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A Retrospective Analysis of the Correlation Between the Type of Pulp Exposure and the Choice of Pulp Capping Agents

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ABSTRACT

The aim was mainly to determine the correlation between the type of pulp capping method and the material of choice in this study. Pulp capping in the carious teeth has been considered as unpredictable and they mainly have a lesser success rate. The pulp capping can be mainly done in two methods; they are direct and indirect pulp capping, which can be mainly done with the help of different materials of choice like calcium hydroxide, MTA etc. The study was conducted in Saveetha Dental College. The data collection has been done from the department of Conservative dentistry and Endodontics for patients undergoing pulp capping treatment. The results were obtained and tabulated, the type of pulp capping method was 67% of indirect pulp capping and 33% of direct pulp capping method in which 81% of calcium hydroxide, 8% of MTA and 11% of RMGIC were used as the materials of choice. Among which indirect pulp capping method was most commonly used than the direct pulp capping method with calcium hydroxide as the material of choice for the treatment ($p < 0.05$, which is statistically significant). The pulpal exposure was mainly due to dental caries and mechanical preparation of the tooth. Within the limits of the present study, the most common type of the pulp exposure was due to dental caries and mechanical exposure during the cavity preparation of the tooth and the most common method of pulp capping was the indirect method with calcium hydroxide (CaOH) as the most common material of choice.

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INTRODUCTION

The pulp can never be an organ which is doomed, they mainly have the initiating ability for the several defence mechanisms in order to protect themselves up to a certain limit from the various bacterial environments to which they have been exposed, this is mainly been a well-exposed reason (Teja and Ramesh, 2019). Throughout the lifetime in the tooth, the present pulp mainly helps in the production of the various types of dentin like the secondary dentin, peritubular dentin and the reparative dentin which is mainly produced in response to the various biological and pathological stimuli (Nasim and

Nandakumar, 2018). And moreover, the best barrier for the protection against various microorganisms which affect the pulpal tissue is the vital pulp which has been present inside the tooth (Ramesh *et al.*, 2018). The various reasons are involved in the exposure of the pulp such as operative procedures that are considered the most frequent cause of pulpal injury which may lead to the formulation of various pulp protecting agents (Nasim *et al.*, 2018). The occurring exposure to the pulp can never be protected as they are subjected to the extensive restorative procedures and depend over the clinician hand skills (Çelik and Sarı, 2016). From the previous studies, which shows that the success or survival rate of the pulp capped tooth is less when compared to that of the endodontic therapy of that particular tooth (Ravinthar, 2018).

There are two available methods for the pulp capping; they are mainly the direct and indirect pulp capping methods. Direct pulp capping is the procedure where the protective dressing is placed directly over an exposed pulp and in indirect pulp capping, a thin layer of softened dentin, which on removal might lead to the pulpal exposure and this is left in place and the protective dressing is to be placed on top of the softened dentin present (Janani *et al.*, 2020). Calcium hydroxide (CaOH) and Mineral Trioxide Aggregate (MTA) were mainly considered as the common choice of materials for the direct and indirect pulp capping method (Jose *et al.*, 2020). Among the materials Calcium hydroxide (Rajendran *et al.*, 2019) is to be considered as the gold standard choice of the material which can be used as a standard choice against the other newer materials in order for the comparative studies. In the early 1900s, the MTA was discovered which mainly had various uses and advantages in the clinical dentistry of its application (Rajendran *et al.*, 2019; Rajakeerthi and Nivedhitha, 2019). There are various studies which showed that MTA tends to produce less pulpal inflammation and forms a more predictable hard tissue barrier formation when it is compared to hard setting calcium hydroxide (Manohar and Sharma, 2018; Noor, 2016). The main developments in the field of GIC's have led to the discovery of resin-modified GIC's (RMGIC). This material mainly has various advantages like enhanced flexural strength, diametral tensile strength and wear resistance on its application, the main disadvantage of this particular material is that they are not as compatible than the normal GIC's (da Silva Modenaa *et al.*, 2011).

Various studies have shown that the survival chance of the pulp with the accidental exposure of the pulp during the time of tooth preparation was high (Ramanathan and Solete, 2015) rather than due to the progression of caries (Janani *et al.*, 2020). The main reason for this is due to the bacterial invasion into the pulp on caries exposure (Kumar and Antony, 2018). Following, the exposed pulp will not be infected or inflamed (Siddique *et al.*, 2019). From the results, it shows that the teeth with the direct pulp exposure are to be survived better with the pulp other than the exposure which has been formed by the advancing cavities (Ramamoorthi *et al.*, 2015). This study is done to fulfill the knowledge of appropriate use of the pulp capping agent during pulp exposure. The main aim of this study was to determine the correlation between the type of pulp capping method and the material of choice.

