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PREVALENCE OF NON-VITAL MOLARS AND INCISORS IN CHILDREN- A RETROSPECTIVE STUDY

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Abstract

Non vital teeth are irreversibly damaged to the pulp which may be associated with necrotic pulp, pulpless or immature permanent teeth. A dead tooth can be differentiated with a decrease in lightlessness and it is more saturated. Trauma, untreated dental cavities are the most common cause of non-vitality which gradually causes infection and the tooth eventually dies. The aim of this study is to investigate the prevalence of non vital incisors and molars in children. Data collection was done in a private dental university setting. 557 case records were reviewed from which 70 patients were selected fulfilling the inclusion and exclusion criteria.The molars and incisors of those patients were reviewed from records i.e 1120 teeth, from which 96 incisors and molars was found non vital. The following parameters were evaluated based on the dental records : age, gender, non vital molar or incisor and presence of pain or discolouration if any all those datas were gathered. Excel tabulation and SPSS version 23 was used and data was subjected to analysis. Chi square test was done. The level of significance set at $p<0.05$. The results proved that overall prevalence of non vital incisors and molars was 8.6% .Male (75%) had a higher prevalence of non vital incisors and molars than females (25%). The prevalence of non vital teeth among the children peaked at the age groups of 11-14 years. The most frequent associated non vital teeth were found to be 11 and 21. Statistically significant differences between age groups and non vital teeth showed a higher proportion of 11-14 years old patients were associated with non vital teeth than other age groups ($p<0.05$). Within the limits of this study, overall prevalence of non vital incisors and molars in 8 to 18 year old children was 8.6% The highest prevalence of non-vital molars and incisors exhibited in males within the age group of 11-14 years. The most frequently associated non vital teeth were found to be 11 and 21. Male had greater prevalence of non vitality when compared with females. As most of the non vital teeth were found to be asymptomatic,there is a need for regular dental visits which may eliminate the future tooth loss in children.

Keywords : *Children; Dental Trauma; Dental Caries; Non Vital Teeth; Prevalence*

Introduction

Dental caries is “the most common cause of pulp-periapical disease. When the pulp tissue involved in caries becomes irreversibly inflamed and progresses to necrotic, the only treatment option is root canal therapy because the infected necrotic pulp in the root canal system is not accessible to the host’s innate and adaptive immune defense mechanisms and antimicrobial agents. Hence, the infected necrotic pulp tissue must be removed from the canal space by pulpectomy to prevent development or persistence of apical periodontitis” [1]

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The prevalence of dental caries rate in the first permanent molar (FPM) is very high. Studies in the 1980s showed that 50-60% of occlusal surfaces in relation to the first permanent molar were decayed or restored in children aged 11-12 years [2],[3],[4],[5]. Many countries suffer high FPM dental caries rates such as China has 41% [6], Brazil is about 40% [7] and the United Kingdom is around 45-48% [8]. However, the increased use of sealants and fluoride treatments in the United States results in reduction of FPM dental caries rate [6],[9],[10]. In addition to this, enamel hypomineralization is proven to cause dental caries in FPMs, though the main reason behind this is still unclear. Previous literature reported prevalence rate of incisor and molar hypomineralization in a range of 4 to 23% [11],[12]. High rate of dental caries and enamel hypomineralization make FPMs more prone to have deep caries and lead to irreversible damage of the pulp.

There are many studies on the prevalence of dental trauma that varies in different countries. Majority of the studies are cross-sectional except few longitudinal [13],[14],[15]. About 5% of traumas involving all parts of the body are dental traumatic injury (16). 17% of the oral trauma is most frequent in 0 to 6 years old children. 58.6% of dental trauma is observed in permanent dentition and 36.8% is more prevalent in deciduous teeth [17],[18],[19],[20]. Dental injuries are more common in upper anterior teeth and the possible etiologies are increased overjet and incompetent teeth due to proclined teeth. Trauma of dentition is due to sports, falls, road traffic accidents and bicycling [21],[22],[23]. These injuries can be varying from concussion to severe damage of the surrounding teeth structures and periodontal tissue [24],[25],[26].

Dentists are usually in dilemma to decide between root canal treatment and extraction to treat irreversible pulpitis. Some guidelines should be considered before making a decision. The American Academy Of Pediatric Dentistry Guidelines on “Pulp Therapy for Primary and Immature Permanent Teeth” stated that “When the infectious process cannot be arrested by the treatment methods included in this section, bony support cannot be regained, inadequate tooth structure remains for a restoration, or excessive pathologic root resorption exists, extraction should be considered” [27]. This list is applicable when the caries rate is severe and cannot be restorable. FPM that is triggered with less severe problems can be treated with endodontic treatment followed by restoration [28],[29],[30].

In regards to dental trauma, the treatment is highly required skillful performance, adequate knowledge and emergency aid located at the place of injury. Parents or guardians also need to know at least basic knowledge on managing dental traumatic injuries. It is related to a precise diagnosis, proper emergency treatment and correct treatment with follow-ups [31],[32]. Dental traumatic injuries in front teeth are usually treated with root canal treatment to retain their natural teeth. As there is a lack of literature on prevalence of nonvital molars and incisors, this study was planned to explore the prevalence of non vital teeth in relation to molars and incisors among children below the age of 18 years.

MATERIALS AND METHOD

This is a retrospective study carried out from June 2019 to March 2020. It was taking place in Saveetha Dental College and Hospital in relation to the South Indian population. The advantage of this study was better accessibility and visibility. However, it was conducted on a limited time frame and only focused on the Chennai population. Ethical approval for the study was obtained from the Institutional Ethical Committee and covered by the following ethical approval number; SDC/SIHEC/2020/DIASDATA/0619-0320. Case sheets of the patients were reviewed individually and two examiners were involved in this study. The sampling bias was minimized with the simple random sampling and cross verification done by two external reviewers.

