

PREVALENCE OF MOLAR INCISOR HYPOMINERLIZATION AMONG A GROUP OF EGYPTIAN CHILDREN: A CROSS SECTIONAL STUDY

Shahinda Abdeen Osman^{*}, Eman Sayd Elmasry^{**}
and Randa Youssef Abd Al Gawad^{**}

ABSTRACT

Objective: The aim of the study was to determine the Prevalence of MIH in a group of Egyptian children attending the Pediatric Dentistry and Dental Public Health Department, Faculty of Dentistry, Cairo University, Investigate morphological characteristics and any associated causes of MIH and Investigate the relationship of MIH to dental caries.

Material and methods: This study was conducted in Outpatient clinic at Pediatric and Dental Public Health Department, Faculty of Dentistry; Cairo University. The entire patients who attended the outpatient clinic on the days of examination were included in the study sample. Examined patients were primarily screened based on the eligibility criteria determined before the study begins. Then fill questionnaire.

The clinical examination to assess the presence / absence of MIH and its severity based on EAPD criteria which will be followed by (Weerheijm & Mejare 2003,2009) Questionnaire are carefully constructed after the thorough literature review to identify all possible etiological conditions associated with MIH and related to the child or parental history, specially the mother.

The questionnaire is filled out during a face-to-face interview with the accompanying parent.

Results: Prevalence of MIH among in this study was 14.2%. with no gender predilection, The prevalence of MIH is significantly associated with childhood illnesses during the first year of life (asthma, tonsillitis, fever, and antibiotics intake). Also this study shown a relationship between increased DMF-T and children with MIH compared to those without MIH.

Conclusion: Prevalence of MIH among in this study was 14.2% with no gender predilection and the most common degree of severity of MIH in this studied population was mild degree.

* Faculty of Dentistry Cairo University

** Pediatric Dentistry and Dental Public Health Department, Faculty of Dentistry, Cairo University.

INTRODUCTION

Structural dental anomalies are associated with alterations occurring during the normal process of odontogenesis and may be related to hereditary, local or systemic factors. According to the time, either affects primary dentition, permanent dentition or both.

Molar incisor hypomineralization (MIH) is defined as 'demarcated, qualitative defects of enamel of systemic origin, affecting one or more permanent molars usually the first permanent molars with involvement of the incisor teeth (Weerheijm, et al., 2001).

The severity of MIH varies among different teeth in the same patient, because not all permanent first molars and incisors are affected or have lesions of the same degree, even though they are formed during the same period (William, et al., 2006).

To date, few data have been published regarding the prevalence of MIH in the Egyptian children. Such lacking of data compromise achieving accurate diagnosis of the problem, good prevention and management plane.

For that, this study was held as the part of coinciding studies in Egyptian children, to determine the prevalence of MIH and any associated causes in group of Egyptian children aged from 8-12 years old, and also to investigate the relationship of MIH to dental caries.

MATERIALS AND METHODS

Sample size Calculation

Sample size was determined by the Center of Evidence Based at the Faculty of Dentistry, Cairo University. o Based on previous paper by Sönmez, et al., 2013, Yannam et al., 2016. Molar incisor hypomineralization in Hong Kong Chinese children. International Journal of Paediatric Dentistry 2008; 18: 348– 352. The prevalent of MIH was 9.7% o

Convenient sampling method was applied to recruit all eligible candidates in a period of one year.

Selection of Samples

Participants were selected from Outpatient clinic at Pediatric and Dental Public Health Department, Faculty of Dentistry, Cairo University according to the following inclusion and exclusion criteria:

Patient eligibility criteria

Inclusion criteria:

1. Egyptian Children age from eight to twelve years.
2. Medically free.
3. Children whose parents signed informed consent.
4. Both sexes are included
5. Parent and children cooperation.

Exclusion criteria:

1. Children with amelogenesis imperfecta, tetracycline tooth stains, fluorosis.
2. Children having restorations or crowns.
3. Children with orthodontic bands on the first permanent molars. Preparation of Samples:

Before the beginning of the study basic education regarding MIH and its possible differential diagnosis of other enamel defects took place in the form of detailed definitions and diagnostic criteria along with methods to differentiate between them clinically, all were saved in a power point presentation that was available for the single final evaluator who was Master Degree student in Pediatric Dentistry and Public Health Department.

