International Journal of Dentistry and Oral Science (IJDOS)
ISSN: 2377-8075

Association of Age and Gender of Patients Who Underwent Perforation Repair Done in Mandibular First Molar

Research Article

Sandhya. A[1], S. Delphine Priscilla Antony[2*], Senthil Murugan. P[3]

[1] Saveetha Dental College and Hospital, Saveetha Institute of Medical and Technical Sciences (SIMATS), Saveetha University, Chennai 600077, Tamil Nadu, India.
[2] Senior Lecturer, Department of Conservative and Endodontics, Saveetha Dental College and Hospital, Saveetha Institute of Medical and Technical Sciences (SIMATS), Saveetha University, Chennai 600077, Tamil Nadu, India.
[3] Associate Professor, Department of Oral and Maxillofacial Surgery, Saveetha Dental College and Hospital, Saveetha Institute of Medical and Technical Sciences (SIMATS), Saveetha University, Chennai 600077, Tamil Nadu, India.

Abstract

Perforation is an artificial communication between the root canal system and supporting tissues of the teeth. Root perforation complicates the treatment and deprives the prognosis if not properly managed. Literature shows many reviews on diagnosis, treatment plan and factors affecting prognosis of perforation repair; but none of these articles elaborated upon age and gender association of patients undergoing perforation repair. The present article aims to evaluate the association between age and gender of patients who underwent perforation repair in mandibular first molar. The study sample consists of all patients between the age group 18-60 years who underwent perforation repair in mandibular first molar from June 2019 – April 2020 at the SDC. The data collected were analysed for the number, age, gender and material used for perforation repair. For a comparison between different variables, statistical package IBM SPSS version 21.0, SPSS, Chicago II, USA software analyzer was used and the statistics were obtained. Chi - square analysis was done and there was no statistically significant association between age and gender. (Pearson chi - square value: 0.027, df: 1, p-value: 0.869>0.05) Whereas there is a statistically significant association between gender and tooth number. (Pearson chi - square value: 4.267, df: 1, p-value: 0.039<0.05) In this study, we can contemplate that females have undergone more perforation repair when compared to males. Whereas, people of age groups 30-60 years have undergone more perforation repair in the mandibular first molar. In addition, bio aggregate material is the most used perforation repair material when compared to RMGIC and GIC. Within the limitations, the age group 30 years and above underwent more perforation repair in the mandibular first molar than the age group 18-30 years. The female population seems to have undergone more perforation repair in the mandibular first molar.

Keywords: Age; Bio Aggregate Material; Gender; Mandibular 1St Molar; Perforation Repair.

Introduction

Root perforations can occur pathologically as a result of resorption and caries or iatrogenically during root canal treatment [28]. Such perforations might compromise the treatment outcome and persist as a significant complication if not repaired. Perforation might occur during preparation of access cavities, post space or may occur as a result of extension of internal resorption into peri radicular tissues [2]. In multi-rooted teeth where the furcation is perforated, the prognosis differs according to the factors described for single-rooted teeth.

Accidental root perforations do occur in approximately 2–12% of endodontically treated teeth that might have serious implications [13, 48, 19, 23, 51, 9]. This perforation acts as an open channel encouraging bacterial entry either from root canal or periodontal tissues or both eliciting inflammatory response that results in fistulae including bone resorptive processes may follow. When perforation occurs laterally or in the furcation area there might be overgrowth of gingival epithelium towards the perforation site worsening prognosis of the tooth [54].

***Corresponding Author**:
Dr. S. Delphine Priscilla Antony,
Senior Lecturer, Department of Conservative and Endodontics, Saveetha Dental College and Hospital, Saveetha Institute of Medical and Technical Sciences (SIMATS), Saveetha University, Chennai 600077, Tamil Nadu, India.
Tel: +91-9790856274.
E-mail: delphine.sdc@saveetha.com

Received: July 30, 2021
Accepted: August 11, 2021
Published: August 18, 2021

Citation: Sandhya. A, S. Delphine Priscilla Antony, Senthil Murugan. P. Association of Age and Gender of Patients Who Underwent Perforation Repair Done in Mandibular First Molar. *Int J Dentistry Oral Sci.* 2021;8(8):3906-3910. doi: http://dx.doi.org/10.19070/2377-8075-21000799

Sufficient data is available regarding the prognosis of a tooth with perforation defects. Factors determining the prognosis include size and location of the defect, time, duration of exposure to contamination, the material used to repair it, the possibility of sealing the perforation and the accessibility to the main canal [16, 4].