MATERIALS AND METHODS

The study setting was mainly a university setting and a single centred study. The various advantages are they have large available data and similar ethnicity and the disadvantages of this particular study are mainly the geographical limitations and the isolated populations.

Inclusion criteria

1. Patients undergoing pulp capping treatment
2. Patient with deep dental caries
3. No other lesions present
4. No medical history and systemic complications
5. Patient with positive pulp vitality test.

Exclusion criteria

1. Patients with caries involving the pulp
2. Patients with medical complications.

Sampling method

The non-probability convenience sampling method has been used for the randomization and to eliminate the bias. The study was conducted in Saveetha Dental College. The data collection has been done from the department of Conservative Dentistry and Endodontics for the patients undergoing pulp capping treatment. A total sample data of 140 patients were obtained for a period of nine months (June 2019 – March 2020) and the collected data were tabulated. Ethical approval was obtained from the institutional ethical committee (ethical approval number: SDC/SIHEC/2020/DIASDATA/0619-0320). The variables are defined. The parameters

that were to be assessed are a type of pulp capping and the material of choice.

Statistical Analysis

The obtained data were subjected to the statistical analysis, which was done by using the SPSS software by IBM of version 23 in which both the descriptive and the inferential test has been done which was Chi-square test.

RESULTS AND DISCUSSION

In the present retrospective study, from the 140 patients, it was observed that the most commonly used pulp capping methods were 67% of indirect pulp capping and 33% of direct pulp capping method [Figure 1] with 81% of calcium hydroxide, 8% of MTA and 11% of RMGIC as the common material of choice [Figure 2] and the correlation between the pulp capping method and material of choice shows that indirect pulp capping method was more prevalent for the pulp capping treatment with calcium hydroxide as the common material of choice. This was mainly statistically significant [p=<0.05], [Figure 3]

The procedure of the pulp capping should be mainly done with the utmost importance in order to reduce the inflammation of the pulp (Stanley, 1998). The choice of the material of both the calcium hydroxide and the MTA doesn't show any major adverse effects to the teeth. There is a major communication between the capping material and the dental pulp. They can be mainly helpful in ensuring that proper healing is possible.

The patients undergoing the pulp capping treatment, they mainly show the distribution of the direct pulp capping method (33%) and the indirect, direct pulp capping method (67%) [Figure 1] and this shows the advantage of the indirect pulp capping method over the direct pulp capping, as the indirect pulp capping method has the two-stage approach in its treatment which involves by placing a biocompatible material initially and the filled by a temporary or permanent restoration. These findings are mainly similar to the results obtained from the previous literature (Fagundes *et al.*, 2009).

The different types of materials which are most commonly used for pulp capping are CaOH (81%), CaOH + RMGIC (11%) and MTA (8%). From [Figure 2], The X-Axis represents the material of choice for the treatment and Y-Axis represents the number of patients involved for the pulp capping treatment. 7.732% of bio-aggregate material or MTA (Purple), 80.93% of calcium hydroxide (Blue) and 11.34% of CaOH+RMGIC (Red) were used for pulp capping method. Calcium hydroxide were the most common material of choice for pulp capping treatment. Among which calcium hydroxide has been the most common material of choice for the pulp capping, the various advantages of the CaOH are, they can be used as a gold standard material that tends to limit the zone of firm necrosis as it has the antibacterial property and promotes the healing and repair of the pulpal tissue (Pereira *et al.*, 2017). The second most commonly used material was MTA, as this is a newer biocompatible biomaterial that has been used recently, this mainly has the advantage of better sealing ability by which it can prevent the tooth from the bacterial leakage into the pulp (Bansal *et al.*, 2014). RMGIC was also a material of choice which was least commonly used in the treatment, they are mainly used for direct pulp capping in cases where chronic inflammation is present and lack of dentin is seen. These findings are similar to the results of the previous studies (Mestrener *et al.*, 2003).

The correlation between the type of pulp capping and the material choice showed that the indirect pulp capping technique was the most commonly used method with calcium hydroxide as the choice of material.

From [Figure 3], The X-Axis represents the pulp capping method and Y-Axis represents the number of patients visiting for the pulp capping treatment. Indirect pulp capping techniques were most commonly used with calcium hydroxide (Blue) as the most commonly used material of choice for the pulp capping treatment. A chi-square analysis was used to study the association (Chi-Square test; p-value =0.018(p<0.05)) implying a statistically significant association between the type of pulp capping and the choice of material used. Based on the Chi-square test they are statistically not significant [p>0.05] with a p-value of 7.995 for correlation, this finding is mainly similar to the study (Alex, 2018) and in acceptance to the current study.

