ASSOCIATION BETWEEN AGE, GENDER AND MATERIALS USED IN MANAGEMENT OF OPEN APEX PROCEDURE.

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ABSTRACT:

Conventional endodontic procedures which involve the development and application of techniques in order to eliminate an infection from the root canal. This becomes difficult in cases of immature teeth with open apexes, in which root walls are fragile and thus making it difficult to accomplish the complete obturation of the canal. This study was done to evaluate age, gender and material used in patients undergoing management of open apex procedures. This retrospective clinical study evaluated the patients underwent management of open apex from the department of Conservative Dentistry and Endodontics, Saveetha Dental College, Chennai. Total of 54 patient’s records were evaluated from June 2019 to March 2020 and based on inclusion and exclusion criteria, selected data consisted of 54 patients who received treatment for open apex. The data of patients was collected and tabulated. Chi square test was used to establish correlation between categorical variables. In this study, 81.48% males and 18.52% females have undergone treatment for open apex. Age group 11-20 years (48.15%) were more and 40 years (1.85%)
of age being least. Among all the teeth, upper anteriors was common (87.04%) followed by lower anteriors (5.55%) and the least was upper posterior teeth with (1.85%). Age doesn't play a role in selection of materials for management of open apex p value 0.583 (p>0.05), among the materials used MTA was the most preferred material irrespective of treatment procedures. From our study we conclude that open apex procedures were performed to a greater extent in the upper anteriors region of males. MTA is the material of choice when it comes to the management of open apex irrespective of age, gender and type of treatment.

Keywords: Age, Gender, Mineral Trioxide Aggregate, Open apex

How to cite this article: Santhose T, Deepak S, Malaiappan S (2020): Association between age, gender, and materials used in management of open apex procedure, Ann Trop Med & Public Health; 23(S22): SP232341. DOI: http://doi.org/10.36295/ASRO.2020.232341

INTRODUCTION:

Conventional endodontic procedures which involve the development and application of techniques in order to eliminate an infection from the root canal. This becomes difficult in cases of immature teeth with open apexes, in which root walls are fragile and thus making it difficult to accomplish the complete obturation of the canal [1]. When the pulp tissue of a developing or a completely developed tooth is disturbed by trauma or caries, root canal treatment must be done. Numerous techniques of obturation including the use of cements, silver cones, and gutta-percha have been used in past years with some degree of success [2]. However, the physical properties and cytotoxicity of these materials have limited endodontics to an art form that is costly to the patient and difficult to reproduce. These problems are particularly evident concerning the pulpless open apex tooth [3]. Thin dentinal walls and flaring apical morphological characteristics make routine obturation techniques extremely difficult. Often, root canal cements and gutta-percha are forced through the open apex, causing inflammation of the periapical tissues, resorption, and ultimate failure.

In the past, apexification technique using calcium hydroxide paste has been advocated in an attempt to create hard-tissue bridging [4]. However, hard tissue closure usually requires from 9 to 18 months to form, and the result of that treatment was most often a thin, porous calcific bridging limited to the apical portion of the root canal, Final obturation of the canal with gutta-percha is always advised. All the materials used in open apex management have their own limitations [5–7]. But most clinicians rely on calcium hydroxide paste which in long term therapy can
cause tooth brittle due to its hygroscopic and proteolytic properties [5] that makes the clinician go for conventional root canal treatment even after apexification procedure [8,9].

Apexification with calcium hydroxide is a method of inducing apical closure through the formation of mineralized root structures in the apical pulpal region of a pulpless tooth which has an incompletely formed tooth [open apex] in the last decades [10]. OsteoCementum, osteodentin, or bone sometimes can be the combination of all three; these are the composition of the mineralized root structure. This root development will not lead to a proper lengthening of root, but whatever form is usually in an irregular form.

The term revascularization arises from the dental trauma literature. In some cases, an avulsed tooth with incomplete root formation may be able to re-establish blood supply after autotransplantation or replantation [11]. Revascularization is an emerging regenerative treatment protocol with little published data available in immature molar teeth. A successful revascularization case was first reported in 2001. Meanwhile, revascularization procedures involve root canal disinfection and formation of blood clot. Several case reports showed successful results in clinics (eg, increased in root length and thickness and apical narrowing) [12]. However, some reported outcomes that are unsuccessful. Successful pulp regeneration relies heavily on the rapid and efficient formation of blood vessels. Teeth with large apices involve increased revascularization rates, mainly because of increased possible in growth of newly formed blood vessels [13]. Therefore, the apical diameter is a significant factor in regenerative endodontics. An immature tooth seems more appropriate than a mature tooth for dental pulp regeneration given the wider apical size and higher amount of apical stem cells of the former than those of the latter.