Screening

The entire patients who attended the outpatient

clinic on the days of examination were included in the study sample. Examined patients were primarily screened based on the eligibility criteria determined before the study begins. Then fill questionnaire (appendix 2).

The clinical examination to assess the presence / absence of MIH and its severity based on EAPD criteria which will be followed by (Weerheijm & Mejäre 2003,2009).

The questionnaire is filled out during a face-to-face interview with the accompanying parent; the questionnaire was originally formulated in English and then translated into Arabic.

Enrolled patients:

o Patients were either both free of MIH and got dismissed yet contributed in being part of the sample, or diagnosed with MIH which was confirmed by the calibrated evaluator only when at least one the FPM show any of diagnostic criteria of MIH according to modified index developed in line with EAPD criteria.

Clinical examination of all children was performed by examiner on a dental chair using mirror, dental explorer to clean the molar fissures. Prior to performing dental examinations, index teeth including eight incisors and four first permanent molars were cleaned using prophylactic paste, rotary brush and cotton roll as index teeth should be wet as suggested by FDI ,1992.

Scoring of MIH

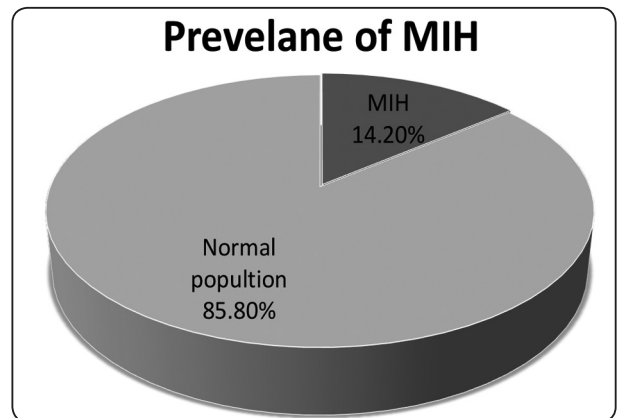
The examiner carefully inspected the coronal part of the four first permanent molars (16,26,36,46) and eight permanent incisors (11,12,21,22,31,32,41,42) for demarcated opacities in each child and evaluated them according to modified index developed in line with EAPD criteria. At least one affected first permanent molar was required for a diagnosis of MIH.

Statistical Analysis

Statistical analysis was performed using a commercially available software program (SPSS 19; SPSS, Chicago, IL, USA).

RESULTS

Prevalence of MIH among study sample: In this study 1000 children with mean age 10.15±1.32 years were included, 142 children were diagnosed with MIH and so the prevalence of MIH was 14.2% (Figure 1).



The flow chart of the patients showing MIH distribution in the following diagram in (Figure 2).

Subject with MIH (n =142)	
girls=72	Boys =70
<p>Incisors</p> <p>20.3% No defect 79.7% Mild MIH 0% Moderate MIH 0% Severe MIH</p>	<p>Incisors</p> <p>19.8% No defect 80.2% Mild MIH 0% Moderate MIH 0% Severe MIH</p>
<p>Molars</p> <p>0.3% No defect 38.9 % Mild MIH 19.5 % Moderate MIH 41.3 % Severe MIH</p>	<p>Molars</p> <p>0.7% No defect 43.3 % Mild MIH 23.9 % Moderate MIH</p>

Demographic data:

The gender distribution of participants with MIH included in the present study: The number and

percentage of girls 72(50.7%) respectively and the number and percentage of boys participants were 70 (49.3%) respectively as presented in (Table 1)

TABLE (1) Gender distribution among subject with MIH

Gender	Frequency (N)	Percent (%)
Girls	72	50.7
Boys	70	49.3
Total	142	100.0

Distribution of severity of MIH in the incisors and first permanent molars in affected participants

Lesion severity was recorded according to Alaluusua 2010. as either mild, moderate, or severe (Sönmez et al. 2013).