557 case records were reviewed from which 70 patients were selected fulfilling the inclusion and exclusion criteria. The molars and incisors of those patients were reviewed from records i.e 1120 teeth, from which 96 incisors and molars was found non vital. Internal validity of this study was random selection of pediatric patients and external validity was defining the eligibility criteria of the sample. The children from 8 to 18 years old with completely erupted non vital teeth were included in the present study. The third molar,partially erupted teeth were excluded. The following criteria were recorded by reviewing the case sheets, age, gender, non vital molar or incisor and presence of pain or discolouration if any. All the data collected were tabulated in MS Excel and incomplete data was eliminated.

Data analysis was carried out using IBM Statistical Package for Social Science (SPSS version 23). The statistical test used for the demographics was frequency distribution. Descriptive statistic was calculated using

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the Chi-square test. P value less than 0.05 was considered as statistically significant. Frequency distribution for non vital teeth was calculated for non vital molars versus non vital incisors cases. The association between age, gender and non vital teeth were investigated by chi square test.

RESULTS

Data collection was done in a private dental university setting. 557 case records were reviewed from which 70 patients were selected fulfilling the inclusion and exclusion criteria. The molars and incisors of those patients were reviewed from records i.e 1120 teeth, from which 96 incisors and molars was found non vital giving the overall prevalence of 8.6%. Among the 96 non-vital teeth incisors were 58 (60.42%) and molars 38(39.58%). The non vital teeth as per age group were tabulated(Figure 1). The most common age group of patients with non-vital molars and incisors was between 11 to 14 years old (39.58%), followed by 15-18 years (31.25%) and the least was 8-10 years (29.17%). Among the 96 patients, 72 (75%) were male and 24 (25%) were female, as displayed in Figure 2. It can be noted from Figure 3 that 36 and 46 teeth were the most involved molars in the overall study population with irreversibly damaged pulp with the percentage of 36.84% and 28.95%, respectively.The only non vital molars found in the sample was 16,36,46,47,26 where the remaining molars 17,27 and 37 were found to be vital in the study sample. Figure 4 shows frequency distribution of non-vital incisors. There is more prevalence for 11 and 21 teeth with the percentage of (44.83%%) and (43.10%) respectively.

Regarding the differences of symptoms associated in only non-vital incisors (Figure 5), there were more proportions of painless and discoloration (52.08%) than pain (2.08%) and painless (6.25%). Likewise, the highest distribution scored by the non-vital molars was painless and discoloration (28.13%), continued by painless (7.29%) and pain (4.17%). Hence, the majority of the non-vital teeth were highly asymptomatic and discoloration when compared to other associated symptoms.

Statistically significant differences between age groups and non-vital molars and incisors in Figure 6 & Table 1 showed a higher prevalence of in age groups of 11-14 years patients were associated with non-vital molars and incisors (p value = 0.002). Based on the distribution of non-vital teeth in gender predilection (Figure 7), there was an increased proportion of males associated with non-vital molars and incisors with no statistical significant difference (p value = 0.435).

Table 1 : shows the association between non-vital teeth based on age groups and gender

Variables	**NON-VITAL TEETH**			**Statistical values**
AGE GROUPS	**INCISORS n(%)**	**MOLARS n(%)**	**TOTAL n(%)**	**Chi square test**
8-10	22 (22.9)	6 (6.2)	28 (29.1)	Pearson Chi Square = 36.6
11-14	22 (22.9)	16 (16.7)	38 (39.6)	
15-18	14 (14.6)	16 (16.7)	30 (31.3)	P value = 0.002*
GENDER				Pearson Chi Square = 7.98
MALE	44 (45.8)	28 (29.2)	72 (75.0)	
FEMALE	14 (14.6)	10 (10.4)	24 (25.0)	P value = 0.435

* statistically significant

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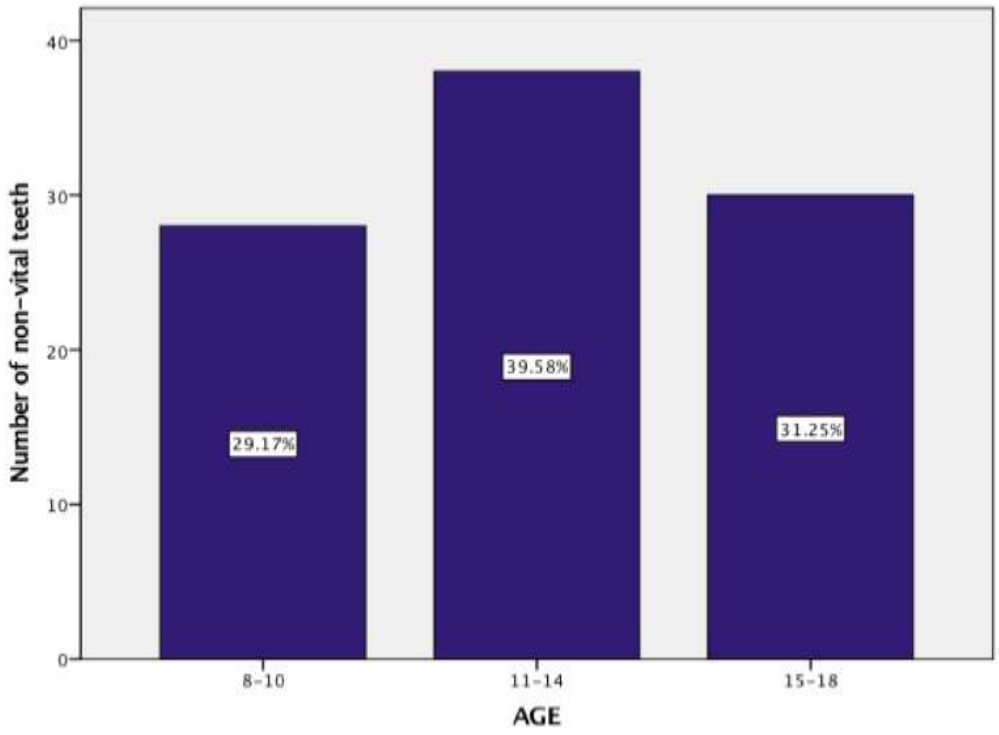

Figure 1 : Bar graph shows the prevalence of non-vital teeth based on age groups. X axis represents age groups and Y axis represents number of non-vital teeth. There is high prevalence among 11-14 years (39.58%).

