



Evaluation Of Vital Pulp Therapy & Root Canal Treatment in Teeth with Irreversible Pulpitis -A Randomized Control Trial

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ABSTRACT:

This randomized control trial was carried out to evaluate the treatment outcomes of vital pulp therapy using Dycal, MTA and Biodentine, comparatively as well as single visit RCT in posterior teeth having irreversible pulpitis.

Ninety permanent first & second mandibular molars displaying symptoms & signs indicative of irreversible pulpitis were randomly assigned equally into 2 groups. One group, consisting of 30 patients, teeth were treated with single visit root canal treatment (SVRCT). In the second group of 60 patients, vital pulp therapy (VPT) was carried out, which was further sub divided into two subgroups, in which direct and indirect pulp capping with Dycal, MTA & Biodentine was carried. Evaluation was carried out at 7 days, 1 month, 3 month, 6 month & 12 months. Success of the treatment was evaluated both clinically and radiographically. Chi-square test was used to compare the success rates between the two treatment modalities. One year success rate observed in VPT group & in SVRCT group was 84.6 % & 88% ($P > 0.05$) respectively. On comparing SVRCT to vital pulp therapy a statistically non-significant result was obtained. Teeth displaying symptoms & signs of irreversible pulpitis, VPT & SVRCT were comparable with respect to relieving clinical symptoms. Amongst Direct pulp therapy & indirect pulp therapy first should be preferred over. Although both VPT & SVRCT can be carried out in conditions with symptomatic irreversible pulpitis & normal periradicular tissue but in situations where RCT is preferred single visit procedure provides adequate results.

1. Introduction

As per the concept of minimal invasive dentistry, so as to avoid exposure of pulp, stepwise excavation of deep carious lesion should be preferred.[1] Quite often teeth with deep carious lesions are treated with root canal treatment. Recent trend has displayed an inclination towards conservative treatment for teeth with irreversible pulpitis. The capability of pulp to repair is not precisely reflected by the clinical features, such as degree & characteristic of pain. Lately, several studies have reported successful outcome of pulp capping in teeth with carious pulp exposure, displaying symptoms and signs indicative of irreversible pulpitis. When the

exposure of pulp occurs, two primarily dissimilar treatment with different outcome & objectives are advised- pulp capping or root canal treatment (RCT).

RCT is carried out as treatment of choice for teeth with irreversible pulpitis. [3] Lately pulp capping has been used as an alternative to RCT in such teeth. The advantages for preferring the former are: being conservative and less complicated than the later.[34] The materials displaying favorable result and those which are widely used for vital pulp therapy are Dycal, MTA and Biodentine. [5,8]

Previous studies have comparatively evaluated the outcome of pulp capping & RCT using Calcium Enriched



Mixture (CEM). They reported clinical success rate varying between 91.3% - 94.4% while radiographic success rate was between 97.6% - 98.3%.[7,8]. This Randomized control trial was conceived to overcome the limitations of previous studies, wherein single visit RCT was comparatively evaluated with direct and indirect pulp capping, using Dycal, MTA and Biodentine.

Null hypothesis considered for this study were that First there would be no difference in success rate with vital pulp therapy and single visit root canal treatment In mature teeth with irreversible pulpitis. And second there would be no difference in success rate with use of Dycal, MTA & Biodentine.

MATERIALS AND METHOD

For this randomized control trial, clearance was obtained from institutional ethical committee. Patients reporting to the department of Conservative Dentistry & Endodontics with the complain of pain in first and second mandibular molar were screened both clinically and radiographically. Patients were examined and selected on the basis of inclusion and exclusion criteria mentioned in Figure 1.

Inclusion criteria	Exclusion criteria
Patient's in the age group of 21-45 years	Evidence of swelling, sinus tract or tender on percussion or palpation
Mandibular first and second molar	Clinical sign of enhanced mobility
Healthy periodontal support	Periodontal probing exceeding normal range (>3mm)
Cariously exposed pulp, diagnosed with symptomatic irreversible pulpitis	Immunocompromised, pregnancy, diseases like liver, renal, bleeding disorder etc.
Radiographic findings- disrupted lamina Dura, widened periodontal ligament space with no periapical radiolucency.	Furcation- radiolucency's, internal and external resorption, periradicular pathosis

Figure 1

Minimum required sample size for this study was calculated by the formula, $= F(\alpha, \beta) \times 2 \times SD^2$ and was found to be 90.

Patients were grouped under two treatment modalities, the controlled treatment group comprising of single visit root canal treatment and experimental group in which vital pulp therapy was performed. The experimental group was further subdivided into two groups of direct & indirect pulp capping. These subgroups were divided into three sections where three different materials were used, viz – Dycal, MTA and Biodentine.(Figure.2)

form. Patients were assigned to different groups and subgroups through the process of randomization. Randomization eliminated bias and achieved equal patient distribution amongst the group. Patients were allotted to one of the group by flip of coin method. Later, patients under the category of vital pulp therapy were asked to choose one wooden stick out of three different colored sticks that were assigned for different material, Red for Dycal, green for MTA and yellow for Biodentine.