The different material used to seal the perforation includes amalgam, gutta-percha, zinc oxide and glass ionomer cements, calcium hydroxide, composites were used. Newer materials such as MTA, biodentine, dentin chips, bioceramics, calcium enriched material, with and without the use of barrier could be used to seal the perforation [35]. Bio aggregate is a bio ceramic material composed of tricalcium silicate, dicalcium silicate, calcium phosphate monobasic, amorphous silicon dioxide and tantalumpent oxide [49]. It induces mineralized tissue formation and precipitation of apatite crystals that become larger with increasing immersion time suggesting it to be bioactive. It has comparable biocompatibility and sealing ability to MTA [59]. In a study by Hashem et al., concluded that MTA is more influenced by acidic pH than bio aggregate when used as perforation repair material [12].

Factors of significance to the prognosis for treatment are time, size, and shape of the perforation as well as its location impacts the potentials to control infection at the perforation site. The factor that is within the control of the operator is the choice of material to be utilized for furcation repair. Certain studies were done in the institutions (Ramamoorthi, Nivedhitha and Divyanand, 2015 [38]; Ramanathan and Solete, 2015 [40]; Noor, S Syed Shihaab and Pradeep, 2016 [29]; Kumar and Delphine Priscilla Antony, 2018 [22]; Manohar and Sharma, 2018 [24]; Nasim and Nandakumar, 2018 [27]; Nasim et al., 2018 [26]; Ramesh, Teja and Priya, 2018 [42]; Ravinthar and Jayalakshmi, 2018 [43]; Rajendran et al., 2019 [36]; R, Rajakeerthi and Ms, 2019 [45]; Siddique and Jayalakshmi, 2019 [50]; Teja. K., 2019 [53]; Janani, Palanivelu and Sandhya, 2020 [15]; Jose, P. and Subbaiyan, 2020 [17]). Frequently, the cause is iatrogenic as a result of the misaligned use of rotary burs amid endodontic access preparation and search for root canal orifices.

Previously our team has a rich experience in working on various research projects across multiple disciplines. (Jain, 2017 [14]); (Varghese, Ramesh and Veeraiyan, 2019 [55]); (Ashok and Ganapathy, 2019 [2]); (Padavala and Sukumaran, 2018 [30]); (Ke et al., 2019 [20]); (Ezhilarasan, 2018 [6]); (Krishnan et al., 2018 [21]); (Ezhilarasan, Sokal and Najimi, 2018 [8]); (Pandian, Krishnan and Kumar, 2018 [32]); (Ramamurthy and Mg, 2018 [39]); (Gupta, Ariga and Deogade, 2018 [11]); (Vikram et al., 2017 [58]); (Paramasivam, Vijayashree Priyadharsini and Raghunandhakumar, 2020 [33]); (Palati et al., 2020 [31]); (Samuel, Acharya and Rao, 2020 [47]). Now the growing trend in this area motivated us to pursue this project.

Thus this study aims to evaluate age and gender of patients who underwent perforation repair and also the material predominantly used.

Materials and Methods

Study Setting and Sampling:

This study is a single-center retrospective study, carried out in the Department of Conservative and endodontic dentistry at the SDC. The pro of the study includes flexibility of the study, less time consumption and accessibility. The cons of the study are limitations in the population group. Our study was approved by the ethical board of Saveetha dental college – Institutional ethical committee [IEC]. Ethical approval number SDC/SIHEC/2020/DIASDATA/0619-0320. All available records of endodontic patients treated from June 2019 – April 2020, were examined and included in our data collection. A total of 16 case sheets were reviewed. The data was cross verified by another examiner to avoid errors. Cross verification of data was done using photographs and RVGs. Sampling bias was minimized by verifying the photographs and radiographs by an external reviewer. Simple random sampling was done to minimize sampling bias. It was generalized to the south Indian population. Two examiners were involved in the study.

