Systematic Review

A SYSTEMATIC REVIEW ABOUT INCIDENCE OF FINDINGS RELATED TO UNTREATED MB2 CANAL IN MAXILLARY FIRST MOLAR IN SAUDI ARABIA FROM 2010 to 2021.

ABSTRACT:

For the success of an endodontic treatment, several factors are associated with it. As the root canal therapy is complex, it cannot be assessed using a two dimensional radio graphs. If any part of the canal is over-looked and untreated, then it can lead to the endodontic failure. Among all the maxillary teeth, the root canals of first and second molars are more complex. It's a challenge to locate the mesio buccal (mb2) canal in the maxillary molars for the endodontic therapy. The three dimensional technology using the cone beam computed tomography (CBCT) is used to locate the mb2 canals. The main aim of this study is to systematically review the studies that reported about the incidence of mb2 canal of maxillary first molars in the Kingdom of Saudi Arabia from 2010 to 2021. In Saudi Arabia, many studies report the incidence of mb2 in the maxillary first molars to range in between 23.3% to 70.6% and the incidence in maxillary second molar to be around 19.8%. Few studies also reported mb2 canal that was not seen in the CBCT scan was located by the direct visualization of the root, followed by troughing.

Keywords: Endodontic Treatment, Root Canal Therapy, Mesio Buccal (Mb2) Canals, 3 Dimensional Technology, CBCT, Maxillary Molars.

INTRODUCTION:

Second mesio buccal (mb2) canal is the infamous canal that haunts the Endodontists for maxillary molar treatment. The mb2 canal often referred to as fourth canal, is the infuriate aspect of the root canals of maxillary molars. The discovery of the mesio buccal (mb2) canal was done about over a century ago [1]. Professor Walter Hess, in the year 1917 first removed the hard tissue by calcification of the root canal in the human teeth using vulcanized rubber, showing the presence of mb2 canals in the maxillary molars for the first time [2]. Most of the dentists perform the root canal treatment without reaching the mb2 canals as it is very difficult to find these canals due to lack of proper tools needed for its screening.

Incomplete root canal treatment in vital cases like the irreversible pulpitis, can account for the ongoing pain to hot/cold liquid intake. If the mb2 Canal is left untreated, it increase the chances of endodontic root canal treatment failure and also the Apical Pathology [3]. Many dentist argue that the mb2 orifice is sealed from the invention of any bacteria as it is mostly covered by a solid layer of dentin. Dr. Hess reported the connection between mb1 and mb2 canal via isthmuses or anastomoses. The bacteria from the mb1 canal can transfer to the mb2 canal through these connections [4].

In the present time, the identification of endodontic failures can be done by tracing the untreated mb2 canal using CBCT imaging. The mb2 canal can be treated by means of non surgical root canal treatment or apicoectomy using the dental microscope. The mb2 canal can be located by Magnification, using the dental loupes with 41% success and Dental microscope with 94%. The mb2 canal can be located in the palatal aspect of the tooth. The mb2 canal is typically located under a layer of dentin called the dentin shelf, in case of middle aged or older patients. The dentin shelf needs to be removed in order to uncover the mb2 orifice [5].

The chemico-mechanical preparation of the root canal can be unsuccessful if there are any anatomical complexities found in case of the maxillary second molars. These complexities are of great importance [6]. It was reported that about 50% to 90% of the cases was due to the presence of untreated mb2 canals in maxillary first molar and second maxillary molars respectively [7]. For planning the Endodontic treatment, it is significant to understand and have proper knowledge about the morphology of the root canal treatment.

The success of the root canal treatment may rely on the disinfection, shaping and swelling of all the root canals. In the past the periapical radio graphs were used to locate the canals. Presently a 3D radio graphic image known as the cone beam computed tomography (CBCT) is used as an important tool to identify the mb2 canal [7]. Thus CBCT scanning not only provides the high resolution images but it also allows the visualization of the image in the sagittal, axial and coronal angles. The CBCT helps in the detection of extra canals, root resorption and pathologies affected by the hard tissues.The rate of of visualization of the mb2 canal can be enhanced using the dental operating microscopes with the ultrasonic tips. The location of the mb2 canals can lead to the clinical success of the root canal treatment. The main aim of this study is to present a systematic review of literature regarding incidence of clinical cases with untreated mb2 canal in maxillary molars that were reported in the kingdom of Saudi Arabia from a time period of 2010 to 2021.

AIM AND OBJECTIVES:

The main aim of this study is to systematically review the studies that reported about the incidence of mb2 canal of maxillary first molars in the Kingdom of Saudi Arabia from 2010 to 2021.

