and 2.55% respectively.

3.1 Discussion

Unerupted teeth are those teeth that have failed to erupt completely or partially in the dental arch. The main causes are local factors and also systemic and genetic disorders were reported [1-3]. The prevalence of impacted teeth is a discrepancy in different population and ethnic groups, as well as, variation in the prevalence and distribution of impacted teeth in different regions of the jaw [4-9]. Depending to some studies, the most pattern impacted teeth are the mandibular third molars followed by the maxillary third molars, the maxillary canines, the mandibular premolars and mandibular incisors [9,10,11,12,13].

Our finding prevalence of impacted teeth (Table 2), is the high figure and the less figure compared to studies reported by some authors [4-9]. But our result is slightly close to those reported by FSC Zhu et al. at Hong Kong [7]. This can be explained by the fact that, clinical dental data were only collected from the Dental teaching hospital in both studies (Hong Kong and...
North-East China studies). But, inclusion criteria for minimum age was different like some other previous studies that have investigated specific age-groups and specific type of impacted teeth only, thus justify this difference [8,9,10,11].

Table 1. Distribution of patients and teeth number according to gender

| Gender | Number of patients | Had impacted teeth | P. value |
|--------|--------------------|--------------------|----------|
| Male   | 3754               | 701 (52.2%)        | 731 (49.2%) | 0.22 |
| Female | 2030               | 641 (47.8%)        | 754 (50.8%) |
| Total  | 5784               | 1342 (100%)        | 1485 (100%) |

Table 2. Prevalence, number of patients, localization and pattern of impacted teeth

| Impacted tooth | Maxilla (%) | Mandible (%) | Total (%) | N. of patients | Prevalence % |
|----------------|-------------|--------------|-----------|----------------|-------------|
| Incisors       | 160 (10.7)  | 13 (0.8)     | 173 (11.6)| 169            | 2.92        |
| Canines        | 331 (22.2)  | 22 (1.5)     | 353 (23.7)| 321            | 5.55        |
| Premolars      | 68 (4.3)    | 100 (6.7)    | 168 (11.3)| 163            | 2.82        |
| First          | 9 (0.6%)    | 4 (0.2)      | 13 (0.8)  | 12             | 0.21        |
| second molars  |             |              |           |                |             |
| Third molars   | 145 (9.7)   | 633 (42.6)   | 778 (52.3)| 677            | 11.70       |

Legend: N= number; %= percent

Table 3. Distribution of prevalence impacted teeth according to age group

| Age group (years) | Number of patients | Patients and impacted |
|-------------------|--------------------|-----------------------|
|                   | No.                | (%)                   |
| 7-16              | 1548               | 385 (24.8)            |
| 17-26             | 1765               | 774 (43.8)            |
| 27-36             | 1184               | 147 (12.4)            |
| 37-46             | 742                | 24 (3.2)              |
| 47-56             | 290                | 8 (2.7)               |
| 57-66             | 175                | 3 (1.7)               |
| 67-77             | 80                 | 1 (1.2)               |
| Total             | 5784               | 1342 (23.2)           |

Table 4. Impacted teeth orientation

| Tooth position | Horizontal | M-A | Vertical | D-A | B-L-A | Inverted | Total |
|----------------|------------|-----|----------|-----|-------|----------|-------|
| U1/L1          | 9/0        | 24/0| 26/10    | 14/0| 16/0  | 35/0     | 124/10|
| U2/L2          | 0/0        | 16/0| 18/3     | 2/0 | 0/0   | 0/0      | 36/3  |
| U3/L3          | 38/2       | 122/6| 162/10   | 0/4 | 9/0   | 0/0      | 331/22|
| U4/L4          | 0/1        | 7/5 | 3/9      | 0/0 | 0/0   | 0/0      | 10/15 |
| U5/L5          | 7/3        | 12/18| 28/55    | 6/9 | 5/0   | 0/0      | 58/85 |
| U6/L6          | 0/0        | 3/0 | 0/0      | 0/0 | 0/0   | 0/0      | 3/0   |
| U7/L7          | 0/0        | 2/3 | 4/1      | 0/0 | 0/0   | 0/0      | 6/4   |
| U8/L8          | 0/303      | 55/163| 87/94    | 3/58| 0/12  | 0/3      | 145/633|
| Total U        | 363        | 436 | 510      | 96  | 42    | 38       | 1485 |

Legend: U = upper jaw; L = lower jaw; M-A = mesioangular; D-A = distoangular and B-L-A = buccal-Lingual-Angular
More than 27% of patients in the current study were aged between 7 and 18 years (Table 3). This may reflect increased prevalence of impacted incisor tooth which as reported that an impacted maxillary incisors and canines teeth are most often occur in the patients with 8 to 12 years and 10 to 14 years old respectively [8]. The pattern of impacted tooth (Table 2) seen with the most common being mandibular third molars, followed by upper canines, upper incisors and mandibular premolars were unlike to those reported by some authors [4-7], but similar to study of Hou, et al. [8]. Also, the finding of an impacted third molars occurred in 52.3% of all impacted third molars teeth, and impacted mandibular third molars occurred in 42.6% were not close of those found by others authors [7,12,13], may difference due to the methodology used and selection of age group.