Data Collection/Tabulation:

After verification acquisition of data was done from the hospital digital database which records all patients details such as name, age, gender, tooth number and the number of patients undergoing perforation repair in mandibular first molar were tabulated in Microsoft Excel. The data was then entered in excel manually and imported to SPSS for analysis. Incomplete data and radiographs which were not adequate diagnostic accuracy were excluded from the study.

Statistical Analysis:

Descriptive statistics were used to summarize the demographic information of the patients included in this study. Descriptive statistics is used for the acquisition of frequency of distribution of the data. The number of patients underwent perforation repair in mandibular first molar and clinical variables such as gender, and age at the start of treatment were collected. The statistical analysis was done using SPSS software (SPSS version 21.0, SPSS, Chicago II, USA). The data was analyzed using a chi- square test. The p value of less than 0.05 was considered to be statistically significant.

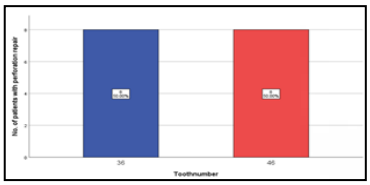
Results & Discussion

It is observed that there is an equal number of patients undergone perforation repair in 36 and 46 (50%). (Graph 1) A higher number of patients who have undergone perforation repair were above 30 years of age (81.25%).(Graph 2) The graph shows that 37.50% of males and 62.50% of females have undergone perforation repair in the mandibular first molar. From which it is observed that females have undergone more perforation repair in the mandibular first molar when compared to males. (Graph 3) Out of 16 patients 13 of them have undergone perforation repair with bio aggregate material (81.25%), 2 of them with RMGIC (12.50%) and remaining 1 of them with GIC(6.255). From the chart it is observed that most of the patients were treated using the bio aggregate repair material.(81.25%) (Graph 4) It is observed that people of age group above 30 years have undergone more perforation repair than people of 18-30 years There was no significant difference between age and tooth number. (Graph 5) chi square analysis was done and P value was 0.039. This depicts that there is statistically significant association between gender

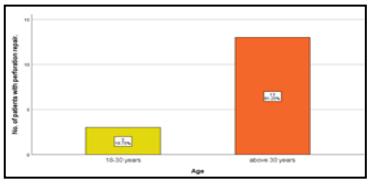
Table 1: This table shows that out of 16 patients 7 female patients and 1 male patient have undergone perforation repair in 36 and 5 male patients and 3 female patients have undergone perforation repair in 46. Female patients had undergone more perforation repair in the mandibular first molar when compared to male patients. P value was 0.039. This depicts that there is statistically significant association between gender and tooth number. (p value: 0.039<0.005).

		gender		Total	Chi-square value	P value
		male	female			
Tooth number	36	1	7	8		
	46	5	3	8	4.267	0.039
Total		6	10	16		

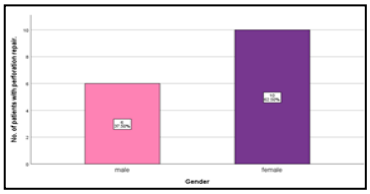
Graph 1: The Bar chart shows the frequency of tooth wise distribution of study population. X axis represents the tooth number - 36 & 46. Y Axis represents the number of patients with perforation repair. It is observed that high prevalence was noted in both 36 - 50% and 46 - 50%.



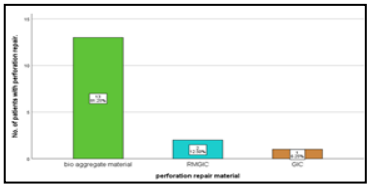
Graph 2: The Bar chart shows the frequency of age wise distribution of study population. X Axis represents the age group ranging - 18-30 years and above 30 years. Y Axis represents the number of patients with perforation repair. The highest frequency was noted at the age group above 30 years 81.25% followed by 18-30 years 18.75%.