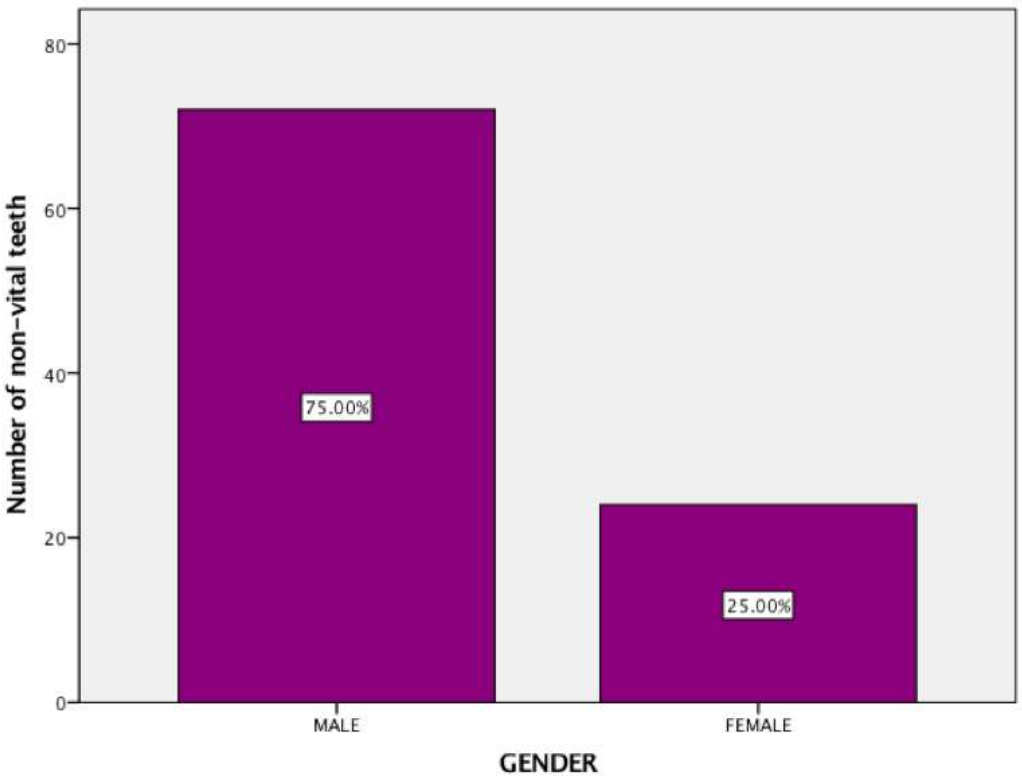

Figure 2 : Bar graph shows the prevalence of non-vital teeth based on gender. X axis represents gender and Y axis represents number of non-vital teeth. There is more prevalence in males (75%) compared to females (25%).

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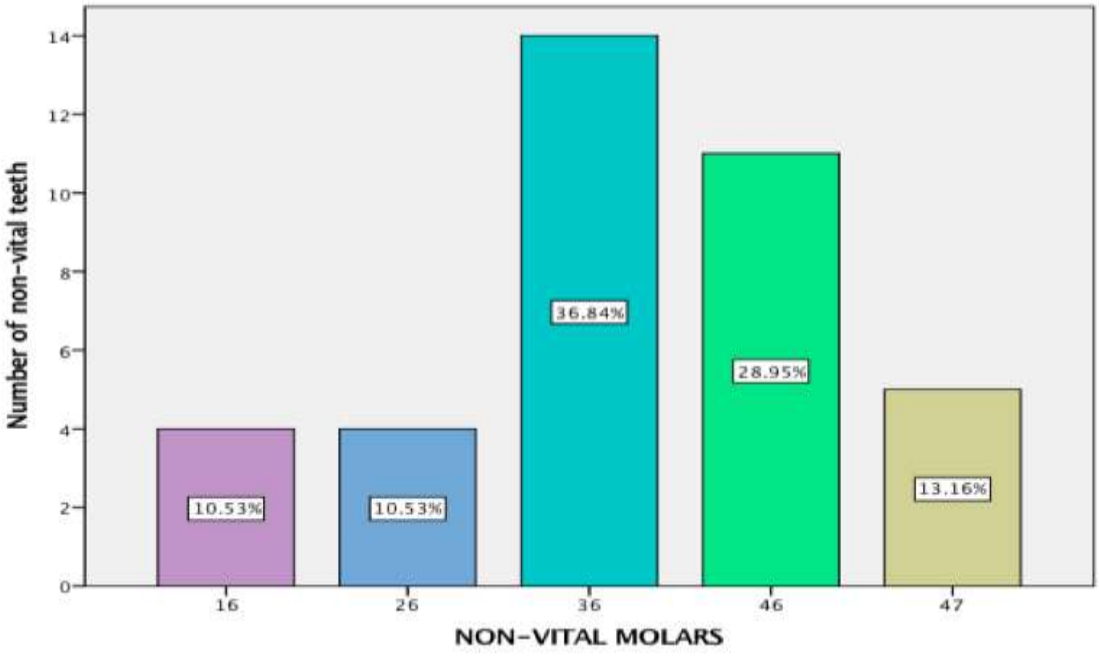

Figure 3 : Bar graph shows frequency Distribution of Non-vital Molar teeth. X axis represents distribution of non-vital molars and Y axis represents number of non-vital teeth. There is more prevalence for 36 and 46 (FDI notation) with the percentage of (36.84%) and (28.95%) respectively .