Biocompatible materials play an important role in management of open apex procedures. Drawbacks of calcium hydroxide led the way for development of Mineral trioxide aggregate (MTA). It is a root canal repair material that was developed at the beginning of the 1990s at Loma Linda University in California [14]. MTA is a mechanical mixture of three powder ingredients: Portland cement, bismuth oxide, and gypsum [15]. When mixed with sterile water, hydration reaction happens and MTA sets. The pH of MTA increases from 10 to 12.5 ph after mixing. It is believed that in a high pH environment the calcium ions that are released from MTA react with phosphates in the tissue fluid to form hydroxyapatite. Endodontists were mostly interested in investigating the much known feature the
biocompatibility of MTA, which has since been confirmed in many in vitro and in vivo studies. The biocompatibility of MTA and its ability to successfully seal the root apices in the presence of moisture, including blood, are properties that support its successful application for the orthograde obturation of nonvital teeth with open apices. MTA prevents extrusion of root canal filler materials beyond apices [16].

Biodentin is a calcium silicate based cement of the same type as MTA. It exhibits physical and chemical properties similar to those described for certain Portland cements. Its biocompatibility has also been explained experimentally by laurent et al. Based on all its properties, Biodentine has been claimed to be a bioactive dentin [17] substitute for the repair of root perforations, apexification and retrograde root filling by the manufacturers. A modified powder composition, the addition of setting accelerators and softeners, and a new pre-dosed capsule formulation for use in a mixing device, largely improved the physical properties of this material making it much more user-friendly with a shorter setting time. Till date very few studies have been reported associating age, gender and comparing materials used in both apexification and revascularization procedure.

Previously our team had conducted numerous studies which include in vitro studies [18–23], review [24–27], survey [28,29], clinical trial [30–32]. Now we are focussing on retrospective studies, the aim of the study is to evaluate age, gender and material used in patients undergoing management of open apex procedures.

MATERIALS AND METHOD:

The case records of all 8600 patients visiting Saveetha Dental College from June 2019 to March 2020 were analysed and the data of 54 patients who have undergone management of open apex were retrieved retrospectively. Ethical clearance was obtained from the research ethical board of Saveetha dental college and hospitals prior to the study. Inclusion criteria - Incomplete root formation. Exclusion criteria - Completely formed roots, periodontally compromised teeth. The statistical analysis was done using SPSS software version 2.0. All descriptive analysis mean, standard deviation and percentages were used to analyse the number of male and female and their demographic variables. Chi square test was used to establish correlation between categorical variables. (p≤0.05) was set to be statistically significant.

The internal validity of the study was established as the data was collected from a verifiable and standardised database. The external validity is established as the data is from a clinical setup which is duplicated.
RESULTS AND DISCUSSION:

In this study, 81.48% males (n=44) and 18.52% females (n=10) have undergone treatment for open apex (Figure 1). Age group of all the subjects ranged from 5 to 80 years of age; (Figure 2) age group of 11-20 years (48.15%) were more and 40 years (1.85%) of age being least.

Among all the teeth, upper anterior was common (87.04%) followed by lower anterior (5.55%) and the least was upper posterior teeth with (1.85%) (Figure 3). Single rooted teeth were found to be in higher percentage in the management of open apex procedure (88.89%) compared to multi rooted teeth (Figure 4).

Apexification is the treatment of choice for the management of open apex. Apexification was found to be about 61.11% followed by revascularization (16.67%) and root canal treatment (22.22%) (Figure 5).

Age doesn't play a role in selection of materials for management of open apex p value 0.583 (p>0.05), among the materials used MTA was the most preferred material irrespective of treatment procedures (Figure 6,7).

In this study we also found that the age group of 10 -25 years of age is more prone to open apices. This can be mainly due to the fact they are more prone to traumatic injury [33]. The same reason is also applicable with the fact that the upper and lower anterior teeth are the most treated teeth for open apex management. This is all due to the fact that anterior teeth are more prone to trauma in younger age. Trauma can occur due to accidents, fights, sports etc [33].