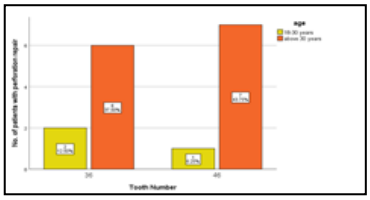
Graph 3: The Bar chart shows the frequency of gender wise distribution of study population. X Axis represents the gender - males and females. Y Axis represents the number of patients undergone perforation repair. The highest frequency was noted in females - 62.50% followed by males - 37.50%.



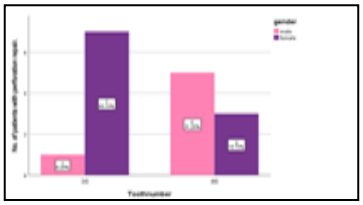
Graph 4: The Bar chart shows the frequency of perforation repair material. X Axis represents the perforation repair material - bio aggregate material; RMGIC; GIC. Y Axis represents the number of patients undergone perforation repair. It was observed that higher frequency was noted with bio aggregate - 81.25% followed by RMGIC - 12.50% and GIC 6.25%.



Graph 5: The Bar chart represents the association between gender and teeth number. X Axis represents the tooth number and Y Axis represents the age. It is observed that people of age group above 30 years have undergone more perforation repair than people of 18-30 years There was no significant difference between age and tooth number.(Chi-Square test, p value:0.522 (p>0.05 statistically non-significant)).



Graph 6: The Bar chart represents the association between gender and teeth number. X Axis represents the tooth number and Y Axis represents the number of patients undergone perforation repair. It is observed that a higher number of female patients have undergone perforation repair than male patients There was a significant difference between gender and tooth number.(Chi-Square test, p value:0.039 (p<0.05 statistically significant)).



and tooth number. (p value: 0.039<0.005).(Table 1) It is observed that females (43.75%) have undergone more perforation repair in 36 than males (6.25%). The male populations (31.25%) have undergone more perforation repair in 46 than the female population (18.75%). (Graph 6).

The etiology of root perforations can be pathological, i.e. secondary to resorption or caries, or iatrogenic, occurring during root canal treatment. Approximately 2–12% of endodontically treated teeth show accidental root perforations. These act as an open channel between the root canal and surrounding periodontium facilitating bacterial entry. When the perforation occurs laterally or in the furcation area, it might be followed by an overgrowth of gingival epithelium towards the perforation site. Perforations may occur during access cavity preparation, post space preparation or as a result of pathological internal resorption extending into the periradicular tissues [12].

In this study, the female population had undergone more perforation repair in the mandibular first molar. The perforation may occur during access cavity preparation, post space preparation or as a result of pathological internal resorption extending into the peri radicular tissues. Fuss & Trope have proposed a classification of root perforations based on the level at which the defect occurs [10].

The people of age groups 30-60 years have more Root, furcal perforation and have undergone perforation repair in the mandibular first molar. This can be overcome by Kvinnsland [23] found that attempts to negotiate calcified canals resulted in 42% of the reported perforations in their study.

The life of an endodontically treated tooth is associated with correct diagnosis and treatment planning, root canal shaping, sanitization, sealing, and, lastly, tooth rehabilitation. The successful treatment of a root perforation depends on certain factors, like sealing material, perforation extent and location, time between diagnosis and treatment, presence of contamination and related operator experience, presence of preoperative lesions, communication of the perforation with the oral environment, and type and quality of the final restoration. The material recommended for treatment of root canal perforations should have good physicochemical and biological properties, proper sealing capacity, antimicrobial activity and osteogenic potential [5].

In this study, bio aggregate material is predominantly used as perforation materials when compared to GIC and RMGIC. The sealing ability and biocompatibility of bio aggregate is compared to that of the MTA which has been considered as an ideal material for perforation repair, apexification etc [18].

Our institution is passionate about high quality evidence based research and has excelled in various fields ((Pc, Marimuthu and Devadoss, 2018 [34]; Ramesh et al., 2018 [41]; Vijayashree Priyadharsini, Smiline Girija and Paramasivam, 2018 [57]; Ezhilarasan, Apoorva and Ashok Vardhan, 2019 [7]; Ramadurai et al., 2019 [37]; Sridharan et al., 2019 [52]; Vijayashree Priyadharsini, 2019 [56]; Chandrasekar et al., 2020 [3]; Mathew et al., 2020 [25]; R et al., 2020 [44]; Samuel, 2021 [46]). We hope this study adds to this rich legacy.

