Original Article

Association between Immobile Over-Retained Primary Incisors, Diet Consistency, and the Presence of Crowding

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Abstract

Context: Immobile over-retained primary teeth often deflect the path of eruption of their corresponding permanent teeth, resulting in ectopic eruption. Although various etiologies have been mentioned in literature, there is little regarding its association with consistency of diet and the presence of crowding. **Aim:** This study was undertaken to evaluate the association between the presence of immobile over-retained primary incisors (IOPIs), the consistency of foods consumed, and the presence of crowding. **Materials and Methods:** A total of 101 children with IOPI were randomly selected for evaluation. The consistency (soft, medium, or hard) of the foods consumed by each child during the day was assessed. The presence of crowding in the arches, the number of IOPI present, and the length of the root of each IOPI following its extraction were also assessed. **Statistical Analysis:** It was carried out using the SPSS software (version 11.5, IBM Corporation, Armonk, New York, USA). The Chi-square test and the *Z* test were used. **Results and Conclusion:** No significant association was found between IOPI, the consistency of foods consumed, and the presence of crowding.

Keywords: Food consistency, retained roots, retained teeth

Introduction

In literature, various factors have been mentioned that result in physiologic primary root resorption (PPRR). The pressure exerted by a succedaneous tooth through its pericoronal follicle (rich in epithelial growth factor) is the most important factor in the differentiation of odontoclasts to result in PPRR.[1,2] In a study on rabbit teeth, it was found that the dental follicle might play the role of recruitment, development, and activation of odontoclasts.[3] The cytokines and transcription factors in the stellate reticulum and permanent tooth follicle are also known to result in PPRR.[4] However, PPRR has also been reported to occur independently of the eruptional processes of succeeding teeth.[5] The only study in literature that evaluated the relation between occlusal force and PPRR was done on Beagle dogs. It was found that when succedaneous teeth were present, PPRR occurred irrespective of whether occlusal forces were normal or decreased. When occlusal forces were decreased, delay in resorption was observed.[6] However, it has also been mentioned that the resultant trauma to periodontal ligament fibers due to increased masticatory forces may result in PPRR.[7] This cross-sectional study was undertaken to evaluate the association between the presence of immobile over-retained primary incisors (IOPIs), the consistency of foods consumed and the presence of crowding. The research hypothesis assumed was that the consistency of diet and the presence of crowding affected the presence of IOPI.

Materials and Methods

A total of 101 children with IOPI who had visited the department of pedodontics were selected for evaluation irrespective of their age. A primary incisor was considered "over-retained" only if it was present along with its corresponding succedaneous

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incisor after its eruption. The judgmental sampling method was used, and the sample size was calculated using the formula:

$$ss = \frac{Z^2 \times p(1-p)}{c^2}$$

Where, $Z = Z$ value (2.58 for 99% confidence and 1.96 for 95% confidence level); p = percentage picking a choice (0.5 used for sample size needed) and; c = confidence interval (0.05). The new sample size (corrected for a finite population) was calculated using the formula:

$$\text{New } ss = \frac{ss}{1+\frac{(ss-1)}{N}}$$

Where, N = population. Each child was handed over a questionnaire which included the following questions that needed to be answered by either of the child's parents or the guardian if the child was not living with his/her parents: name, age, and sex, and list of foods consumed for breakfast, lunch, dinner, and snack. The answers were again recorded by a single examiner after they were compared with a reference sheet which contained names of all conventional foods that may be consumed for breakfast, lunch, dinner, or snack and the consistency (soft, medium. or hard) of each of the foods. Clinical examination was also made and the following were recorded: number of IOPI present in the maxillary and mandibular arches, length of the root of each IOPI following its extraction, and the presence of crowding in relation to each IOPI. Statistical analysis was carried out using the SPSS software (version 11.5, IBM Corporation, Armonk, New York, USA). The Chi-square test and the Z test were used. The assessment of IOPI and associated factors in 101 children was completed over a period of 1 month.

Results

Of a total 101 children who constituted the study sample, 58 were males and 43 were females. None of the children had 3 IOPI in the maxillary arch (1, 2, or 4 IOPI only). However, the number of mandibular IOPI varied from one to four in each child. No significant associations were found between the consistency of foods consumed during breakfast [Table 1], lunch [Table 2], dinner [Table 3], or snack [Table 4] and the presence of IOPI in the maxillary arch. Similarly, no significant associations were found between the consistency of foods consumed during breakfast [Table 5], lunch [Table 6], dinner [Table 7], or snack [Table 8] and the presence of IOPI in the mandibular arch. No significant associations were found between crowding and the presence of IOPI in the maxillary [Table 9]

Table 1: Association between maxillary immobile over-retained primary incisor and the consistency of foods consumed for breakfast