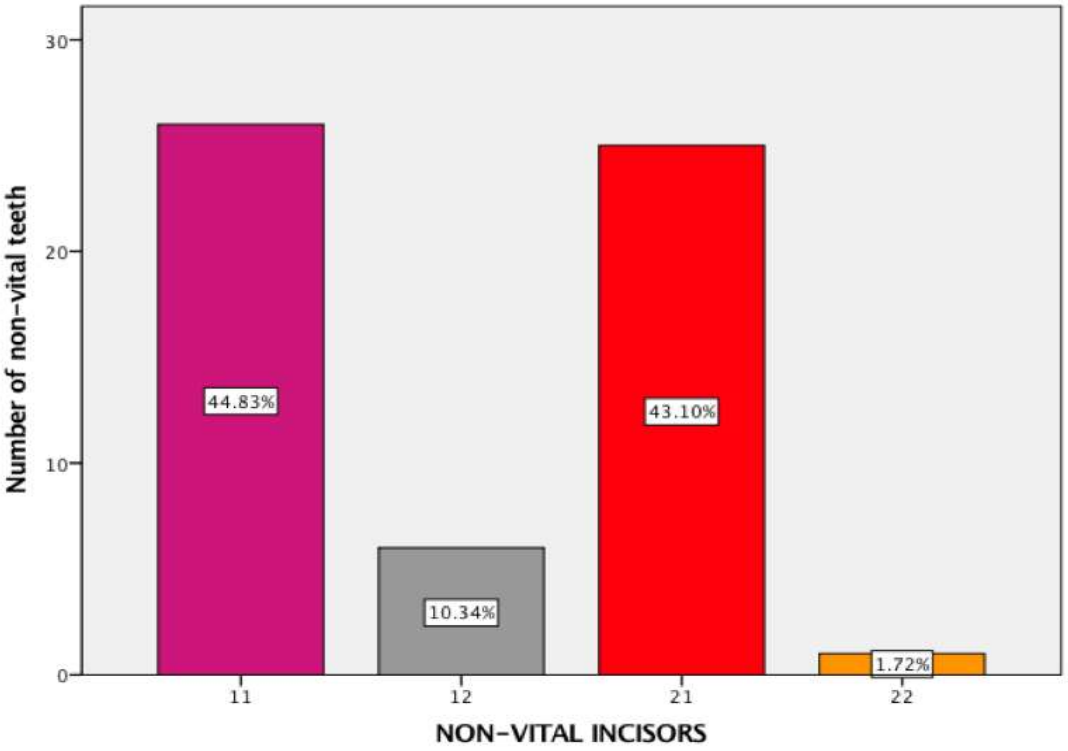

Figure 4 : Bar graph shows frequency Distribution of Non-vital Incisors. X axis represents distribution of non-vital incisors and Y axis represents number of non-vital teeth. There is more prevalence for 11 and 21 (FDI notation) with the percentage of (44.83%%) and (43.10%) respectively .

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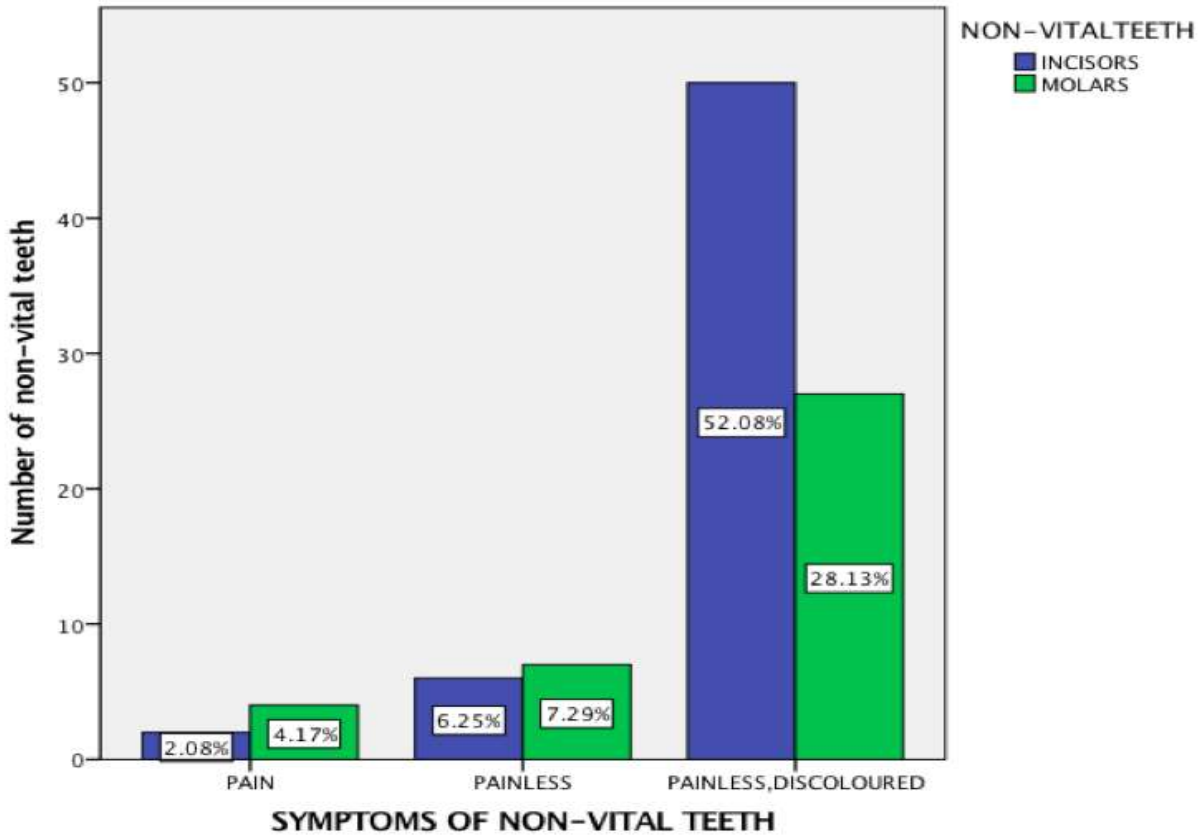

Figure 5 : Bar graph shows frequency distribution of non-vital teeth based on their symptoms. X axis represents symptoms of non-vital teeth and the Y axis represents the number of non-vital teeth (blue - incisors and green - molars). Highest distribution of the symptoms seen was painless and discoloration among incisors (52.08%) and molars (28.13%).