Conclusion

Within the limitations of the current study, the age group 30years and above underwent more perforation repair in the mandibular first molar than the age group 18-30 years. There is no statistically significant difference between the age and gender of the patients who underwent perforation repair in mandibular first molar. The female population seems to have undergone more perforation repair in the mandibular first molar. There is statistically significant difference between the gender and tooth number of the patients who underwent perforation repair in mandibular first molar.

References

[1]. A, P. A. et al. (2012) 'Endodontic Management of C-Shaped Root Canal System in Mandibular First Molar: A Rare Case Report', International Journal of Scientific Research, pp. 316–317.

[2]. Ashok V, Ganapathy D. A geometrical method to classify face forms. J Oral Biol Craniofac Res. 2019 Jul-Sep;9(3):232-235. doi: 10.1016/j.jobcr.2019.06.001. Pubmed PMID: 31198677.

[3]. Chandrasekar R, Chandrasekhar S, Sundari KKS, Ravi P. Development and validation of a formula for objective assessment of cervical vertebral bone age. Prog Orthod. 2020 Oct 12;21(1):38. Pubmed PMID: 33043408.

[4]. ElDeeb ME, ElDeeb M, Tabibi A, Jensen JR. An evaluation of the use of amalgam, Cavit, and calcium hydroxide in the repair of furcation perforations. J Endod. 1982 Oct;8(10):459-66. Pubmed PMID: 6958784.

[5]. Estrela C, Decurcio DA, Rossi-Fedele G, Silva JA, Guedes OA, Borges ÁH. Root perforations: a review of diagnosis, prognosis and materials. Braz Oral Res. 2018 Oct 18;32(suppl 1):e73. Pubmed PMID: 30365614.

[6]. Ezhilarasan D. Oxidative stress is bane in chronic liver diseases: Clinical and experimental perspective. Arab J Gastroenterol. 2018 Jun;19(2):56-64. Pubmed PMID: 29853428.

[7]. Ezhilarasan D, Apoorva VS, Ashok Vardhan N. Syzygium cumini extract induced reactive oxygen species-mediated apoptosis in human oral squamous carcinoma cells. J Oral Pathol Med. 2019 Feb;48(2):115-121. Pubmed PMID: 30451321.

[8]. Ezhilarasan D, Sokal E, Najimi M. Hepatic fibrosis: It is time to go with hepatic stellate cell-specific therapeutic targets. Hepatobiliary Pancreat Dis Int. 2018 Jun;17(3):192-197. Pubmed PMID: 29709350.

[9]. Farzaneh M, Abitbol S, Lawrence HP, Friedman S; Toronto Study. Treatment outcome in endodontics-the Toronto Study. Phase II: initial treatment. J Endod. 2004 May;30(5):302-9. Pubmed PMID: 15107640.

[10]. Fuss Z, Trope M. Root perforations: classification and treatment choices based on prognostic factors. Endod Dent Traumatol. 1996 Dec;12(6):255-64. Pubmed PMID: 9206372.

[11]. Gupta P, Ariga P, Deogade SC. Effect of Monopoly-coating Agent on the Surface Roughness of a Tissue Conditioner Subjected to Cleansing and Disinfection: A Contact Profilometric In vitro Study. Contemp Clin Dent. 2018 Jun;9(Suppl 1):S122-S126. Pubmed PMID: 29962776.

[12]. Hashem AA, Wanees Amin SA. The effect of acidity on dislodgment resistance of mineral trioxide aggregate and bioaggregate in furcation perforations: an in vitro comparative study. J Endod. 2012 Feb;38(2):245-9. Pubmed PMID: 22244646.

[13]. INGLE JI. A standardized endodontic technique utilizing newly designed instruments and filling materials. Oral Surg Oral Med Oral Pathol. 1961 Jan;14:83-91. Pubmed PMID: 13717698.