Consistency	Number of IOPI, *n* (%)			Total	χ^2	*P*
	1	2	4			
Medium	2 (6.50)	1 (4.80)	0 (0.00)	3 (5.70)	0.128	0.938
Soft	29 (93.50)	20 (95.20)	1 (100.00)	50 (94.30)		
Total	31 (100.00)	21 (100.00)	1 (100.00)	53 (100.00)		

IOPI: Immobile over-retained primary incisor

Table 2: Association between maxillary immobile over-retained primary incisor and the consistency of foods consumed for lunch

Consistency	Number of IOPI, *n* (%)			Total	χ^2	*P*
	1	2	4			
Hard	1 (3.2)	1 (4.8)	0 (0.0)	2 (3.8)	0.501	0.973
Medium	8 (25.8)	5 (23.8)	0 (0.0)	13 (24.5)		
Soft	22 (71.0)	15 (71.4)	1 (100.0)	38 (71.7)		
Total	31 (100.0)	21 (100.0)	1 (100.0)	53 (100.0)		

IOPI: Immobile over-retained primary incisor

Table 3: Association between maxillary immobile over-retained primary incisor and the consistency of foods consumed for dinner

Consistency	Number of IOPI, *n* (%)			Total	χ^2	*P*
	1	2	4			
Hard	1 (3.2)	3 (14.3)	0 (0.0)	4 (7.5)	2.278	0.320
Soft	30 (96.8)	18 (85.7)	1 (100.0)	49 (92.5)		
Total	31 (100.0)	21 (100.0)	1 (100.0)	53 (100.0)		

IOPI: Immobile over-retained primary incisor

Table 4: Association between maxillary immobile over-retained primary incisor and the consistency of snacks consumed

Consistency	Number of IOPI, *n* (%)			Total	χ^2	*P*
	1	2	4			
Hard	0 (0.0)	1 (4.8)	0 (0.0)	1 (1.9)	1.895	0.755
Medium	5 (16.1)	4 (19.0)	0 (0.0)	9 (17.0)		
Soft	26 (83.9)	16 (76.2)	1 (100.0)	43 (81.1)		
Total	31 (100.0)	21 (100.0)	1 (100.0)	53 (100.0)		

IOPI: Immobile over-retained primary incisor

Table 5: Association between mandibular immobile over-retained primary incisor and the consistency of foods consumed for breakfast

Consistency	Number of IOPI, *n* (%)			Total	χ^2	*P*
	1	2	4			
Medium	6 (13.6)	0 (0.0)	0 (0.0)	6 (8.6)	3.878	0.144
Soft	38 (86.4)	25 (100.0)	1 (100.0)	64 (91.4)		
Total	44 (100.0)	25 (100.0)	1 (100.0)	70 (100.0)		

IOPI: Immobile over-retained primary incisor

Table 6: Association between mandibular immobile over-retained primary incisor and the consistency of foods consumed for lunch

Consistency	Number of IOPI, *n* (%)			Total	χ^2	*P*
	1	2	4			
Hard	1 (2.3)	2 (8.0)	0 (0.0)	3 (4.3)	2.350	0.672
Medium	11 (25.0)	8 (32.0)	0 (0.0)	19 (27.1)		
Soft	32 (72.7)	15 (60.0)	1 (100.0)	48 (68.6)		
Total	44 (100.0)	25 (100.0)	1 (100.0)	70 (100.0)		

IOPI: Immobile over-retained primary incisor

Table 7: Association between mandibular immobile over-retained primary incisor and the consistency of foods consumed for dinner

Consistency	Number of IOPI, *n* (%)			Total	χ^2	*P*
	1	2	3			
Hard	4 (9.1)	1 (4.0)	0 (0.0)	5 (7.1)	0.701	0.704
Soft	40 (90.9)	24 (96.0)	1 (100.0)	65 (92.9)		
Total	44 (100.0)	25 (100.0)	1 (100.0)	70 (100.0)		

IOPI: Immobile over-retained primary incisor

Table 8: Association between mandibular immobile over-retained primary incisor and the consistency of snacks consumed

Consistency	Number of IOPI, *n* (%)			Total	χ^2	*P*
	1	2	3			
Hard	1 (2.3)	0 (0.0)	0 (0.0)	1 (1.4)	3.743	0.442
Medium	8 (18.2)	1 (4.0)	0 (0.0)	9 (12.9)		
Soft	35 (79.5)	24 (96.0)	1 (100.0)	60 (85.7)		
Total	44 (100.0)	25 (100.0)	1 (100.0)	70 (100.0)		

IOPI: Immobile over-retained primary incisor

or mandibular [Table 10] arches. Moreover, no significant associations were found between the extent of root resorption on IOPI and their presence in the maxillary [Table 11] or mandibular [Table 12] arches.