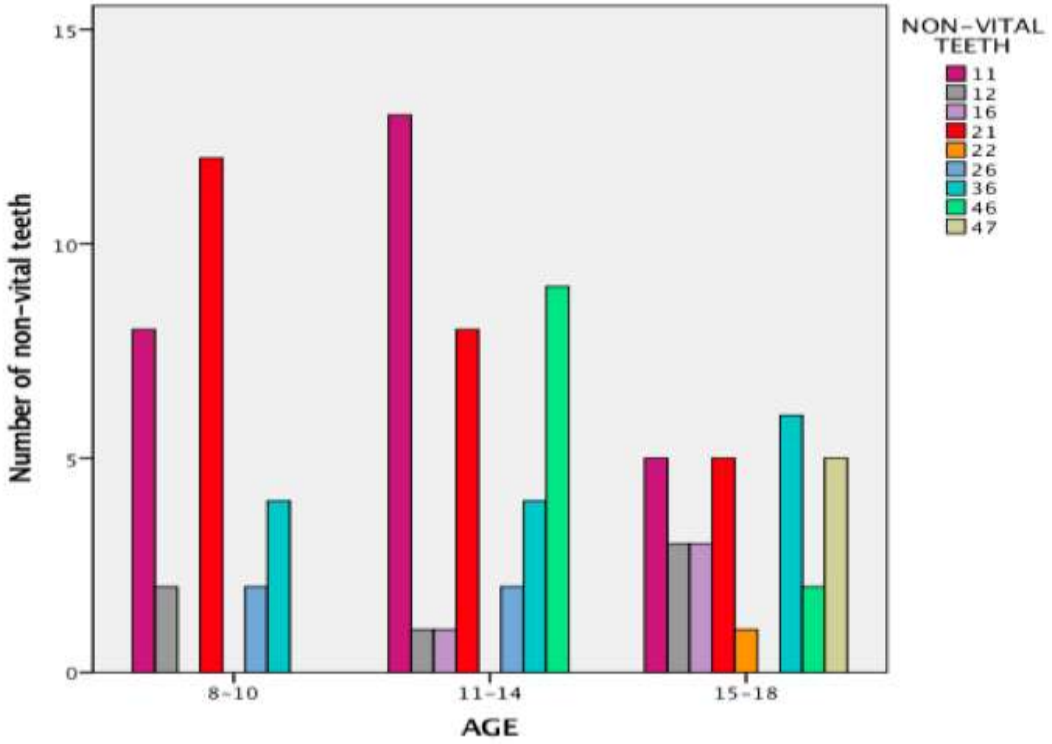

Figure 6 : Bar graph depicts the association between age and non-vital teeth. X axis represents age and the Y axis represents the number of non-vital teeth. There is a significant association between age group and non

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vitality. There is an increase in non-vital 11 and 21 among those patients aged from 8-10 years and 11-14 years (Pearson's Chi-square value - 36.6 ; p = 0.002 (p < 0.05)) which shows statistical significant difference. Incisors have more prevalence of non vitality than molars