[14]. Jain AR. Prevalence of partial edentulousness and treatment needs in rural population of South India. World J Dent. 2017 Jun;8(3):213-7.

[15]. Janani K, Palanivelu A, Sandhya R. Diagnostic accuracy of dental pulse oximeter with customized sensor holder, thermal test and electric pulp test for the evaluation of pulp vitality: an in vivo study. Brazilian dental science. 2020 Jan 31;23(1):8-p.

[16]. Jew RC, Weine FS, Keene JJ Jr, Smulson MH. A histologic evaluation of periodontal tissues adjacent to root perforations filled with Cavit. Oral Surg Oral Med Oral Pathol. 1982 Jul;54(1):124-35. doi: 10.1016/0030-4220(82)90427-3. PMID: 6956820.

[17]. Jose J, Subbaiyan H. Different treatment modalities followed by dental practitioners for Ellis class 2 fracture–A questionnaire-based survey. The open dentistry journal. 2020 Feb 18;14(1).

[18]. Kakani AK, Veeramachaneni C, Majeti C, Tummala M, Khiyani L. A review on perforation repair materials. Journal of clinical and diagnostic research: JCDR. 2015 Sep;9(9):ZE09.

[19]. Kerekes K, Tronstad L. Long-term results of endodontic treatment per-

formed with a standardized technique. J Endod. 1979 Mar;5(3):83-90. Pubmed PMID: 296248.
[20]. Ke Y, Al Aboody MS, Alturaiki W, Alsagaby SA, Alfaiz FA, et al. Photosynthesized gold nanoparticles from Catharanthus roseus induces caspase-mediated apoptosis in cervical cancer cells (HeLa). Artif Cells Nanomed Biotechnol. 2019 Dec;47(1):1938-1946. Pubmed PMID: 31099261.
[21]. Krishnan RP, Ramani P, Sherlin HJ, Sukumaran G, Ramasubramanian A, Jayaraj G, Don KR, Santhanam A. Surgical Specimen Handover from Operation Theater to Laboratory: A Survey. Ann Maxillofac Surg. 2018 Jul-Dec;8(2):234-238. Pubmed PMID: 30693238.
[22]. Kumar D, Antony S. Calcified canal and negotiation-A review. Research Journal of Pharmacy and Technology. 2018;11(8):3727-30.
[23]. Kvinnsland I, Oswald RJ, Halse A, Grønningsaeter AG. A clinical and roentgenological study of 55 cases of root perforation. Int Endod J. 1989 Mar;22(2):75-84. Pubmed PMID: 2599663.
[24]. Manohar MP, Sharma S. A survey of the knowledge, attitude, and awareness about the principal choice of intracanal medicaments among the general dental practitioners and nonendodontic specialists. Indian J Dent Res. 2018 Nov-Dec;29(6):716-720. Pubmed PMID: 30588997.
[25]. Mathew MG, Samuel SR, Soni AJ, Roopa KB. Evaluation of adhesion of Streptococcus mutans, plaque accumulation on zirconia and stainless steel crowns, and surrounding gingival inflammation in primary molars: randomized controlled trial. Clin Oral Investig. 2020 Sep;24(9):3275-3280. doi: 10.1007/s00784-020-03204-9. Pubmed PMID: 31955271.
[26]. Hussainy SN, Nasim I, Thomas T, Ranjan M. Clinical performance of resin-modified glass ionomer cement, flowable composite, and polyacid-modified resin composite in noncarious cervical lesions: One-year follow-up. J Conserv Dent. 2018 Sep-Oct;21(5):510-515. Pubmed PMID: 30294112.
[27]. Nandakumar M, Nasim I. Comparative evaluation of grape seed and cranberry extracts in preventing enamel erosion: An optical emission spectrometric analysis. J Conserv Dent. 2018 Sep-Oct;21(5):516-520. Pubmed PMID: 30294113.
[28]. NICHOLLS E. Treatment of traumatic perforations of the pulp cavity. Oral Surg Oral Med Oral Pathol. 1962 May;15:603-12. Pubmed PMID: 14479440.