Discussion

Apart from the permanent tooth follicle, the formation of odontoclasts may also be from pulpal cytokine-producing cells

Table 9: Association between maxillary immobile over-retained primary incisor and the presence of crowding

Crowding	Number of IOPI, *n* (%)			Total	χ^2	*P*
	1	2	4			
No	5 (16.1)	5 (23.8)	0 (0.0)	10 (18.9)	0.719	0.698
Yes	26 (83.9)	16 (76.2)	1 (100.0)	43 (81.1)		
Total	31 (100.0)	21 (100.0)	1 (100.0)	53 (100.0)		

IOPI: Immobile over-retained primary incisor

Table 10: Association between mandibular immobile over-retained primary incisor and the presence of crowding

Crowding	Number of IOPI, *n* (%)			Total	χ^2	*P*
	1	2	3			
No	7 (15.9)	4 (16.0)	1 (100.0)	12 (17.1)	4.903	0.086
Yes	37 (84.1)	21 (84.0)	0 (0.0)	58 (82.9)		
Total	44 (100.0)	25 (100.0)	1 (100.0)	70 (100.0)		

IOPI: Immobile over-retained primary incisor

Table 11: Extent of root resorption in extracted maxillary immobile over-retained primary incisor

Root resorption	Number of IOPI, *n* (%)			Total	χ^2	*P*
	1	2	4			
0	22 (71.0)	17 (81.0)	1 (100.0)	40 (75.5)	1.953	0.744
1/3	2 (6.5)	0 (0.0)	0 (0.0)	2 (3.8)		
2/3	7 (22.6)	4 (19.0)	0 (0.0)	11 (20.8)		
Total	31 (100.0)	21 (100.0)	1 (100.0)	53 (100.0)		

IOPI: Immobile over-retained primary incisor

Table 12: Extent of root resorption in extracted mandibular immobile over-retained primary incisor

Root resorption	Number of IOPI, *n* (%)			Total	χ^2	*P*
	1	2	3			
0	31 (70.5)	21 (84.0)	1 (100.0)	53 (75.7)	2.070	0.723
1/3	2 (4.5)	1 (4.0)	0 (0.0)	3 (4.3)		
2/3	11 (25.0)	3 (12.0)	0 (0.0)	14 (20.0)		
Total	44 (100.0)	25 (100.0)	1 (100.0)	70 (100.0)		

IOPI: Immobile over-retained primary incisor

that mediate the monocyte–macrophage lineage.[8] Odontoclasts express cathepsin K mRNA[9] and matrix metalloproteinase-9 (MMP-9),[10] which may participate in proteolysis, leading to PPRR. H+-ATPase mediates the active extrusion of proton ions, resulting in odontoclastic decalcification of apatite crystals.[11] Odontoclasts have been found to express MT1-MMP (Membrane type 1-MMP) mRNA.[12] Odontoclasts and its surrounding areas have also been found to contain extracellular matrix proteins such as bone sialoprotein and osteopontin.[13] The role of stem cells from human exfoliated deciduous teeth has been suggested in PPRR, due to its osteoclastic and osteogenic potentials.[14,15] Apoptosis induced by cementoblasts, which reveals the mineralized portion of the root while attracting odontoclasts, has also been suggested as the cause for PPRR.[1,16] Proteoglycans such as biglycan and decorin may also lead to PPRR.[17] Receptor activator of NF-kappaB ligand (RANKL), that is probably produced by mononuclear stromal cells and odontoclasts, is expressed by periodontal ligament cells and may participate in odontoclastogenesis.[4,8,11,18,19] Moreover, the gene Runx2 upregulates RANKL and downregulates OPG, in periodontal ligament stem cells, leading to PPRR.[20] There has been no previous study in literature that has assessed the relation between diet consistency, crowding, and the presence of IOPI in humans. The clinical implication of this study is the finding that diet consistency or the presence of crowding does not affect the occurrence of IOPI. However, the occurrence of IOPI may be attributed to misalignment in the path of eruption of their corresponding succedaneous teeth, especially in the case of primary molars with divergent roots.[7] The extent of root resorption was calculated by comparing the length of the root of each IOPI with the standard root length of those teeth.[21] The study contained certain limitations in assessment. The consistency of the food items consumed daily was assessed;

however, the quantity of foods consumed by each child could not be assessed. Although the consistency of each meal was recorded as either soft, medium, or hard, it could have been possible that certain children would have consumed a mixture of hard, medium, and soft foods in a single meal. A diet diary was not provided for recording the foods consumed over a period of time since it was a cross-sectional study. The foods shared between friends which could have differed in consistency, were not taken into account in this study. Moreover, the frequency of snacking could have also varied from child to child. Future studies may be conducted to assess the association between the frequency or quantity of diet and the presence of IOPI.

Conclusion

No association was found between consistency of foods consumed, presence of crowding, and the occurrence of IOPI.

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Conflicts of interest

There are no conflicts of interest.

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