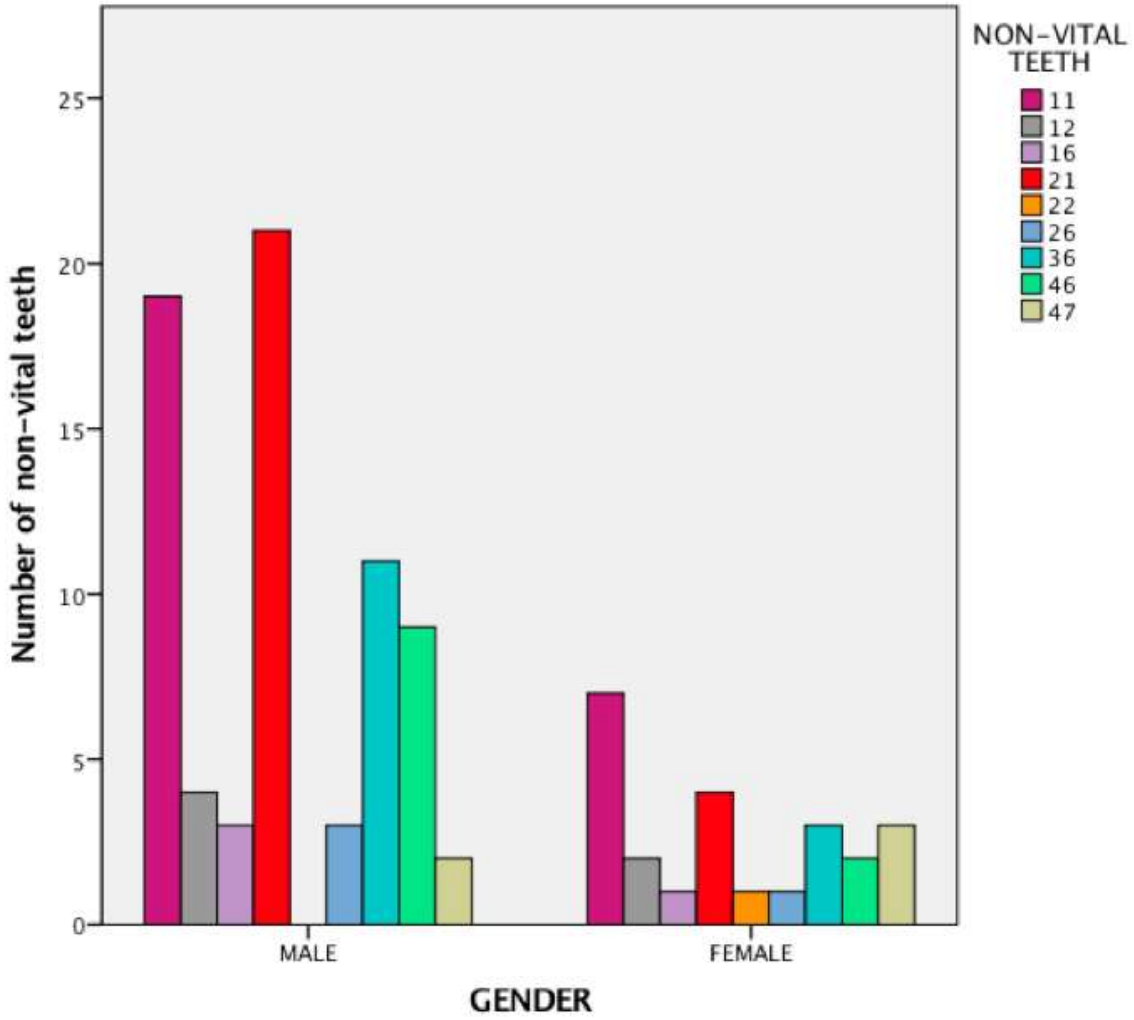

Figure 7 : Bar graph depicts the association between gender and non-vital teeth. X axis represents gender and the Y axis represents the number of non-vital teeth. There is a non significant association between gender and non-vital teeth. There is an increase in non-vital 11 and 21 among male patients. (Pearson's Chi-square value - 7.98 ; p = 0.435 (p > 0.05)) which is statistically not significant. Incisors have more prevalence of non vitality than molars.

DISCUSSION

Dental trauma in permanent and primary teeth is proven to be relatively dependent on the type and causes of the injuries. Oftentimes, displacement of the tooth occurs in trauma related to primary dentition, involving the age group of 0-6 years. Injuries during sports activities and falls were seen most in 7-15 years and dental injuries due to violence seen repeatedly between 21-25 year [31].Dental traumatic injury is commonly seen in young children and it is highly related with non vital pulp in immature permanent incisors. A survey on Children's Dental Health reported a higher prevalence of dental trauma of permanent teeth among which 11% were 12 year olds and 13% was 15 year olds. However, the majority of them were left untreated and only 27% had their root canal treatment done. This can be related with child dental neglect that is seen mostly with parents residing in suburban locations [33].The age peak of having treatment seen was 15 year olds. This is in line with the present study that most age groups involved in non vital teeth were in between 11-14 years. Previous studies over the years showed a variation of their findings. In a study by Altun et al, the highest prevalence of non vital teeth in traumatized children was 8-10 years. Fath-Damia et al found that it was highest at the peak of 12.2 years old. Meanwhile, Eyuboglu observed the highest rate of dental injuries in 8-10 years. According to Diaz et al, the age

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group of 7-9 years old was frequently associated with non vital teeth due to traumatic dental injuries. Lam et al concluded that 92% of dental trauma happens before the age of 34 years [34]. Differences observed in the prevalence of non vital teeth among children could be explained by the different countries, sample size distribution and socioeconomic factors. Statistically significant differences between age groups and non vital teeth showed a higher proportion of in age groups of 11-14 years patients were associated with non vital teeth involving molars and incisors.

Since FPM erupts early into the dental cavity, it is more susceptible to decay while it is still maturing compared to other teeth. Therefore, dental caries rate is significantly high in FPM among the children with increased risk of irreversible pulpitis. In Saudi Arabia, the caries rate in FPM was 66.4% with an average DMFT of 2.74 ± 1.18, suggesting an increase of the prevalence with increasing age. As the decay gradually reaches the pulp, it can cause necrosis if left untreated. The tooth becomes non vital over time and the treatment choice can be either extraction or root canal treatment, depending on the severity of the dental caries. Root canal treatment is often done in teeth with apical closure but this treatment is technique sensitive and sometimes weakens the tooth. In some cases, extraction is easy and convenient to do but it can also be as aggressive as a complicated case. It is the last resort for non vital teeth associated with severe infection and periodontal problems [35] .

In this study, gender predilection showed male patients outnumbered female patients in having non vital teeth. This is in corroborating study by Zaleckiene et al with the statement that boys had higher prevalence of non vital teeth due trauma than girls. Concurrently, previous literature found males experienced dental injuries twice as often as females. The male:female ratio was in the range of 1.5:1.0 to 2.4:1.0. This can be most likely explained by the increased boys participation in sport activities that tend to be more active and energetic. Girls are behaving more mature thereby often having less hard tissue and pulp injury when compared with the boys [31].

The results obtained from this study revealed upper central incisors teeth are more often injured and become non vital. In concordance to this study, an Iranian study produced a similar finding and the prevalence was found to be 27.56%. The maxillary central incisors (66.7%) were affected the most continued by maxillary lateral incisors (17.4%). The anterior teeth in the upper jaw are often affected in both primary and secondary dentition because of their front positions, increase in overjet, open bite and most traumas occur in incomplete lips closure of the patients. Incompetent lips three times increase the severity of the trauma [31].

This study involved the symptoms associated with the non vital teeth which is not published yet. The symptoms associated in non-vital incisors showed more proportions of painless and discoloration (86.2%) than pain (3.4%) and painless (10.3%). In relation to the non-vital molars, the highest distribution scored by the symptom of painless and discoloration (71.1%), continued by painless (18.4%) and pain (10.5%). Hence, the majority of the non-vital teeth were highly asymptomatic and discoloration.

The challenges of this study include the lack of awareness of non vital teeth since most of them are asymptomatic, regular dental visits may eliminate leading to tooth loss which can rather be treated and saved. A basic knowledge regarding emergency treatment of dental traumatic injuries should be instilled among the community which needs immediate treatment without delay. Also awareness about protective gear during sport activities such as mouth guards, face cages and helmets should be encouraged. Considering the rare literature of the similar study, further large-scale studies and multiple risk factors could be considered in future. This will help to promote awareness and encourage more regular dental visits as an early intervention of child dental health.

CONCLUSION

Within the limits of the current study, the overall prevalence of non vital incisors and molars in 8 to 18 year old children was 8.6%. Male had greater prevalence of non vitality when compared with females. The prevalence of non vital teeth among the children peaked at the age groups of 11-14 years. The most frequently associated non

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vital teeth were found to be 11 and 21 .Majority of the non vital teeth were found to be highly asymptomatic. As most of the non vital teeth were found to be asymptomatic,there is a need for regular dental visits which may eliminate the future tooth loss in children.