[29]. Noor SS. Chlorhexidine: Its properties and effects. Res J Pharm Technol. 2016;9(10):1755-60.
[30]. Padavala S, Sukumaran G. Molar Incisor Hypomineralization and Its Prevalence. Contemp Clin Dent. 2018 Sep;9(Suppl 2):S246-S250. Pubmed PMID: 30294152.
[31]. Palati S, Ramani P, Shrelin HJ, Sukumaran G, Ramasubramanian A, Don KR, Jayaraj G, Santhanam A. Knowledge, Attitude and practice survey on the perspective of oral lesions and dental health in geriatric patients residing in old age homes. Indian J Dent Res. 2020 Jan-Feb;31(1):22-25. Pubmed PMID: 32246676.
[32]. Pandian KS, Krishnan S, Kumar SA. Angular photogrammetric analysis of the soft-tissue facial profile of Indian adults. Indian J Dent Res. 2018 Mar-Apr;29(2):137-143. Pubmed PMID: 29652003.
[33]. Paramasivam A, Vijayashree Priyadharsini J, Raghunandhakumar S. N6-adenosine methylation (m6A): a promising new molecular target in hypertension and cardiovascular diseases. Hypertens Res. 2020 Feb;43(2):153-154. Pubmed PMID: 31578458.
[34]. J PC, Marimuthu T, C K, Devadoss P, Kumar SM. Prevalence and measurement of anterior loop of the mandibular canal using CBCT: A cross sectional study. Clin Implant Dent Relat Res. 2018 Aug;20(4):531-534. Pubmed PMID: 29624863.
[35]. Rajablou N, Azimi S. An in vitro comparative SEM study of marginal adaptation of IRM, light- and chemically-cured glass ionomer, and amalgam in furcation perforations. Aust Endod J. 2001 Dec;27(3):119-22. Pubmed PMID: 12360666.
[36]. Rajendran R, Kunjusankaran RN, Sandhya R, Anilkumar A, et al. Comparative evaluation of remineralizing potential of a paste containing bioactive glass and a topical cream containing casein phosphopeptide-amorphous calcium phosphate: An in vitro study. Pesquisa brasileira em odontopediatria e clinica integrada. 2019 Oct 10;19.
[37]. Ramadurai N, Gurunathan D, Samuel AV, Subramanian E, Rodrigues SJL. Effectiveness of 2% Articaine as an anesthetic agent in children: randomized controlled trial. Clin Oral Investig. 2019 Sep;23(9):3543-3550. Pubmed PMID: 30552590.
[38]. Ramamoorthi S, Nivedhitha MS, Divyanand MJ. Comparative evaluation of postoperative pain after using endodontic needle and EndoActivator during root canal irrigation: A randomised controlled trial. Aust Endod J. 2015 Aug;41(2):78-87. Pubmed PMID: 25195661.
[39]. Ramamurthy JA, Mg V. Comparison of effect of Hiora mouthwash versus Chlorhexidine mouthwash in gingivitis patients: A clinical trial. Asian J Pharm Clin Res. 2018 Jul 7;11(7):84-8.
[40]. Ramanathan S, Solete P. Cone-beam Computed Tomography Evaluation of Root Canal Preparation using Various Rotary Instruments: An in vitro Study. The journal of contemporary dental practice. 2015 Nov 1;16(11):869-72.
[41]. Ramesh A, Varghese S, Jayakumar ND, Malaiappan S. Comparative estimation of sulfiredoxin levels between chronic periodontitis and healthy patients–A case-control study. Journal of periodontology. 2018 Oct;89(10):1241-8.
[42]. Teja KV, Ramesh S, Priya V. Regulation of matrix metalloproteinase-3 gene expression in inflammation: A molecular study. J Conserv Dent. 2018 Nov-Dec;21(6):592-596. Pubmed PMID: 30546201.
[43]. Ravinthar K. Recent advancements in laminates and veneers in dentistry. Research Journal of Pharmacy and Technology. 2018;11(2):785-7.
