Teeth position, eruption and temporomandibular joint ankylosis

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Abstract

Background Abnormality of tooth formation and position is often encountered in mandibular growth with TMJ ankylosis resulting from mandibular condylar fractures. Literature is scarce in this phenomenon and remains largely anecdotal

Aim and objectives To study the relationship of teeth formation and position, to the age at which trauma occurred resulting in a mandibular unilateral condylar ankylosis.

Material and methods Retrospective qualitative analysis of orthopantomograms from archives of cases diagnosed with mandibular unilateral condylar ankylosis.

Predictor variable Position of mandibular 2nd premolar, 1st, 2nd, 3rd molar, age at which trauma occurred

Outcome variables Degree of impaction or normally erupted

Result In the ipsilateral side of trauma, 66.67% of 2nd premolars, 44.4% of 1st molar, 88.89% of 2nd molar and 44.4% of 3rd molars were abnormal, while in the contralateral normal side and 22.2% of 3rd molar exhibited abnormality.

Discussion In mandible, post condylar fracture growth brings about deficiency in the length of corpus. The deficiency of length brings teeth abnormality - in terms of its growth and eruption. The abnormality in the position of teeth is related to the age at which trauma occurred.

Conclusion Evidence of tooth formation and eruption being affected in mandibular growth after mandibular condylar fractures and this phenomenon appears to be age related.

Keywords Ankylosis · Impacted teeth

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Introduction

Unilateral condylar fracture, during growth phase, often results in mandibular deformity in children. There is a scarcity of literature involving the status of teeth - formation and its proper eruption. The aim of this study is to compare the status of posterior teeth in unilateral temporomandibular joint (TMJ) ankylosis with the apparently normal uninvolved side in an age group of 6 to 25 years.

Materials and methods

Archival Orthopantomograms (2003–2008) of unilateral TMJ ankylosis cases (diagnosed by clinical, radiological and surgically confirmed) in age of 6 years to 25 years were

retrieved. They were assessed for position of mandibular 2nd premolar, first, second and third permanent molars on both the ipsilateral and contralateral side as normal and abnormal (developing or established mesioangular / distoangular / vertical / horizontal impaction). Assessment of radiographs was done by a single senior Oral and Maxillofacial surgeon with more than 2 decades of clinical experience (Author). Age at which trauma occurred were collected from patient's medical history. The teeth were categorized further as those that were normal for the given biological age (as per standard text books) and abnormal if any discrepancy noted. The data were entered and analyzed in SPSS version 16. Descriptive statistics and association between variables are presented. *p* value of <0.05 was considered as statistically significant.

Results

9 cases met the criteria and were included for analysis. The mean age was 13.67 ± 5.22 years with a range of 8 to 22 years. There were 6 males (66.67%) and left: right side involvement was 2:7. Crowding of ipsilateral side of TMJ ankylosis was observed in 6 cases (66.67%) and none in the contralateral side. The difference between sides was statistically significant. ($p = 0.012$) The mean age at the time of trauma was 6.22 ± 3.35 years with a range of 2 to 12 years.

Table 1 shows the actual position of various teeth in both sides and Table 2 lists the difference between normal and abnormal teeth for every included tooth. Chi square analysis with Yates correction (as there were 0 in 2x2 table) for 2nd

Case 1 Orthopantomogram of 16-year-old male; left side TMJ ankylosis

Case 2 Orthopantomogram of 10-year-old female; left side TMJ ankylosis

Case 3 Orthopantomogram of 12-year-old female; right side TMJ ankylosis

Case 4 Orthopantomogram of 10-year-old female; right side TMJ ankylosis

Case 5 Orthopantomogram of 24-year-old male; right side TMJ ankylosis

Case 6 Orthopantomogram of 22-year-old male; right side TMJ ankylosis

premolar and 2nd molar was statistically highly significant. While fisher's exact 't' test (as one cell contained less than 5) for 3rd molar was significant. Table 3 refers to the abnormal side and compares the mean age at which trauma occurred and the normal and abnormality with each tooth. The abnormal of 2nd premolar and 1st molar teeth demonstrated a statistically significantly different mean age of occurrence of trauma in the involved side.