Specific objectives:

1. Describing mb2 canals, its location, occurrence of the mb2 canals in maxillary first and second molars.
2. Determining the significance of untreated mb2 canals in the failure of endodontic treatment.
3. Carrying the online literature review using the different databases to know about the untreated mb2 canal incidence.
4. Performing a systematic review of all the articles describing the incidence of the untreated mb2 canals inside the maxillary first molar in Saudi Arabia from 2010 to 2021.

METHODOLOGY:

An online based, web search was made using various databases like Medline, Pubmed, Embase, Scopus, Google Scholar, Directory of Open Access Journals (DOAJ), and Cochrane electronic databases. The systematic review of literature was carried out in English language. In the initial term of reviewing, no filters were applied to make sure all the studies are available for successive screening. Later on filters like only human studies, only adult studies were added. The literature review was conducted by studying about 6 articles related to study the incidence of untreated mb2 canal in maxillary molars in the kingdom of Saudi Arabia.

TIME LINE OF STUDY:

The research was done in a time range of 6 months to study and review all the literature and prepare the manuscript related to systematically review the studies that reported about the incidence of mb2 canal of maxillary first molars in the Kingdom of Saudi Arabia from 2010 to 2021.

WHAT GAPS WOULD THE STUDY FILL IN THE AREA OF INVESTIGATION?

1. The detailed information about Mesio buccal (mb2) canal will be attained.
2. The adverse effects of untreated mesio buccal (mb2) canal in endodontic therapy will be studied.
3. The incidence about the prevalence of untreated mb2 canal of maxillary first molars that lead to the failure of the endodontic therapy in the Kingdom of Saudi Arabia from 2010 to 2021.

RESULTS:

About 6 studies were available that described the findings related to the incidence of the untreated mb2 canals in Saudi Arabia reported in the time period ranging from 2010 to 2021. Al-Fouzan et al, in the year 2012 reviewed about the incidence of two canals in extracted mandibular incisor teeth of Saudi Arabia that reported the canals in the range of 12.4% to 53% among the Saudi Population in Riyadh [8]. Al swilen R et al, reported in the year 2018 about the three dimensional cone beam computed tomography assessment of additional canals of permanent first molars: A Pinocchio for successful root canal treatment, concluded the prevalence of additional canal detection among the Saudi population by using the 3 D scanning among the Saudi, Jordanian and Egyptian population [9]. Al Fouzan carried out his research work related to the mb2 canals and in the year 2019 published an article that detected the second mesio buccal canal in the maxillary molars using the micro CT scanning among the Saudi population in Riyadh [10].

Table 1. 6 studies related to the incidence of mb2 canals in Saudi Arabia

Author's Name	**Year Of Publications**	**Study Topic**	**Incidence Of Mb2 Canals**	**Region In Saudi Arabia**	**Most Commonly Used Diagnostic Tool**	**Population**
Al-Fouzan KS, AlManee A, Jan J, Al-Rejaie M.	2012	Incidence of two canals in extracted mandibular incisors teeth of Saudi Arabian samples	The incidence of two canals in mandibular anterior teeth has been reported by several authors to vary between 12.4% to 53% respectively	Riyadh, King Saud bin Abdulaziz University, Saudi Arabia.	Cone-Beam Computed Tomography (CBCT)	Saudi Population
Alswilem R, Abouonq A, Iqbal A, Alajlan SS, Alam MK.	2018	Three-dimensional cone-beam computed tomography assessment of additional canals of permanent first molars: A Pinocchio for successful root canal treatment	The prevalence of additional canal in U16, U26, L36, and L46 of Saudi population was 41.80%, 41.80%, 17.30%, and 19.10%, respectively.	Sakaka, Al Jouf University, Saudi Arabia	3D- Cone Beam Computed Tomography (CBCT) scans	Saudi, Jordanian and Egyptian population.
Alfouzan K, Alfadley A, Alkadi L, Alhezam A, Jamleh A.	2019	Detecting the Second Mesiobuccal Canal in Maxillary Molars in a Saudi Arabian Population: A Micro-CT Study.	70% incidence of mb2 canals in the maxillary first molars	Riyadh, King Abdullah International Medical Research Centre, National Guard Health Affairs	Micro CT scanning	Saudi Population

Fouad Abduljabba, Lina F Mengari1, Ahlam M Bahkali1, Ghada Essa1, Fayssal Farahat2 and Rehab M Abdelaal1	2019	Long Term Study of the Prevalence of Second Mesiobuccal canal in Maxillary First Molar of Saudi Population	Ninety-seven (20.3%) of the right maxillary first molars	Jeddah, King Abdulaziz Medical University, Saudi Arabia.	Cone-Beam Computed Tomography (CBCT)	Saudi Population
Hadi M. Alamri, Mubashir B. Mirza, Abdullah M. Riyahi, Fahad Alharbi, Fahd Aljarbou,	2020	Root canal morphology of maxillary second molars in a Saudi sub-population: A cone beam computed tomography study	The prevalence of four canals was seen in 12% (coronal third), 27.6% (middle third), and 19.4% (apical third)	Al-Kharj, Prince Sattam Bin AbdulAziz University	Cone-Beam Computed Tomography (CBCT) scans	Saudi Population
Howait M, Al-Habib M.	2021	Assessment of Mesiobuccal Canal Configuration, Prevalence and Inter-Orifice Distance at Different Root Thirds of Maxillary First Molars: A CBCT Study.	The MB2 canal was found in 92 (86.8%) maxillary first molar teeth.	Jeddah, King Abdul Aziz University	Cone-Beam Computed Tomography (CBCT)	Saudi Sub Population