Teeth that were scored 1, 2 (Mild MIH) represented about 41% of all affected index teeth while teeth were scored as 3a, 3b (moderate MIH) represented about 21.7% of all affected index teeth, teeth were scored as 3c, 4, 5 (severe MIH) represented about 36% of all affected index teeth. as presented in (Table 2)

Distribution of MIH scores in affected first permanent molars and incisors:

		Incisor	Upper right molar	Upper left molar	Lower right molar	Lower left molar	Total
No defect	(0) Count	228	0	0	2	1	231
	%	20.1%			1.4%	0.7%	0.5%
Mild	(1,2) Count	908	52	63	55	63	1.141
	%	79.9%	36.6%	44.4%	38.7%	44.4%	41%
Moderate	(3a,3b) Count	0	22	35	30	36	123
	%		15.5%	24.6%	21.1%	25.4%	21.7%
Severe	(3c,4,5) Count	0	68	44	55	42	209
	%		47.9%	31.0%	38.7%	29.6%	36.8%
Total Count		1136	142	142	142	142	1.704
%		100%	100%	100%	100%	100%	100%

Table (3) Severity of MIH in molars:

		Upper right molar	Upper left molar	Lower right molar	Lower left molar	Total
No defect	Count	0	0	2	1	3
	%			1.4%	.7%	0.5%
Mild	Count	52	63	55	63	233
	%	36.6%	44.4%	38.7%	44.4%	41%
Moderate	Count	22	35	30	36	123
	%	15.5%	24.6%	21.1%	25.4%	21.7%
Severe	Count	68	44	55	42	209
	%	47.9%	31.0%	38.7%	29.6%	36.8%
Total		142	142	142	142	568
%		100%	100%	100%	100%	100%

Comparison between molars:

Severe MIH was observed more frequently in upper right molars (47.9%), followed by lower right molar (38.7%), then upper left molar (31%), with the least occurrence in lower left molar (29.6%).

Chi square test revealed that the difference between molars was statistically significant ($p=0.0415$).

Prevalence of DMF According to severity of MIH

Children with MIH showed a significantly higher DMF-T value ($p= 0.000^*$). The number and percentage of MIH children who had dental caries was 112 (78.7 %). The number and percentage of children with MIH who had no dental caries was 30 (21.1%). Regarding to the severity MIH, the number and percentage of children who had dental caries mild MIH was 42 (29.6%), moderate MIH 36 (25.4%) and severe MIH was recorded 63 (44.4%). Chi square test revealed that the difference in DMF-T score according to MIH in FPM was statistically significant ($p=0.000$), (Fig. 2)

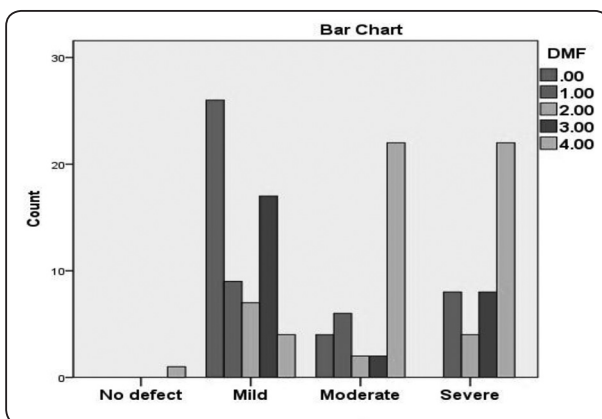


Fig. (3) Bar chart showing distribution of DMF scores according to MIH

DISCUSSION

The presented study is an observational Cross-sectional study. It was conducted to determine the prevalence and severity of MIH among a group of Egyptian children seeking dental treatment in

Pediatric and Dental Public Health Department at the Faculty of Dentistry, Cairo University.

Results from the current study revealed moderate prevalence of MIH among study sample compared to previous studies, (14.2%). Previous studies done by **Koruyucu et al., 2018** and **Zagdwon et al., 2002** reported comparable prevalence (14.2%) in **Turkey**, (14.6%) **England** in and children respectively. Result that were comparable between different studies may have been due to similar methodologies used as matching age group.

Whereas these result were lower compared with **Wogelius et al., 2008**; **Soviero et al., 2009**; **Balmer et al., 2005** studies showing the prevalence of (37.5%) in **Denmark**, (40%) in **Brazilin** and (44.%) in **Australian** children respectively. Lower result of MIH were observed among **German** children in the study conducted by **Preusser et al., 2007**, (5.9%), **Fleita et al., 2006** (2.9%) in Libya children and **Saber et al., 2015** (2.3%) in **Egyptian children** respectively.

The total number of children with MIH included in this study was **142** participants. The number and percentage of female participants with MIH was **72** and **50.7%**, respectively; the number and percentage of male participants with MIH was **70** and **49.3**, respectively, Male and female participants diagnosed with MIH equal in number (**Alaluusua et al. 1996**).