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AUTHORS CONTRIBUTIONS

Conceptualisation-Nor Masitah and Jessy P; methodology-Nor Masitah and Jessy P; validation-Nor Masitah and Jessy P; statistical analysis- Nor Masitah and Jessy P; draft preparation:-Nor Masitah; supervision and editing-Jessy P;visualisation-Arthi B

CONFLICT OF INTEREST

There was no conflict of interest.

REFERENCES

[1] Ng Y-L, Mann V, Gulabivala K. Outcome of secondary root canal treatment: a systematic review of the literature. Int Endod J [Internet]. 2008 Dec;41(12):1026–46. Available from: http://dx.doi.org/10.1111/j.1365-2591.2008.01484.x

[2] Abernathy JR, Graves RC, Greenberg BG, Bohannan HM, Disney JA. Application of life table methodology in determining dental caries rates. Community Dent Oral Epidemiol [Internet]. 1986 Oct;14(5):261–4. Available from: http://dx.doi.org/10.1111/j.1600-0528.1986.tb01068.x

[3] Jeevanandan G. Kedo-S Paediatric Rotary Files for Root Canal Preparation in Primary Teeth - Case Report. J Clin Diagn Res [Internet]. 2017 Mar;11(3):ZR03–5. Available from: http://dx.doi.org/10.7860/JCDR/2017/25856.9508

[4] Govindaraju L, Jeevanandan G, Subramanian EMG. Comparison of quality of obturation and instrumentation time using hand files and two rotary file systems in primary molars: A single-blinded randomized controlled trial. Eur J Dent [Internet]. 2017 Jul;11(3):376–9. Available from: http://dx.doi.org/10.4103/ejd.ejd_345_16

[5] Benn DK, Watson TF. Changes in the distribution of decayed and filled tooth surfaces and the progression of approximal caries in children between the ages of 11-12 years and 15-16 years. Br Dent J [Internet]. 1988 Jun 25;164(12):377. Available from: http://dx.doi.org/10.1038/sj.bdj.4806466

[6] Cheng R-B, Tao W, Zhang Y, Cheng M, Li Y. [Analysis of the first permanent molar caries epidemiological investigation in area of northeast China]. Hua Xi Kou Qiang Yi Xue Za Zhi [Internet]. 2008 Feb;26(1):73–6. Available from: https://www.ncbi.nlm.nih.gov/pubmed/18357890

[7] Noronha JC, Massara M de L, Souki BQ, Nogueira AP. First permanent molar: first indicator of dental caries activity in initial mixed dentition. Braz Dent J [Internet]. 1999;10(2):99–104. Available from: https://www.ncbi.nlm.nih.gov/pubmed/10863396

[8] Albadri S, Zaitoun H, McDonnell ST, Davidson LE. Extraction of first permanent molar teeth: results from three dental hospitals. Br Dent J [Internet]. 2007 Oct 13;203(7):E14; discussion 408–9. Available from: http://dx.doi.org/10.1038/bdj.2007.679

[9] Somasundaram S, Ravi K, Rajapandian K, Gurunathan D. Fluoride Content of Bottled Drinking Water in Chennai, Tamilnadu. J Clin Diagn Res [Internet]. 2015 Oct;9(10):ZC32–4. Available from:

Received: Sep 2019 | Revised: Oct 2019 | Accepted: Nov 2019

http://dx.doi.org/10.7860/JCDR/2015/14691.6594

[10] Jeevanandan G, Govindaraju L. Clinical comparison of Kedo-S paediatric rotary files vs manual instrumentation for root canal preparation in primary molars: a double blinded randomised clinical trial [Internet]. Vol. 19, European Archives of Paediatric Dentistry. 2018. p. 273–8. Available from: http://dx.doi.org/10.1007/s40368-018-0356-6

[11] William V, Messer LB, Burrow MF. Molar incisor hypomineralization: review and recommendations for clinical management. Pediatr Dent [Internet]. 2006 May;28(3):224–32. Available from: https://www.ncbi.nlm.nih.gov/pubmed/16805354

[12] Govindaraju L, Jeevanandan G, Subramanian EMG. Knowledge and practice of rotary instrumentation in primary teeth among indian dentists: A questionnaire survey [Internet]. Vol. 9, Journal of International Oral Health. 2017. p. 45. Available from: http://dx.doi.org/10.4103/jioh.jioh_4_17

[13] Gabris K, Tarjan I, Rozsa N. Dental trauma in children presenting for treatment at the Department of Dentistry for Children and Orthodontics, Budapest, 1985-1999 [Internet]. Vol. 17, Dental Traumatology. 2001. p. 103–8. Available from: http://dx.doi.org/10.1034/j.1600-9657.2001.017003103.x

[14] Rajab LD. Traumatic dental injuries in children presenting for treatment at the Department of Pediatric Dentistry, Faculty of Dentistry, University of Jordan, 1997-2000 [Internet]. Vol. 19, Dental Traumatology. 2003. p. 6–11. Available from: http://dx.doi.org/10.1034/j.1600-9657.2003.00131.x

[15] Jokic NI, Bakarcic D, Fugosic V, Majstorovic M, Skrinjaric I. Dental trauma in children and young adults visiting a University Dental Clinic [Internet]. Vol. 25, Dental Traumatology. 2009. p. 84–7. Available from: http://dx.doi.org/10.1111/j.1600-9657.2008.00711.x

[16] Eilert-Petersson E Andersson L Sorensen. Traumatic oral vs non-oral injuries. An epidemiological study during one year in a Swedish county. Swed Dent J. 1997;21:55–68.