Later in the same year, in 2019 Fouad Abduljabba et al, carried on the long term studyof the prevalence of Second Mesio Buccal canal in maxillary first molar of Saudi population, reporting an incidence of 20.3% mb2 canals of the right maxillary first molars using the cone beam computed tomography in Jeddah [11]. Hadi M et al in 2020 carried out a study on the root canal morphology of maxillary second molars in a Saudi sub population using a Cone Beam computed Tomography in Al-Kharj and reported the incidence and prevalence of the four canals [12]. Howait M et al, in 2021 carried out a study named Assessment of Mesio Buccal canal configuration, prevalence and inter orifice distance at different root thirds of maxillary first molar using CBCT scans in Jeddah among the Saudi Sub Populations [13].

DISCUSSION:

The incidence of the untreated mb2 canal in maxillary molars mainly depends on the method used to locate it. Root sectioning with direct vision of the roots, CBCT scan, dental microscopes and micro CT are the various techniques used to locate the mb2 canal in the maxillary molars. About 94.1% of the incidence of untreated mb2

canals was reported by kulild and Peter while assessing the internal anatomy of maxillary first molar using the root sectioning technique [14].

Lyra reported that root sectioning is more accurate when compared to the CBCT in order to reveal the internal anatomy of maxillary molars [15]. Another study reported 100% of mb2 canal tracing in maxillary first molar using the micro CT scan and around 57% in case of maxillary second molar. Digital radiography is not so accurate as micro CT and CBCT scans. The present armamentarium available in modern Endodontics is CBCT scan. It helps in diagnosing and planning the treatment and paramount of endodontic cases in case of complex anatomy. About 0.125 mm and 0.200 mm voxel sizes are more accurate in locating the mb2 canal. Bauman reported 93.3% with 0.125 mm resolution and 8.8% with 0.200 mm resolution in locating the mb2 canal [16].

Few studies also reported mb2 canal that was not seen in the CBCT scan was located by the direct visualization of the root followed by troughing. Many researchers reported the success rate of locating mb2 canals in maxillary first molar and second molars using the CBCT in the Egyptian, Spanish, Thai and North American population. Reis reported age as an important factor that impacts the visualization of the mb2 canals. He concluded that the rate of visualization was 9.7 % and 81.9%, in case of patients with age ranging from 20-30 and 60-70 years respectively [17].

Another study pointed the full crown coverage as a factor that can prevent the location of mb2 canal. It was found that the patients who consumed the statins to lower the cholesterol level demonstrated lower pulp chamber volume when compared to the non-statin consuming patient. With this we can say that the HMG-CoA reductase inhibitor (statin) is another factor impacting the location of the mb2 canal. Nalapatti and Glassman proposed the use of 1% sodium fluorescein that binds to the connective tissue which shines when exposed to blue light [18].

In Saudi Arabia, many studies report the incidence of mb2 in the maxillary first molars to range in between 23.3% to 70.6% and the incidence in maxillary second molar to be around 19.8%. Al Shehri reported the incidence of mb2 canals in the maxillary first molars to be 64.6% among the Saudi patients using CBCT [19]. Another study reported allow mb2 canal visibility to be in between, 88% and 97% by using selective dentinal removal (troughing) upto 2mm. The Western Saudi Sub population reported the incidence of mb2 canals in the maxillary first molars up to 86.8%. Several international studies reported the incidence of mb2 canals in the

maxillary first molars to be in between 69 and 90%. Al Nazhan studies the prevalence of mb2 canals and reported its incidence in the maxillary first molars to be around 23.3% [20] and Al Fouzan reported to be around 51.3% [21].

CONCLUSION:

As the variation in the anatomy in the root morphology of the molar teeth is commonly seen in dentistry. The fourth canal or the mb2 canal is mostly left untreated due to lack of its identification. A proper knowledge about the location and treatment of Mb2 canals is significant for the success of maxillary molars treatment. There is not enough research done on the incidence of untreated mb2 canals in the maxillary first molar.

ETHICAL CONSIDERATIONS:

Compliance with ethical standards

Ethical approval: This is systematic review of the systematically review the studies that reported about the incidence of mb2 canal of maxillary first molars in the Kingdom of Saudi Arabia from 2010 to 2021.

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