ASSOCIATION OF MAXILLARY TRANSVERSE DISCREPANCY AND IMPACTED MAXILLARY CANINES

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ABSTRACT

The maxillary permanent canine acts as the corner stone of occlusion and plays a key role in smile design. Any morphological defect or eruption anomaly, affecting the maxillary permanent canine has a negative impact on the smile and facial esthetics of the person. The etiology of impacted maxillary permanent canine is multifactorial. Maxillary transverse discrepancies have been reported in 7 – 23% of the population. The objective of this study was to assess the association between maxillary transverse discrepancy and impacted permanent maxillary canines.

The study was carried out at the Armed Forces Institute of Dentistry. After obtaining informed written consent from all patients, 60 casts of skeletal class I patients with complete permanent dentition except third molars were selected from the records of the Orthodontics department; 30 with impacted maxillary canines for the experimental group and 30 without any impacted teeth for the control group. The maxillary arch width was measured as the distance between the mesiopalatal cusp tips of the first permanent molars. The mandibular arch width was measured as the distance between the central fossae of the mandibular first permanent molars. The difference between the two measurements was calculated to determine maxillary transverse discrepancy.

A positive \( r = 0.341 \) and highly significant \( p < 0.01 \) association was observed between maxillary transverse discrepancy and impacted maxillary permanent canines. Early correction of maxillary transverse discrepancy may reduce the chances of maxillary permanent canine impaction.

Key Words: Maxillary transverse discrepancy, Impacted maxillary permanent canine, Early treatment.

INTRODUCTION

The maxillary permanent canine acts as the corner stone of occlusion and plays a key role in smile design. Any morphological defect or eruption anomaly, affecting the maxillary permanent canine has a negative impact on the smile and facial esthetics of the person.

Impaction has been defined in a number of ways by various clinicians. Raghoobar\(^1\) defined it as “a cessation of eruption of a tooth caused by a physical barrier in the eruption path or the abnormal position of the tooth” while Richardson\(^2\) described it as “teeth with a delayed eruption time or that are not expected to erupt completely based on clinical and radiographic assessment.” The maxillary permanent canine is one of the

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maxillary transverse discrepancy being second only to the mandibular third molars. The prevalence of impacted maxillary canines has been reported to be 0.9% – 2.2%. Maxillary canines develop high in the maxilla and are one of the last teeth to erupt. The etiology of impacted maxillary permanent canine is multifactorial. It may be genetic or due to local factors such as congenitally missing lateral incisors, supernumerary teeth, odontomas, transposition of teeth and other mechanical determinants that interfere with the path of eruption of the canine.

Maxillary transverse discrepancies have been reported in 7 – 23% of the population. Higher rates may be reported if edge to edge discrepancies are also included in the definition. The rate of self correction of cross bites is too low to justify non intervention. Very few studies have tried to assess the relation between maxillary transverse discrepancy and impaction of maxillary permanent canines with no such research previously conducted on the local population. Thus the purpose of this study was to assess the association between maxillary transverse discrepancy and impacted maxillary permanent canines which would serve as another indication for early treatment of maxillary transverse discrepancies.

**METHODOLOGY**

This is a Case – control study carried out at the Armed Forces Institute of Dentistry, Rawalpindi, Pakistan. Records of only skeletal Class I patients were included in the study. The study was carried out on casts of the dentition from the records of Orthodontics Department. Since the permanent maxillary canines usually erupt prior to the eruption of the permanent second molars, only casts with permanent second molars and radiographic evidence of root completion of the maxillary permanent canines were selected to ensure the impacted status of the maxillary permanent canines. For the control group, casts of patients with complete set of permanent teeth except third molars were randomly selected. The same criterion was used for the selection of the experimental group except that the maxillary permanent canine/s was impacted. Syndromic patients or patients suffering from any other medical disorder that could interfere with the eruption of teeth or the growth of the jaws were excluded. Impressions of all Orthodontic patients were taken with fast setting Alginate. Impressions along with squash bite of both the jaws were taken. Pouring of impressions was done with orthodontic plaster with a total expansion of 0.2%. Based on this criterion a total of 60 casts (N = 60), 30 for the control group (n = 30, mean age 15.2 years) and 30 for the experimental group (n = 30, mean age 14.7 years), were selected for the study out of a total 400 records examined.

For the maxillary arch, the maxillary arch width (MxW), was taken as the distance between the mesiopalatal cusp tips of the maxillary first permanent molars. For the mandibular arch, the mandibular arch width (MnW), was taken as the distance between the central fossae of the mandibular first permanent molars. All measurements were done in millimeters with a digital caliper for greater accuracy. Ideally the mesiopalatal cusp tip of the maxillary first permanent molar should occlude into the central fossa of the mandibular first permanent molar and thus

\[ MxW = MnW \]

Based on this principle, the maxillary transverse discrepancy (TD) was calculated by the following formula:

\[ TD = MnW - MxW \]

**TABLE 1: MEANS AND STANDARD DEVIATIONS FOR MAXILLARY TRANSVERSE DISCREPANCY**

<table>
<thead>
<tr>
<th>Group</th>
<th>Minimum (mm)</th>
<th>Maximum (mm)</th>
<th>Range (mm)</th>
<th>Mean (mm)</th>
<th>S.D. (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total sample</td>
<td>-2*</td>
<td>4</td>
<td>6</td>
<td>0.67</td>
<td>±1.18</td>
</tr>
<tr>
<td>Control gp.</td>
<td>-2*</td>
<td>2</td>
<td>4</td>
<td>0.27</td>
<td>±0.97</td>
</tr>
<tr>
<td>Experimental gp.</td>
<td>-1*</td>
<td>4</td>
<td>5</td>
<td>1.07</td>
<td>±1.26</td>
</tr>
</tbody>
</table>

*Negative values indicate a greater maxillary arch width than mandibular arch width
For inter examiner reliability, a second equally trained examiner repeated the measurements on 15 randomly selected casts from each group. For intra examiner reliability, the measurements were repeated by the same examiner, one month after the original measurements for 15 randomly selected casts from each group.