Discussion

Normal and abnormal jaw growth and tooth eruption are topics of great importance for several dental and medical disciplines. It is reported that the position of tooth buds remained relatively stable inside the jaw until root formation started. The normal eruption paths of canines and

Graph 1 Comparison of mean age of trauma compared across teeth in ipsilateral and contralateral teeth of the side of TMJ ankylosis

Abnormal – ipsilateral side of TMJ ankylosis; Normal side – contralateral side of TMJ ankylosis

premolars are usually vertical, whereas molars erupt in a lingual direction [1]. Position of teeth during mandibular post-traumatic growth is still largely unexplored systematically.

Effect of condylar fracture and subsequent TMJ ankylosis development further impedes the normal functional positioning of the teeth. The age group of 6–25 years was chosen for the study as first

Table 1 Status of mandibular posterior teeth in study group (n = 9)

	Contralateral side (%)	Ipsilateral side (%)
Mandibular 2nd premolars		
Normally erupted	5 (55.6)	3 (33.3)
Developing	4 (44.4)	-
Impacted - mesioangular	-	1 (11.1)
Developing mesioangular impaction	-	4 (44.4)
Impacted - distoangular	-	1 (11.1)
Mandibular 1st molar		
Normally erupted	9 (100)	5 (55.6)
Developing	-	2 (22.2)
Impacted - mesioangular	-	2 (22.2)
Mandibular 2nd molar		
Normally erupted	5 (55.6)	-
Developing	4 (44.4)	3 (33.33)
Missing	-	1 (11.1)
Impacted – mesioangular	-	1 (11.1)
Impacted – horizontal	-	2 (22.2)
Developing impaction - mesioangular	-	2 (22.2)
Mandibular 3rd molar		
Normally erupted	1 (11.1)	-
Developing	3 (33.3)	-
Missing	3 (33.3)	5 (55.6)
Impacted – mesioangular	1 (11.1)	-
Impacted – vertical	1 (11.1)	1 (11.1)
Impacted – horizontal	-	2 (11.1)
Developing impaction – mesioangular	-	1 (11.1)

Table 2 Comparison of contralateral and ipsilateral mandibular posterior teeth in study group (n = 9)

	Contralateral side of trauma	Ipsilateral side of trauma	P value
Mandibular 2nd premolars			
Contralateral	9 (100)	3 (33.3)	0.004* (Significant; Yates corrected)
Ipsilateral		6 (66.67)	
Mandibular 1st molar			
Contralateral	9 (100)	5 (55.56)	0.0889 (Yates corrected & 0.041 if Fisher exact t test is applied)
Ipsilateral	-	4 (44.4)	
Mandibular 2nd molar			
Contralateral	9 (100)	1 (11.11)	0.00089* (Significant; Yates corrected)
Ipsilateral		8 (88.89)	
Mandibular 3rd molar			
Contralateral	7 (77.78)	5 (55.56)	0.309 (Fisher exact t test)
Ipsilateral	2 (22.2)	4 (44.44)	

Table 3 Comparison of mean age during trauma in the involved side mandibular posterior teeth in study group (n = 9)

Teeth	Status	Mean age during trauma (in years)	95% CI	P value
2nd premolar	Contralateral	10 ± 2	2.49–8.85	0.004 (Significant)
	Ipsilateral	4.33 ± 1.86		
1st molar	Contralateral	8.6 ± 2.4	2.30–8.41	0.004 (Significant)
	Ipsilateral	3.25 ± 0.96		
2nd molar	Contralateral	10	-3.88–12.38	0.256
	Ipsilateral	5.75 ± 3.24		
3rd molar	Contralateral	4.6 ± 2.4	-8.29–0.99	0.105
	Ipsilateral	8.25 ± 3.5		

molar would have erupted by 6 years and the functional position of the 3rd molar would have been stabilized by 25 years in the normal, uninvolved side. Though advance imaging techniques such as CT scan/MRI will help to accurately diagnose the degree of TMJ damage and its correlation, it does not demonstrate all teeth in a 2-dimension and thus will not help for this study. Hence orthopantomogram were chosen over the routinely used imaging modalities in recent period.