The various factors which are mainly considered for the treatment of the tooth which the pulpal exposure are the degree of infection spread and the inflammation of that particular pulp rather than the size of the pulp and duration of the pulpal exposure. The most common reasons for the exposure of the pulp are mainly dental caries and the mechanical preparation of the teeth and caries excavation that can lead to the exposure of the pulp. This is mainly in acceptance of the present study (Hilton, 2009). This mainly shows that the proper selection of the cases and treatment planning is more important for the success and survival rate of the tooth to which the treatment has

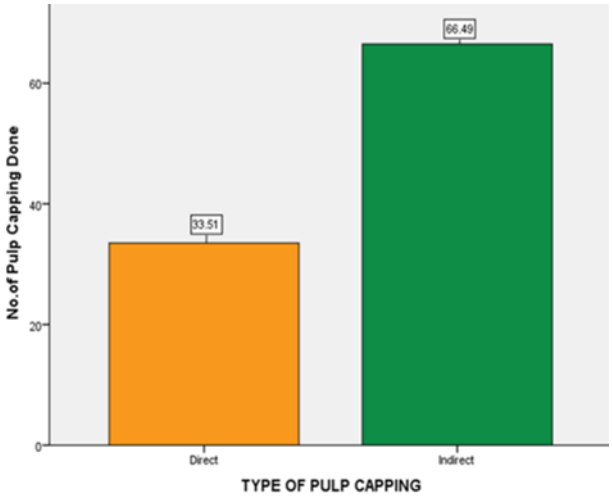

Figure 1: Bar graph showing the distribution of type of pulp capping method

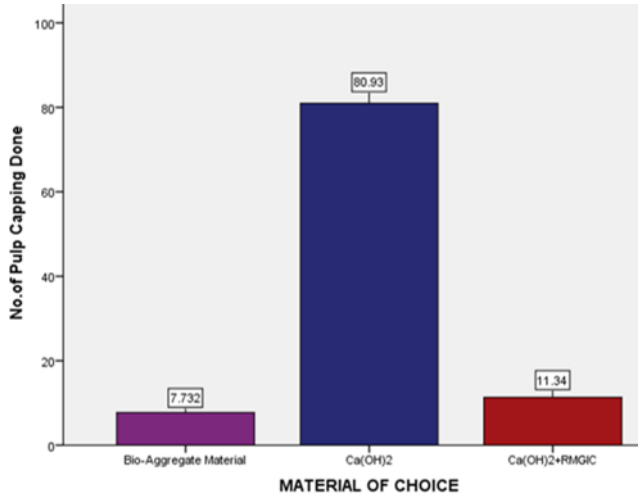

Figure 2: Bar chart showing the distribution of different materials used in the pulp capping method.

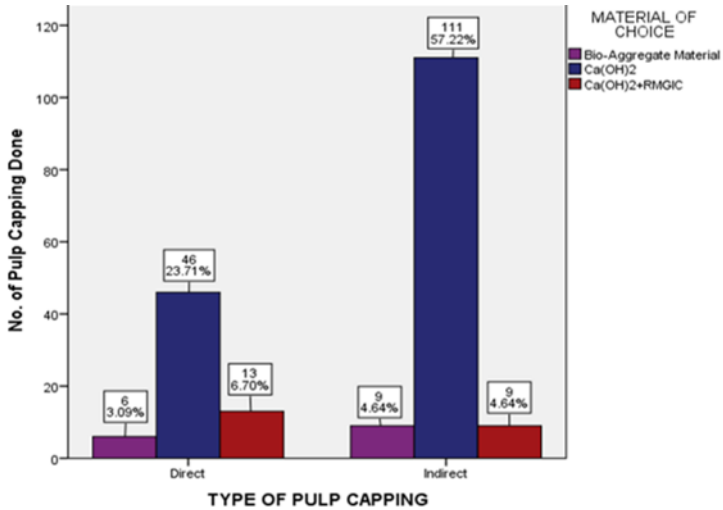

Figure 3: Bar chart comparing the association between the type of pulp capping technique and the choice of material for the treatment

been done.

Within the limits of the above-done study, the most common type of the pulpal exposure mainly occurs due to dental caries. By mechanical preparation during the cavity preparation which can be treated with indirect pulp capping method more commonly with calcium hydroxide as the material of choice, they have been a successful material with numerous applications in dentistry and especially in endodontics, apart from being very economical and ease in handling properties compared to some other materials like MTA and RMGIC.

The main limitations of this particular study were mainly that it has a limited sample size and a single centred study. The future scope of this particular study is to know the advantage of the pulp capping, higher sample size and various ethnicities can produce better results for the study.

CONCLUSION

From the results of this particular study, it can be concluded that Calcium hydroxide is the most commonly used pulp capping agent for the carious and the traumatic exposure of the pulp. However, the success rate of the treatment mainly depends on the exposure size and the age of the patient. Considering the outcome of this study, more retrospective and randomized clinical studies with larger sample size are needed to define predictive criteria for the choice of material and the method for the pulp capping of the tooth.

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Conflict of Interest

The authors declare that they have no conflict of interest for this study.

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