Strong male predilection was seen in this study, the reason can be, males have more traumatic factures when compared to females. Males are more active and practice more aggressive sports or sports with high risk of accidents.

In this study MTA was commonly used in management of open apex which is favouring previous studies performed by Ham.et al [34]. MTA also provides an alternative treatment modality for immature pulpless teeth [35]. In this study we also found that revascularization is done less when compared to apexification because prognosis plays an important role in management of necrotic immature permanent teeth [36].

Apexification was the treatment of choice as we found in this study. Apexification can be done either with calcium hydroxide or with MTA. However calcium hydroxide needed multiple visits and replacement in a regular interval [37]. Some recent studies have shown that the apical barrier was formed in a short period of time like 30 months [38]. However radiographic is not as evident to detect calcium hydroxide washout [39], because some of the additives with
CAOH can be still appreciated in the radiograph. MTA was found to be used in higher numbers this can be mostly because it reduces the repeated visits almost makes the apexification as a single visit procedure. Other studies have reported 85% to 96% of apical barrier formation with MTA while treating immature teeth. Calcium hydroxide has formed apical marrier in 7 months whereas MTA has formed it in 3 months [40]. After a 4 year follow up of the patients only one had periodontal radiolucency when treated with MTA [41]. This shows usage of MTA in higher numbers is because of its potential positive prognosis. As calcium hydroxide takes a prolonged time to form an apical barrier periodontal lesion formation is higher in the case of calcium hydroxide.

Studies done prior show that the biodentine has superior biocompatibility and sealing ability and it is less toxic. But in our study we found the usage of biodentine is less when compared to other materials. However in some studies we see literature stating that the revascularization therapy can provide advantage over traditional apexification procedure [42].

Limitations to this study included limitation to one geographic area and the limited amount of data acquired. However, there have been several studies done in the past from the existing data. Further studies would be required to understand the properties of new materials used in the different treatments of open apex management and the efficacy of the same has to be studied.

**CONCLUSION:**

From our study we conclude that open apex procedures were performed to a greater extent in the upper anterior region of males. MTA is the material of choice when it comes to the management of open apex irrespective of age, gender and type of treatment. Age doesn't play a role in selection of materials for management of open apex. Although further research in use of biodentine and revascularization is emphasized to gain knowledge about regenerative endodontics. Prudent case selection which involves age, chronicity and stage of root development plays a major role in management of necrotic immature teeth.

**AUTHOR CONTRIBUTIONS**

**T. Santosh** contributed to the design of the study, data collection, analysis of data, results tabulation, and manuscript preparation.

**Deepak Shad** contributed to the design of the study, analysis of data, results, manuscript preparation.
Sankari Malaiappan had contributed to the design of the study, manuscript preparation, and proof reading of the manuscript.

CONFLICT OF INTEREST

There is no conflict of interest.

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https://doi.org/10.1016/j.joen.2011.05.033.


Figure 1: The pie chart represents the gender distribution of patients who had undergone management of open apex. Majority of the patients were male in open apex management.

Figure 2: The pie chart represents the age of patients who had undergone management of open apex. The majority of the patients were aged between 11-20 years (48.15%) and least was >40 years (1.85%).

Figure 3: The bar graph represents the teeth underwent management of open apex procedure. X axis represents type of tooth; Y axis represents total number of teeth undergone open apex procedure. When compared to all the teeth, upper anteriors were common (87.04%).

Figure 4: The bar graph represents the type of teeth and open apex procedure. X axis represents the type of teeth; Y axis represents the total number of teeth undergone open apex procedure. Majority of the teeth were single rooted (88.89%).
Figure 5: This bar graph represents the type of treatment done for open apex procedure. X axis represents the treatment types; Y axis represents the total number of teeth undergone open apex procedure. Apexification was the most commonly preferred procedure (61.11%) in the management of open apex.
Figure 6 - This bar graph depicts the association between age and material used for management of open apex. X axis represents age; Y axis represents total number of teeth undergone open apex procedure. Pearson chi square test - p=0.583 (>0.05), statistical not significant. Age doesn't play a role in selection of materials for management of open apex, among the materials used MTA was the most preferred material.
Figure 7: This bar graph depicts the association between the type of treatment and material used for management of open apex. X axis represents treatment type; Y axis represents the total number of teeth undergone open apex procedure. Pearson chi square test; p - 0.004 (<0.05), statistically significant. MTA was the most preferred material irrespective of the type of treatment.