All Statistical calculations were done using SPSS v16. Means and standard deviations were calculated for maxillary transverse discrepancy. Paired t – test was used to check for inter examiner and intra examiner reliability. Chi square test and Pearson’s correlation were used to assess the association between maxillary transverse discrepancy and impacted maxillary canines.

RESULTS

The mean age of the control group was 15.2 years and it was 14.7 years for the experimental group. The mean transverse discrepancy calculated for the whole sample (N = 60) was 0.667 ± 1.18 mm (see Table 1). For the control group (n = 30) it was calculated to be 0.27 ± 0.97 mm (see Figure 1) and 1.07 ± 1.26 mm for the experimental group (n = 30) (see Figure 1). Paired t-test did not yield significant (p > 0.05) results for inter and intra examiner reliability.

Chi square test showed a highly significant association (p < 0.01) between maxillary transverse discrepancy and impaction of maxillary permanent canine (see Table 2). Pearson’s Correlation also showed a positive relationship (Pearson’s r = 0.341) between maxillary transverse discrepancy and impaction of maxillary permanent canines (see Table 3).

DISCUSSION

Maxillary growth completes first in the transverse dimension22 and thus discrepancies in this dimension can be detected within the mixed dentition. Only skeletal Class I patients were selected for this study to rule out the confounding effect of sagittal discrepancies on maxillary transverse discrepancies. Since the permanent maxillary canines usually erupt prior to the eruption of the permanent second molars22, only casts with permanent second molars were selected to ensure the impacted status of the maxillary permanent canines. Ideally the mesiopalatal cusp tip of the maxillary first permanent molar should occlude into the central fossa of the mandibular first permanent molar23 thus these points were used to assess the transverse discrepancy.

McConell et al17 studied the contribution of transverse deficiency and other factors, such as arch length, arch perimeter, and arch form to canine impaction. They compared 57 subjects with impacted canines to 103 subjects without impacted canines. The results showed a significantly greater maxillary transverse discrepancy in patients with impacted maxillary permanent canines.

Sambatro et al18 used postero anterior (PA) cephalograms to predict impaction of maxillary permanent canines. They took PA cephalograms of 43 patients at 8 years of age and again at 14.3 years of age for the same patients. They reported a wider posterior hemi maxilla and less distance between the crown of the unerupted canine and mid sagittal plane, for patients who later developed maxillary canine impaction.
Occlusal features that could contribute to canine impaction were studied by Al Nimri et al. in 2005. 34 pretreatment casts of patients with unilateral canine impaction were compared with pretreatment casts of patient without any impactions. They found a significantly (p < 0.01) wider arch dimension in patients with maxillary canine impaction. This finding is in sharp contrast to our results probably because they only took the absolute maxillary arch width into consideration while we considered the maxillary arch width discrepancy.

Saiar et al. in 2007 studied the casts and occlusograms of seventy nine patients with palataly impacted canines and matched them for age, gender and malocclusion to seventy nine controls. They found a significant difference in only the inter canine width of the maxilla for both groups. They concluded that since inter canine width is heavily dependent on the eruption of the permanent canines, it cannot be used as a predictor for canine impaction. Thus suggesting that a narrow arch width in canine impaction cases should be taken as an effect of the impaction rather than a cause for the impaction and no advantage could be gained by early correction of the arch width.

Correlation between maxillary transverse discrepancy and occurrence of impacted maxillary canines in the mixed dentition was studied by Schindel et al. in 2007. Casts and panoramic radiographs of 184 patients, 84 with maxillary transverse discrepancy and 100 controls, in the mixed dentition were included in the study. Canine impaction for both the groups was predicted on the panoramic radiographs based on Sector classification. Their results showed a greater predisposition to canine impaction in patients with transverse discrepancy and impaction was more likely to be unilateral than bilateral.

Fattahi et al. in 2012 studied 53 patients with canine impaction. They divided them into two groups based on buccal or palatal impactions. Subjects in the experimental group were compared to control group based on age, gender, crowding and type of malocclusion. Their results showed only a significant difference in the arch length between buccal canine impaction group and control group but no significant difference in inter molar width, inter premolar width, inter canine width, palatal depth and palatal height index.

The Interrelationship between the position of impacted maxillary canines and the morphology of the maxilla using arch length / inter molar width x 100 as indicator of maxillary arch shape and palatal vault depth / inter molar width x 100 as indicator of palatal shape was assessed by Kim et al. in 2012. Measurements were done directly on study casts. They found significant differences for both arch length / inter molar width x 100 and palatal vault depth / inter molar width x 100 between the experimental and control groups indicating a different maxillary morphology in patients with impacted maxillary canines.

The results of the present study are in agreement with those of McConell et al., Schindell et al. and Kim et al. in that a strong association between maxillary transverse discrepancy and impacted maxillary canines was found. Since a transverse discrepancy can be detected and treated early at mixed dentition stage, the chances of labial maxillary canine impaction may be reduced.

CONCLUSIONS

This study concluded that

- There is a positive association between maxillary transverse discrepancy and occurrence of impacted maxillary permanent canines.
- Early detection and correction of moderate to severe maxillary transverse discrepancy may help reduce the occurrence of impacted maxillary permanent canines.

REFERENCES