[44]. R H, Ramani P, Ramanathan A, R JM, S G, Ramasubramanian A, K M. CYP2 C9 polymorphism among patients with oral squamous cell carcinoma and its role in altering the metabolism of benzo[a]pyrene. Oral Surg Oral Med Oral Pathol Oral Radiol. 2020 Sep;130(3):306-312. Pubmed PMID: 32773350.
[45]. Rajakeerthi R, Nivedhitha MS. Natural Product as the Storage medium for an avulsed tooth–A Systematic Review. Cumhuriyet Dental Journal. 2019 Jun 11;22(2):249-56.
[46]. Samuel SR. Can 5-year-olds sensibly self-report the impact of developmental enamel defects on their quality of life? Int J Paediatr Dent. 2021 Mar;31(2):285-286. Pubmed PMID: 32416620.
[47]. Samuel SR, Acharya S, Rao JC. School Interventions-based Prevention of Early-Childhood Caries among 3-5-year-old children from very low socioeconomic status: Two-year randomized trial. J Public Health Dent. 2020 Jan;80(1):51-60. Pubmed PMID: 31710096.
[48]. Seltzer S, Bender IB, Smith J, Freedman I, Nazimov H. Endodontic failures--an analysis based on clinical, roentgenographic, and histologic findings. II. Oral Surg Oral Med Oral Pathol. 1967 Apr;23(4):517-30. doi: 10.1016/0030-4220(67)90547-6. PMID: 5227404.
[49]. Shokouhinejad N, Nekoofar MH, Razmi H, Sajadi S, Davies TE, et al. Bioactivity of EndoSequence root repair material and bioaggregate. Int Endod J. 2012 Dec;45(12):1127-34. Pubmed PMID: 22803801.
[50]. Siddique R, Jayalakshmi S. Assessment of Precipitate Formation on Interaction of Chlorhexidine with Sodium Hypochlorite, Neem, Aloevera and Garlic: An in vitro Study. Indian Journal of Public Health Research & Development. 2019 Nov 1;10(11).
[51]. Sinai IH, Romea DJ, Glassman G, Morse DR, Fantasia J, Furst ML. An evaluation of tricalcium phosphate as a treatment for endodontic perforations. J Endod. 1989 Sep;15(9):399-403. Pubmed PMID: 2576900.
[52]. Sridharan G, Ramani P, Patankar S, Vijayaraghavan R. Evaluation of salivary metabolomics in oral leukoplakia and oral squamous cell carcinoma. J Oral Pathol Med. 2019 Apr;48(4):299-306. Pubmed PMID: 30714209.
[53]. Teja KV, Ramesh S. Shape optimal and clean more. Saudi Endodontic Journal. 2019 Sep 1;9(3):235.
[54]. Tsesis I, Fuss ZV. Diagnosis and treatment of accidental root perforations. Endodontic Topics. 2006 Mar;13(1):95-107.
[55]. Varghese SS, Ramesh A, Veeraiyan DN. Blended Module-Based Teaching in Biostatistics and Research Methodology: A Retrospective Study with Postgraduate Dental Students. J Dent Educ. 2019 Apr;83(4):445-450. Pubmed PMID: 30745352.
[56]. Vijayashree Priyadharsini J. In silico validation of the non-antibiotic drugs acetaminophen and ibuprofen as antibacterial agents against red complex pathogens. J Periodontol. 2019 Dec;90(12):1441-1448. Pubmed PMID: 31257588.
[57]. Vijayashree Priyadharsini J, Smiline Girija AS, Paramasivam A. In silico analysis of virulence genes in an emerging dental pathogen A. baumannii and related species. Arch Oral Biol. 2018 Oct;94:93-98. Pubmed PMID: 30015217.
[58]. Vikram NR, Prabhakar R, Kumar SA, Karthikeyan MK, Saravanan R. Ball Headed Mini Implant. J Clin Diagn Res. 2017 Jan;11(1):ZL02-ZL03. Pubmed PMID: 28274084.
[59]. Zhang H, Pappen FG, Haapasalo M. Dentin enhances the antibacterial effect of mineral trioxide aggregate and bioaggregate. J Endod. 2009 Feb;35(2):221-4. Pubmed PMID: 19166777.