This study showed that a significantly higher percentage of children with MIH had histories of illnesses during the first four years of their childhood.

Assessing the causes association with presence of MIH in this study sample, the highest associated disease was upper respiratory tract infections (**88.8%**) tonsillitis (**79.9%**) followed by asthmatic bronchitis (**29.1%**), nutritional defects (**4.5%**).

A statistically significant **difference** was found among children have medical problem during first year's old of life. This result meets that finding

of (Alaluusua, 2009, Allazzam, 2014), but it counters the finding of (Whatling, 2008) where no association found.

The number and percentage of MIH children who had dental caries was 112 (78.7 %) While the number and percentage of children with MIH who had no dental caries was 30 (21.1 %).

CONCLUSIONS

From the results of this present study the following conclusions can be made:

- Prevalence of MIH among in this study was 14.2%. with no gender predilection.
- The prevalence of MIH is significantly associated with childhood illnesses during the first year of life (asthma, tonsillitis, fever, and antibiotics intake).
- There is no association between MIH and histories of birth prematurity, birth complications, low birth weight, or breast feeding duration.
- The most common degree of severity of MIH in this studied population was mild degree.
- The most prevalent defect reported in this study was demarcated opacity.
- This study shown a relationship between increased DMF-T and children with MIH compared to those without MIH.
- ❖ Limitation of the study:
 - Study setting may be contributing factor sample taken from university hospital is expected to show higher prevalence of oral and dental problem.
 - This was not possible in the present study as two permanent examiners at the study center would be necessary which could not be fulfilled.
 - Quality of obtained medical information not adequate because Some of parents they did not remember full information.

❖ Recommendations:

- Further population based studies to evaluate the prevalence of MIH in Egyptian children.
- Further prospective studies to evaluate the effect of any disturbance occurring during the prenatal or postnatal periods on the occurrence of MIH in Egyptian children.
- Increase the awareness of pediatric dentists about the prevalence of molar incisor hypomineralization in Egyptian children and how to manage such cases.
- Future studies can overcome this shortcoming using the child's in addition to parents' recollection
- Improve the quality of obtained medical information although it may not contain information on minor illness or treatments not advised by the physician such as the use of over-the-counter medications.

REFERENCES

1. Abhinav N, Shashidhar A, Pentapati k (2016). Prevalence of Molar Incisor Hypomineralization and its Relation with Dental Caries in School Children of Udipi District, South India. European Archives of Paediatric Dentistry.
2. Alaluusua S, Lukinamaa P, Koskimies M (1996). Developmental dental defects associated with long breast feeding. Eur J Oral Sci 104: 493– 497, world Journal of Dentistry DOI:10.5005/jp-journals-10015-1330.
3. Almualllem Z, Busuttill-Naudi A (2018). Molar incisor hypomineralisation british dental journal l-volume 225 no. 7 l Int J Paediatr Dent.
4. Balmer R, Laskey D, Mahoney E, Toumba K (2005). Prevalence of enamel defects and MIH in non-fluoridated and fluoridated communities. Eur J Paediatric Dent; 5: 209-212.
5. Beentjes V, Weerheijm K , Groen H (2002). Factors involved in the etiology of molar-incisor hypomineralisation International Journal of Paediatric Dentistry. 3(1):9-13.
6. Biondi I, Maria del C, Acta O (2010). prevalence of molar-incisor hypomineralization (MIH) in children seeking dental care at the schools of dentistry of the university of