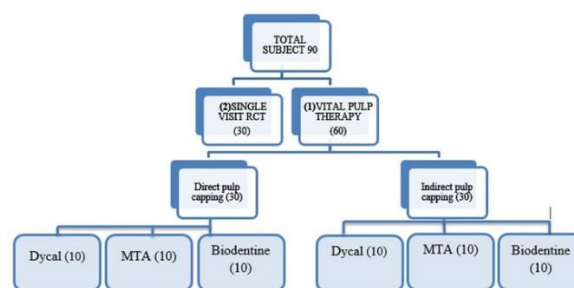


Figure. 2

All the 30 patients in the control group were treated with RCT, which was completed in single visit. Patients were asked to carry out rinse with 0.2% chlorhexidine. The treated teeth were anesthetized with 2% Lidocaine containing 1/2,00,000 epinephrine by inferior alveolar nerve block. Standard access preparation was carried out followed by rubber dam isolation & enlarged using rotary files. Working length determination was done 1.0 mm short of the apex using a ProPex Pixi Apex Locator and confirmed radiographically. Canal preparation was done using Pro Taper Gold system as suggested by the manufacturer. Irrigation of canal was done with 2.5% NaOCl followed by penultimate irrigation with 17% EDTA and final irrigation with 2% Chlorhexidine. Mesial canals were prepared till File no.F1 (20/7%) and distal canals till F2 (25/8%) followed by obturation with corresponding gutta-percha using AH plus sealer. Post endodontic restoration was carried out with composite.

60 patients were randomly assigned to experimental group, anesthesia was obtained with 2% Lidocaine containing 1/2,00,000 epinephrine by inferior alveolar nerve block, the material of choice was chosen by selecting a colored stick for both the procedures of vital pulp therapy. Patients in whom, Direct pulp capping was carried out, the depth of insertion of bur into the tooth was limited by measuring the radiographs from the



enamel surface to extent of initiation of lesion & this length was marked on the bur surface. Rubber dam isolation was carried out and surface was disinfected by scrubbing with 2% chlorhexidine before excavation of caries to reduce microbial load in the cavity. The exposed Pulp was rendered free of caries with a sharp spoon excavator. Exposed pulp was disinfected using cotton pellet moistened with 3% sodium hypochlorite to achieve adequate pulpal hemostasis within 2 min. of application. Once hemostasis was achieved, the respective pulp capping agents were manipulated as per manufacturer's instruction and placed over the exposed pulp followed by permanent restoration with composite after a week

In patients where indirect pulp capping was carried out, after obtaining anesthesia with inferior alveolar nerve block, rubber dam was placed. The bur was taken upto the marked length into the lesion. The distance to which the bur was taken into the tooth was derived by reducing 0.5mm from the distance between the external occlusal surface and the radiolucency of the carious lesion in the IOPA x-ray. After the removal of caries with the marked round bur the remaining caries and the soft dentine was excavated using a sharp excavator, so as not to expose the pulp and the respective pulp capping agents were manipulated as per manufacturer's instruction and placed over pulpal floor followed by permanent restoration with composite.

Patients were evaluated at baseline i.e. before starting the treatment and after the treatment at periodic recall visit of 1 week, 1, 3, 6 & 12 months for clinical and radiographic examination. The clinical features considered for evaluation were: pain, tenderness on percussion and palpation, presence of mobility, greater than physiologic mobility, swelling, increase in pocket depth and response of pulp toward cold and electric pulp test. Radiographic evaluation was based on further disruption or reformation of lamina dura, increase in physiologic width of periodontal ligament and presence of radiolucency or radiopacity at periapical region. Similarly the evaluative features for single visit group were pain, tenderness while percussion or palpation, swelling, increase in physiologic mobility or pocket depth & radiographic evaluation.

Patients with vital pulp and no sign and symptoms as tenderness, pain, sensitivity to cold and hot, enhanced mobility & without increase in physiologic width,

disruption of lamina dura & periapical radiolucency were considered successful after 1 year of follow up. Cases were considered as failure if patients complained of spontaneous pain or to thermal stimuli, pain or discomfort while chewing, swelling or increased mobility, sinus formation or if reported on unscheduled appointment due to pain in the respective tooth. In patients, who experienced persistent pain within 48 hours of the VPT, RCT was carried out & these patients were excluded.

The cumulative success rate of SVRCT & VPT with Dycal, MTA, Biodentine was compared & Statistically evaluated by applying Chi square test. All the data were analyzed by using software SPSS 22.0 (Chicago, USA) Level of sig set at p-value equal to or less than 0.05 For evaluating the statistical finding between different material in direct & indirect pulp capping procedure, the following formula was used.