The canine tooth has a second complicated eruption pattern and is one of the last teeth to erupt in the dental arch. Due to these conditions, this tooth may not erupt naturally [16]. The maxillary canine was the second most pattern impacted teeth (Table 2) in the recent research, which is close to another study [17]. The results of others studies indicate that the incidence of impacted canine may be higher in some populations whereas less in another population such as study of Fardi, et al. [4] that canines were the most commonly impacted teeth with 8.8% in the Greek population, 3.6% for study of Zahrani AA, [18] in Saudi population, 3.58% for study of Aydin et al. [19] and 0.92 for study of Dachi SF, et al. [20].

The different results may be attributed to the racial differences, Selection of age group, eruption time of teeth and differences in the methodology of the study. Maxillary canines impaction are believed to occur 10-20 times more frequently than mandibular canine impaction and there are limited numbers of studies revealing its frequency of occurrence [21]. In a study of Shah, et al. [22] 8 unerupted mandibular canines were found in 7886 individuals, while in the study of Grover PS, et al. [23] 11 impacted mandibular canines were found in 5000 individuals which resulted in an incidence of 0.10%. These results are quite similar with our finding (Table 2).

Some studies have reported that the impaction of the maxillary central incisor is almost as prevalent as impacted canines but its etiology is different [24]. Chaushu et al. [25] provided evidence of a significant environmental influence from the impacted maxillary incisor in delaying and altering the eruption path of the ipsilateral maxillary canine. The recent study found that the incidence of maxillary incisor was seen in one hundred sixty of the Chinese patients. However, the prevalence of maxillary incisor impaction (10.7%) was much less than that of canine impaction (22.2%). Our results are similar with to those found by Hou, et al. and also for those found by FSC Zhu, et al. [7,8]. But in order of prevalence, the most impacted teeth in the recent study was third molars followed by canines, incisors, and premolars which are also similar to the study of Hou, et al. [8] but different
with the study of FSC Zhu, et al. [4-9] who reported that the premolars were seen in third order of prevalence, followed by incisors. According to those results, we can conclude that those studies will only included patients above 17 years old and not have included patient aged between 6 or 7 years, as the patients old than 17 years may have already consulted the dental practitioner for orthodontic treatment or extraction before the study, and hence the prevalence of impacted incisors found will not correlate to reality of that patients. The correct prevalence of impacted incisors must include the patients of minimum age of 7 years in the study.

Very few studies have been done regarding impacted premolars. It has been concluded from the results of previous studies that premolars impaction are rare [14,26], with the prevalence ranging from 2.1 to 2.7%, alike our recent research. The mandibular premolars were the frequently impacted than maxillary premolars, analogous to Hou, et al. [8]. Impacted mandibular first and second molars and impacted maxillary first and second molars are relatively rare with few cases reported and their prevalence ranged from 0.03% to 0.3%, with a slight predilection for males [27,28]. This affirmation was similar to our study and also to the study of Matheus Bandeca et al. [5].

It is difficult to estimate the 3-dimensional direction of impacted teeth from the x-ray films. Therefore, we have only performed a 2-dimensional investigation of the impaction orientation using the OPG radiographs in our present research. In this research, the vertical impaction was the most common, occurring in nearly 1/3 of all the impacted teeth, followed by Mesio-angular impaction and by a horizontal impaction who impacted mandibular third molars are more usual (Table 4). This result was different to the study of Hou R, et al. [8], who the most common angulation of impaction in both maxillary was vertical and mesio-angular impaction orientation. This dissimilarity could be explained by the fact that all of the type of impacted teeth were included in our study unlike the study of Hou, et al. [8] who the third molars impaction were excluded. About 27.84% impacted maxillary central incisors had inverted impaction. This affirmation is similar to our study and the study of Hou R, et al. [8].

4. CONCLUSION

The prevalence of impacted teeth was 23.2%. The minimum age of 7 years must be included in the study for to assess the real prevalence of incisor impaction. The impacted teeth were mostly encountered in Chinese patients aged between 17 to 26 years old. All dentist, oral and maxillofacial surgeons should know this prevalence and pattern to perform a thorough evaluation, interceptive treatments and valid support in planning suitable treatment to be provided.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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