- buenos aires (argentina) *International Journal of Paediatric Dentistry*. 25 n° 2 .224-30.
7. Calderara A, Mej` are, Bergman E (2005).Hypomineralized molars and incisors of unknown origin: treatment outcome at age 18 years,," *International Journal of Paediatric Dentistry*, vol. 15,no.1,pp.20–28.
 8. Cobourne M, Williams A, Harrison M. (2014). A guideline for the extraction of first permanent molars in children. Available www.rcseng.ac.uk.
 9. Da Costa-Silva K et al. (2015). Molar incisor hypomineralization: prevalence, severity and clinical consequences in Brazilian children. *Int J Paediatr Dent*. 20, 426–434.
 10. Daniela h, elisabeth t , ute h , joachim A (2012). a positive relationship between molar incisor hypomineralization and the presence of dental caries. *International, Journal of Pediatric Dentistry*.
 11. Elfrink M et al. (2010). Factors increasing the caries risk of second primary molars in 5-year-old Dutch children. *Int J Paediatr Dent*. 20, 151–157.
 12. Fagrell T, Dietz W, J€alevik B, Noren JG. (2010) . Chemical, mechanicaland morphological properties of hypomineralized enamel of permanent first molars.
 13. FDI Commision on Oral Health,Research and Epidemiology(1992). A review of the development defects of enamel index (DDE Index) *Int Dent J*; 42: 411-426.
 14. Fearn J, Anderson P, Davis (2004). microscopic study of the extent of variations in enamel density in first permanent molars with idiopathic enamel hypomineralisation *Br Dent J*; 196: 634–638.
 15. Fleita D, Ali A, Alalusua S.(2006). Molar-incisor hypomineralisation (MIH) in a group of school-aged children in Benghazi, Libya. *European Archives of Paediatric Dentistry*. 2006: 7; 92-95.
 16. Garcia M, Margarit A, Pizarro J, Montiel (2014). Epidemiologic Study of Molar-Incisor Hypomineralization in 8-Year-Old Spanish Children. *International, Journal of Pediatric Dentistry*.
 17. Ghanim A, Silva M J, Elfrink M E C et al. (2017). Molar incisor hypomineralisation (MIH) training manual for clinical field surveys and practice. *Eur Arch Paediatr Dent*; 18: 225–242.
 18. Grošelj M, Jan J (2013). Molar incisor hypomineralisation and dental caries among children in Slovenia *European Journal of Paediatric Dentistry* vol. 14/3-2013.
 19. Jalevik B, Noren JG. (2000). Enamel hypomineralization of permanent first molars:a morphological study and survey of possible etiological factors. In *J Paediatr Dent* 2000;10: 278-289.
 20. Jan K, Lamiaa K, Yuri M, Katrin R (2017). Relationship between caries experience and demarcated hypomineralized lesions (including MIH) in the permanent dentition of 15-year-olds. *European Journal of Paediatric Dentistry*.
 21. Jalevik B (2010). Centre of Orthodontics and Paediatric Dentistry, Linköping, SwedenPrevalence and Diagnosis of Molar-IncisorHypomineralisation (MIH): A systematic review *European Archives of Paediatric Dentistry* //11.
 22. Jalevik B , Klingberg G (2002). Dental treatment, dental fear and behaviour management problems in children with severe enamel hypomineralization of their permanent first molars. *Int J Paediatr Dent*. 12, 24–32 40.
 23. Johnson D, Kreji C, Hack M, Fanaroff (1984).Distribution of enamel defects and the association with respiratory distress in very low birth weight infants. *J Dent Res* 63(1): 59–64.
 24. Kemoli E (2008). Prevalence of Molar Incisor Hypomineralization in Six to Eight Year-Olds in Two Rural Divisions in Kenya. *European Journal of Pediatric Dentistry*.
 25. Kirthiga M, Poornima P, Praveen R, Gayathri P, Manju M (2015). prevalence and severity of molar incisor hypomineralization in children aged 11-16 years of a city in Karnataka, Davangere,southIndian .*International Journal of Paediatric Dentistry*
 26. Kirkpatrick L , Feeney B (2013). A simple guide to IBM-SPSS for version 20.0 student ed Belmont, calif: wadsworth, cengagelearning. *Eur J PaediatrDent*.
 27. Klein HT, Palmer CE, Knutson JW (1996). Studies on dental caries dental status and dental needs of alimentary school children. *Public Health Rep*; 53:751-65. *European Journal of Pediatric Dentistry*.
 28. Kosma I, Kevrekidou A, Boka V, Arapostathis K, Kotsanos N (2016). Molar incisor hypomineralisation (MIH): correlation with dental caries and dental fear. *Apr*;17(2):123-9. doi: 10.1007/s40368-016-0221-4. Epub 2016 Mar 30.
 29. Koruyucu a, Sevda Ö, Elif B (2018). Prevalence and etiology of molar-incisor hypomineralization (MIH) in the city of Istanbul *J Dent Sci*. 2018 Dec; 13(4): 318–328.(Kotz et al. 2006, Kirkpatrick and Feeney 2013).