RESULTS

Success rate of direct pulp capping with Dycal was found to be 75% (7 patients) whereas for both MTA and Biodentine it was 88% (9 patients) respectively. With Indirect pulp capping procedure, the success achieved using Dycal was 67% (6 patients) and with both MTA & Biodentine 88% (9 patients). In the control group patients treated with single visit root canal treatment, successful outcome was observed in 92 % of cases (23 patients). Table -2

Three cases in control group treated with SVRCT experienced severe pain with increased tenderness on percussion, with two patients displaying swelling along with periapical radiolucency. These cases were retreated and kept on further follow up. Table-1

Four patients treated with direct pulp capping, experienced moderate pain with tenderness on percussion and non-responsiveness toward cold and electric pulp test along with radiographic changes. Table-1

Among the patients treated with indirect pulp capping, group five patients experienced pain with tenderness on percussion along with non-responsiveness towards cold and electric pulp test as well as radiographic changes. These cases in vital pulp therapy group were considered as failure & were root canal treated. Table-1



The success rate of Dycal, when used as pulp capping agent in direct pulp capping was 75% whereas for indirect pulp capping was 67%. Similarly the success rate, of MTA and Biodentine in both the vital pulp therapy procedures were 88%. However the difference was statistically non-significant. Table -2

Overall success rate was 84% in VPT group and 88% in RCT group, which was statistically non-significant. Table -3

DISCUSSION

Conditions in which pulp is affected have been treated with root canal treatment since long but lately there has been an emergence of the view that rather than treating entire pulp only the affected part of pulp should be treated.^(6,7) Justification for this school of thought has been proposed & supported in various studies by Hegde et al (2006), Asgary S et al (2013), Uesrichai, N. (2019), Eren, B (2019). The underlying thought behind this view, is the understanding that in the initial stages of pulp involvement & inflammation, the superficial part is primarily affected, the distant pulp remains largely unaffected.^(7,8,9)

In this study symptomatic cases in young healthy patients were taken up so as to provide optimal condition for healing of pulp after vital pulp therapy. Since, it has been the general observation that young pulp has higher regenerative potential [Ward J (2002)]¹² therefore young adults were enrolled in this study. For evaluating the success or failure of treated cases, clinical signs & symptoms along with radiographic finding were considered, as advocated by Wolter et al & Zanini et al (2012 & 2016)^{5,10,11}

On comparing vital pulp therapy with single visit root canal treatment, the later provided with higher success rate. Although this finding was statistically non significant but it negated the view that VPT might be a successful alternative to root canal treatment. This finding has been the premises of various studies by Asgary S (2013), Uesrichai, N. (2019), Eren, B (2019). The key factor for success of VPT in their studies was the sealing ability of the material;[] on the other word, the primary cause of failure was the bacterial recontamination during the healing process.

The reason for high clinical success rate in our study can be attributed to the fact that since the teeth in earlier

stages of symptomatic irreversible pulpitis were taken, it can be assumed that entire pulp was not involved. The infection & the inflammatory process was limited to the most superficial layers of coronal pulp & those parts were treated. The concentration of inflammatory mediators & by products was thus relatively less & these were effectively reduced/ controlled with VPT. Thus resulting in relief from pain & inflammation.

Among the three tested materials for VPT, the success rate with MTA and Biodentine was similar and higher than Dycal, which was statistically insignificant. This finding has been the mainstay of study by Cvek and Matuso, according to them approximately 2 years follow up is reasonable to reach a conclusion when CH is used as DPC agent.[] According to Gandolfi, higher amount of calcium is released from MTA as compared to Calcium hydroxide.[] Results obtained were better with MTA. The reason for lower success rate obtained with calcium hydroxide can be attributed to fact that calcium hydroxide has no inherent adhesive properties, it possess high solubility, biocompatibility is questionable due to its caustic pH, and provides poor seal.⁷⁶ Furthermore, Dentin Bridge formed underneath has tunnel defects that may provide pathway for bacterial ingress. Whereas MTA & Biodentine are bioactive cements with comparable biological properties for VPT. They produce poor inflammatory reaction, possess high biocompatibility, odontogenic along with antibacterial impact and angiogenesis, Dentin Bridge formed underneath is complete.[]

On the basis of result obtained in the study both the null hypothesis stand rejected. Our study had a few limitations as well. For estimating the outcome of VPT histologic examination is the gold standard, it was not carried out because in that case extraction would have been required while, the entire goal of this study was the preservation of teeth.

CONCLUSION

On the basis of the results obtained in our study it can be concluded that VPT is a valid & helpful procedure in comparison to RCT. Between the two types of pulp capping DPC has better prognosis. Whenever RCT is required, if indicated SV treatment should be preferred over multiple visit.



VARIABLE	SVRCT	VPT(Direct Pulp Capping)	VPT (Indirect Pulp Capping)
Pain	3	3	5
Tenderness on percussion	3	5	6
Mobility	1	3	3
Swelling	2	2	3
Tenderness on palpation	2	-	4
Pocket depth	1	5	3
Response to cold test	-	4	6
Response to electric pulp test	-	5	6
Lamina dura	2	6	5
Periodontal ligament	2	7	8
Periapical area	3	5	6

Table-1

Vital pulp therapy	Dycal	MTA	Biodentine
Direct pulp capping	75%	88%	88%
In direct pulp capping	67%	88%	88%

Table-2

	Single visit root canal treatment	Vital pulp therapy
Clinical success rate	88%	84%

Table-3

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