After a trauma, the mandibular growth is stunted and may react in various ways. Trauma to condyle often decreases the vertical height as the bony mandibular corpus and its soft tissue covering, the matrix, are considered as independent tissue systems capable of independent rotation. Both forward and backward rotation can be divided into three components: the total rotation, the matrix rotation, and the intra-matrix rotation, showing different individual interrelationships and a changing composition in each individual during the entire period of development [2]. It has been established that vertical direction of condylar growth leads to lesser resorption of anterior border of ramus contributing to less space. Furthermore, reduced growth in mandibular length, vertical direction of mandibular growth and a distal pattern of eruption of mandibular eruption would lead to impaction of 3rd molar [3]. In our present case series, contralateral side to TMJ ankylosis, in 2 cases, third molars were more abnormal as compared to normal sides. Hence the remaining cases, reduced growth in mandibular length and vertical direction of mandibular growth are the only probable cause. On the contrary it has been reported that about 66–75% of normal vertical mandibular growth is due to the passive translation of the mandibular macro-skeletal unit as a secondary response to the primary volumetric expansion of the orofacial functioning spaces acting as a capsular matrix. The change in position of ramal ‘micro-skeletal units’ is due to transformation [4].

It is reported that patients with impacted mandibular 2nd molar had increased sagittal jaw relationship, smaller jaw angle, mandibular alveolar prognathism as compared to normal controls. These are important signs seen in a patient with vertically directed condylar growth wherein mandibular dentition is forced to erupt in an anterior direction [5].

The present study involves 8 abnormal 2nd molars of the nine involved 2nd molars (88.89%) in the ipsilateral side of TMJ

ankylosis. This emphasizes the fact that loss of backward movement of mandible and lack of creation of space occurs during post-traumatic mandibular growth. The absence of a significant relationship between the contra and ipsilateral side 3rd molar ($p=.309$) indicates that 3rd molar development and position, in a unilateral TMJ ankylosis cases cannot be predicted.

In an earlier cephalometric craniofacial characteristics study, it was established that the total mandibular length was severely decreased in affected side. It was smaller than the norm by more than 30 mm on the affected side. The mandibular body length and mandibular ramus height was also significantly smaller on the affected side. Furthermore, ramus height was found to be less than 15–20 mm on affected sides in all age groups and a significant difference of 5–10 mm was shown between the affected and the non-affected ramus heights [6].

As seen in graph 1, the mean age at which trauma occurred for abnormal premolar and first molar was 4.33 and 3.25 years whereas for the normal teeth, the mean age was 10 and 8.6 years. This with the above discussion, it can be assumed that

1. Trauma at younger age interferes with development of teeth.
2. The reasons for this could be a lack of space, owing to decreased growth of mandibular body. It is a known fact that bone deposition tends to occur on the posterior border of the ramus, whereas concomitant resorption on the anterior border maintains the proportions of the ramus and, moves it backward in relation to the body of the mandible. This deposition and concomitant resorption extends upto the coronoid process, involving mandibular notch [7].

Conclusion

These findings help us to resolve clinical conditions wherein it is necessary to assess the growth deficiency in order to plan growth center transplantations, especially when the patient has a unilateral ankylosis but has sustained bilateral condylar injuries. The findings of this study help us in judging the potential growth deficiency that would ensue, using the eruption pattern and positioning of the permanent teeth in relation to the occlusal plane and alveolar bone. Coupling with fact that post condylar fracture growth brings about deficiency in the length of corpus [7], this article demonstrates that:

1. The deficiency of length probably leads to teeth abnormality – in terms of its growth and eruption.
2. The abnormality in the position of teeth is related to the age at which trauma occurred.
3. The age at which trauma occurred can be also determined from this chart.

Though the results are statistically significant, this article suffers from disadvantage of a limited sample size. Larger sample size will help us to elucidate more significant findings with a higher power. This in turn will help to address significant intervention in developing asymmetries with regards to TMJ trauma in young children. With clinical multidisciplinary management of TMJ trauma, TMJ ankylosis are diagnosed earlier and efficiently managed. However, further such studies are essential to understand the essential growth pattern of orofacial bone frame, intermaxillary occlusal relationship especially in aspect of mandibular teeth formation and eruption, and the long-term planning to the treatment of TMJ ankylosis cases or any such facial deformities as well.

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