30. Lygidakis NA. (2010). Treatment modalities in children with teeth affected by molar-incisor enamel hypomineralization (MIH): A systematic review. *Eur Arch Paediatr Dent*; 11: 65–74.
31. Lygidakis M, et al., (2005). Molar-Incisor-Hypomineralization (MIH) A retrospective Clinical Study in Greek Children. *European Journal of Pediatric Dentistry*.
32. Mathu-Muju K, Wright JT (2006). Diagnosis and treatment of molar incisor hypomineralization. *Compend Contin Educ Dent* 27:604-610.
33. Negre-Barber A (2018). Degree of severity of molar incisor hypomineralization and its relation to dental caries. *European Journal of Paediatric Dentist*
34. Ogden A.R, Pinhasi R, White W.J. (2007). Gross Enamel Hypoplasia in Molars from Subadults in a 16th–18th Century London Graveyard. *International Journal of Paediatric Dentistry* 133:957–966.
35. Parikh A et al., (2010). Prevalence and Characteristics of Molar Incisor Hypomineralization (MIH) in The Child Population Residing in India. *Journal of Indian Society of Pedodontics and Preventive Dentistry*.
36. Parikh D.R , Ganesh M, Bhaskar V. (2012). Prevalence and characteristics of Molar Incisor Hypomineralisation (MIH) in the child population residing in Gandhinagar, Gujarat, India. *European Journal of Paediatric Dentistry*.
37. Proffit WR. (2000). *Contemporary orthodontics*. St. Louis, Missouri: Mosby, Incp. 83.
38. Saber F, Waly N, D. Moheb (2018). Prevalence of molar incisor hypomineralisation in a group of Egyptian children using the short form: a cross-sectional study.
39. Schwendicke F, Elhennawy K , Reda S , Bekes K, Manton D, Krois , (2018). Global burden of molar incisor hypomineralization. *J. Dent.* 68, 10–18.
40. Soviero V, Haubek D, Trindade C, Matta TD, Poulsen S.(2009). Prevalence and distribution of demarcated opacities and their sequelae in permanent 1st molars and incisors in 7 to 13-year-old Brazilian children. *Acta Odontol Scand.* 2009; 67: 170-175.
41. Sonja E. Preusser D, Verena F (2007). Prevalence and Severity of Molar Incisor Hypomineralization in a Region of Germany <https://doi.org/10.1111/j.1752-7325.2007.00040>.
42. Sulaiman A, Sumer M (2014). Molar incisor hypomineralization, Prevalence, and Etiology in Saudi Arabia. *Hindawi Publishing Corporation International Journal of Dentistry*, dx.doi.org/10.1155/2014/234508.
43. Weerheijm KL, Jälevik B, Alaluusua S. (2001). Molar incisor hypomineralization Caries *International Journal of Paediatric Dentistry Res*;35(5):390-391.
44. Weerheijm , Duggal E, Mejareeta I(2003). “Judgment criteria for molar incisor.,vol.4, no.3,pp.110–113,2003. *European Journal of Pediatric Dentistry*.
45. Weerheijm K.L. (2017). Molar Incisor Hypomineralization (MIH): Clinical Presentation, Aetiology and Management. *International Journal of Paediatric Dentistry*.
46. Whatling R, Fearn M.(2008). Molar incisor hypomineralization: a study of etiological factors in a group of UK children. *Int J Paediatr Dent*.
47. William, Louise B, Michael F, (2006) . Molar Incisor Hypomineralization: Review and Recommendations for Clinical Management Vanessa . *International Journal of Paediatric Dentistry*.
48. Wogelius P, Haubek D, Poulsen S. (2008). Prevalence and distribution of demarcated opacities in permanent 1st molars and incisors in 6 to 8-years-old Danish children. *Acta Odontol Scand*; 66: 58-64.
49. Yannam S, Amarlal D , Rekha C (2016). Prevalence of molar incisor hypomineralization in school children aged 8-12 years in Chennai. *Journal of Indian Society of Pedodontics and Preventive Dentistry*, 34(2), p.134.
50. Yin C, et al. (2008). Molar Incisor Hypomineralization in Hong Kong Chinese Children, *International Journal of Paediatric Dentistry*, 18(5), pp.348–352.
51. Zagdwon A, Toumba K, Curzon M (2002).The prevalence of developmental enamel defects in permanent molars in a group of English school children. *Eur J Paed Dent* 3:91-96.