[17] Marcenes W, Al Beiruti N, Tayfour D, Issa S. Epidemiology of traumatic injuries to the permanent incisors of 9?12-year-old school children in Damascus, Syria [Internet]. Vol. 15, Dental Traumatology. 1999. p. 117–23. Available from: http://dx.doi.org/10.1111/j.1600-9657.1999.tb00767.x

[18] Govindaraju L, Jeevanandan G, Subramanian E. Clinical Evaluation of Quality of Obturation and Instrumentation Time using Two Modified Rotary File Systems with Manual Instrumentation in Primary Teeth. J Clin Diagn Res [Internet]. 2017 Sep;11(9):ZC55–8. Available from: http://dx.doi.org/10.7860/JCDR/2017/30069.10602

[19] Panchal V, Jeevanandan G, Subramanian E. Comparison of instrumentation time and obturation quality between hand K-file, H-files, and rotary Kedo-S in root canal treatment of primary teeth: A randomized controlled trial. J Indian Soc Pedod Prev Dent [Internet]. 2019 Jan;37(1):75–9. Available from: http://dx.doi.org/10.4103/JISPPD.JISPPD_72_18

[20] Granville-Garcia AF, de Menezes VA, de Lira PIC. Dental trauma and associated factors in Brazilian preschoolers [Internet]. Vol. 22, Dental Traumatology. 2006. p. 318–22. Available from: http://dx.doi.org/10.1111/j.1600-9657.2005.00390.x

[21] Årtun J, Behbehani F, Al-Jame B, Kerosuo H. Incisor trauma in an adolescent Arab population: Prevalence, severity, and occlusal risk factors [Internet]. Vol. 128, American Journal of Orthodontics and Dentofacial Orthopedics. 2005. p. 347–52. Available from: http://dx.doi.org/10.1016/j.ajodo.2004.06.032

[22] Christabel SL, Linda Christabel S. Prevalence of Type of Frenal Attachment and Morphology of Frenum in Children, Chennai, Tamil Nadu [Internet]. Vol. 6, World Journal of Dentistry. 2015. p. 203–7. Available from: http://dx.doi.org/10.5005/jp-journals-10015-1343

[23] Traebert J, Bittencourt DD, Peres KG, Peres MA, de Lacerda JT, Marcenes W. Aetiology and rates of treatment of traumatic dental injuries among 12-year-old school children in a town in southern Brazil [Internet]. Vol. 22, Dental Traumatology. 2006. p. 173–8. Available from: http://dx.doi.org/10.1111/j.1600-9657.2006.00359.x

Received: Sep 2019 | Revised: Oct 2019 | Accepted: Nov 2019

[24] Ravikumar D, Jeevanandan G, Subramanian EMG. Evaluation of knowledge among general dentists in treatment of traumatic injuries in primary teeth: A cross-sectional questionnaire study. Eur J Dent [Internet]. 2017 Apr;11(2):232–7. Available from: http://dx.doi.org/10.4103/ejd.ejd_357_16

[25] Govindaraju L, Gurunathan D. Effectiveness of Chewable Tooth Brush in Children-A Prospective Clinical Study. J Clin Diagn Res [Internet]. 2017 Mar;11(3):ZC31–4. Available from: http://dx.doi.org/10.7860/JCDR/2017/24238.9528

[26] Packiri S, Gurunathan D, Selvarasu K. Management of Paediatric Oral Ranula: A Systematic Review. J Clin Diagn Res [Internet]. 2017 Sep;11(9):ZE06–9. Available from: http://dx.doi.org/10.7860/JCDR/2017/28498.10622

[27] American Academy of Pediatric Dentistry. Guideline on pulp therapy for primary and immature permanent teeth. Ped Dent Ref Manu. 2011;33:194–201.

[28] Chen J-W, Leggitt VL. Pulp treatment for young first permanent molars: To treat or to extract? [Internet]. Vol. 23, Endodontic Topics. 2010. p. 34–40. Available from: http://dx.doi.org/10.1111/etp.12002

[29] Subramanyam D, Gurunathan D, Gaayathri R, Vishnu Priya V. Comparative evaluation of salivary malondialdehyde levels as a marker of lipid peroxidation in early childhood caries [Internet]. Vol. 12, European Journal of Dentistry. 2018. p. 067–70. Available from: http://dx.doi.org/10.4103/ejd.ejd_266_17

[30] Fluoride, Fluoridated Toothpaste Efficacy And Its Safety In Children - Review [Internet]. Vol. 10, International Journal of Pharmaceutical Research. 2018. Available from: http://dx.doi.org/10.31838/ijpr/2018.10.04.017

[31] Zaleckiene V, Peciuliene V, Brukiene V, Drukteinis S. Traumatic dental injuries: etiology, prevalence and possible outcomes. Stomatologija [Internet]. 2014;16(1):7–14. Available from: https://www.ncbi.nlm.nih.gov/pubmed/24824054

[32] Nair M, Jeevanandan G, Vignesh R, Subramanian EMG. Comparative evaluation of post-operative pain after pulpectomy with k-files, kedo-s files and mtwo files in deciduous molars -a randomized clinical trial [Internet]. Vol. 21, Brazilian Dental Science. 2018. p. 411. Available from: http://dx.doi.org/10.14295/bds.2018.v21i4.1617

[33] Gurunathan D, Shanmugaavel AK. Dental neglect among children in Chennai. J Indian Soc Pedod Prev Dent [Internet]. 2016 Oct;34(4):364–9. Available from: http://dx.doi.org/10.4103/0970-4388.191420

[34] Duggal M, Jinn Tong H, Al-Ansary M, Twati W, Day PF, Nazzal H. Erratum to: Interventions for the endodontic management of non-vital traumatised immature permanent anterior teeth in children and adolescents: a systematic review of the evidence and guidelines of the European Academy of Paediatric Dentistry [Internet]. Vol. 18, European Archives of Paediatric Dentistry. 2017. p. 153–153. Available from: http://dx.doi.org/10.1007/s40368-017-0292-x

[35] Oa EM, El Meligy OA, Al Nowaiser AM, Al Sheikh LA, Caliwag NO. Decision-making in the Management of Badly Decayed First Permanent Molars in Children and Adolescents [Internet]. Vol. 2, Journal of Dentistry and Oral Care Medicine. 2016. Available from: http://dx.doi.org/10.15744/2454-3276.2.302

[36] Farhat Yaasmeen Sadique Basha , Rajeshkumar S , Lakshmi T ,Anti-inflammatory activity of Myristica fragrans extract . Int. J. Res. Pharm. Sci., 2019 ;10(4), 3118-3120 DOI: https://doi.org/10.26452/ijrps.v10i4.1607

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