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ORIGINAL ARTICLE

Preferred Technique and Material Choice for exposed pulp among dentists practicing in Karachi

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ABSTRACT

Aim: To assess the treatment preference of dentists working in Karachi for clinically managing pulp exposures and their choice of material for Direct Pulp Capping.
Methods: A cross-sectional survey performed from 1st Nov 2018 to 15th April 2019 by selecting a simple random sample of 600 dentists from the 15 dental colleges. Total of 600 questionnaires was sent to the participants with the request to return it on or before 15th April 2019.
Results: Significantly high number of responders, regardless of their clinical experience, handle pulp exposures with RCT in case of exposure ≤ 1mm (p=0.001), carious exposure (p=0.001) and mechanical exposure(p=0.001). The frequency of practitioners performing total caries excavation with definitive restoration was significantly higher (p=.001). The frequency of using Calcium Hydroxide (CH) for DPC was significantly higher (p=.001) as compared to other materials.
Conclusion: It appears as if current evidence-based philosophy of conservative approach to deal with pulp exposures has not yet been completely adopted by responding clinicians and tendency to treat pulp exposure through RCT prevails. The majority of the dentists still employs CH as a material of choice for DPC.
Keywords: Dental Pulp Capping (MeSH); Pulp Capping Agents (MeSH).

INTRODUCTION

The pulp is a soft and exceedingly vascular tissue of a tooth which maintains its vitality to keep the tooth functional. To safeguard its liveliness, this delicate tissue in a coronal part of a tooth is confined within a shell of two highly mineralized tissues – enamel and dentin. Many times, due to caries, trauma or during tooth cutting for caries removal or crown preparation, the pulp gets exposed to the oral environment and is treated by Direct Pulp Capping (DPC). It is a clinical procedure in which a biomaterial is placed directly over the exposed pulp and is allowed to promote pulp healing by producing reparative /tertiary dentin[1]. The vital pulp, with its circulation extending into the tubular dentin, keeps the dentin moist, which in turn ensures that the dentin maintains its resilience and toughness.

If successful, DPC procedure precludes the need for Root Canal Treatment (RCT) which is not only more invasive, more extensive and more expensive treatment but also renders the tooth non-vital. Moreover, in the case of open apices in kids, DPC promotes Apexogenesis[2], thus increases the vital-life expectancy of the affected tooth.

Before the 1990s, DPC was considered as an intermediary or emergency treatment until RCT was performed as a permanent solution.[3] Over the past few years, induction of advanced technology and newer endodontic materials has led to a change in the mind-set of dental clinicians for the management of exposed vital pulps. Researchers have verified that vital exposed pulps have a natural capability for healing through cell reorganization and tertiary dentin deposition if a proper biologic seal is applied and maintained against seepage of saliva.[4] A successful pulp cap protects pulp vitality and develops Dentin Bridge within three months, but dental clinicians feel less confident for its success. The uncertainty of success exists not because of the lack of inherent healing ability of the exposed vital pulp but due to fear of failure of the performed DPC procedure.

For a successful outcome, the exact determination of pulp status is the key to the treatment decision but diagnosing pulpal condition during clinical examination and a patient's symptoms is a challenge for an attending dentist. Evidence suggests that the diagnostic criteria to assess pulp status and the treatment decisions employed by dental clinicians in the management of pulp health are vastly inconsistent and variable[5]. Therefore, in the literature, the success of DPC has been discussed with great controversy. Moreover, the risk perception for the success of DPC of each dentist isn't similar that leads to different treatment approaches[6]. It is also observed that in clinical circumstances where chances of success of DPC anticipated by the clinician are low, they opt for more invasive surgical approaches, including pulpotomy or RCTs.

Various materials are available which are employed in clinics by the dental fraternity for pulp capping procedure. Since the early 20th century, the most preferred material utilized for DPC has been Calcium Hydroxide (CH)[6,7]. Many Bioceramic materials with silicate-based composition like Mineral Trioxide Aggregate (MTA) and Biodentine have also been recommended for various dental applications, including root repair and pulp capping[8,9].

To the best of our knowledge, no study has yet been conducted in this country to know the dentists' treatment preferences on exposed pulps. This study, therefore, has been planned with the null hypothesis that clinical pulp exposures are managed according to the current scientific evidence. The objectives of the study were to assess the preference of dentists to handle pulp exposures, practising in the metropolitan city of Karachi and their choice of material for DPC.

METHODS

A cross-sectional survey was performed from 1st November 2018 to 15th April 2019 among dentists working in Karachi after permission from Ethical Review Committee. In this metropolitan city, 15 private and public sector dentistry colleges exist, catering hundreds of students per year and a large number of dentists practice clinical dentistry. A simple random sample of 600 dentists was selected from the 15 dental colleges in Karachi and contacted physically, telephonically and electronically. On contact, the purpose of the study was explained with the assurance of confidentiality and anonymity of the data. Total of 600 questionnaires was sent to the participants with the request to return it on or before 15th April 2019.

The tool used for the survey was a slightly modified questionnaire used previously in a similar Turkish study[6] with the author's prior permission to use it. Ethical approval for this study

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was obtained from the ethical review board of Baqai Dental College vide BDC/ERB/2020/003.

The questionnaire consisted of well-explained, easy to follow small clinical scenario followed by six closed-ended queries about treatment preference with two options of "DPC" or "RCT". The preference of respondents was sought about the size and number of perforations, type of perforation and age of the patient needing the treatment. A supplementary question was about the choice of material for carrying out DPC in dental operatories.

Data analysis was carried out by using SPSS version 17. Initially, descriptive statistics were carried out. The Chi-square test was conducted to estimate the difference between the frequencies. When obtaining the numerical representation by percentages, the total number of answers for each query was considered. A significant difference was considered with $p< 0.05$.

RESULTS

In the stipulated time, out of 600 distributed questionnaire, 571 filled responses were received at a very healthy response rate of nearly 95% out of which one incorrectly filled response was rejected and 570 were included in the study. Table I shows the demographic features of the participants in the study. The number of practitioners with clinical experience less than or equal to ten years were significantly higher as compared to practitioners with clinical experience >10 years (p=0.039).

It is evident from the findings of this study that significantly high number of responders, regardless of their clinical experience handle pulp exposures with RCT in case of exposure ≤ 1mm (p=0.001), carious exposure (p=0.001) and mechanical exposure(p=0.001). Similarly, in case of double pulp exposure and exposure >1mm the high number of responders, regardless of their clinical experience handle pulp exposures with RCT; however, no significant difference was found (Table II).

In the case of technique, regardless of clinical experience, 43.9% responder prefer to perform total caries excavation with a definitive restoration as compared to the participant using other techniques. The frequency of practitioners performing total caries excavation with definitive restoration compared to other techniques was significantly higher (p=.001). In the case of material selection, 45.6% responders regardless of their clinical experience, prefer to use Calcium Hydroxide alone. The frequency of practitioners prefers to use Calcium Hydroxide alone for direct pulp capping was significantly higher (p=.001) as compared to other materials (Table III).

Table I: Distribution of participants (n=570) according to gender, degree, experience

Demographic features	Male	Female	P value
Experience			
≤10 Years	270 (87.1)	210 (80.8)	0.039
>10 Years	40 (12.9)	50 (19.2)	
Last Dental Degree			
BDS	301 (54.8)	248 (15.8)	0.280
Postgraduate	9 (42.9)	12 (57.1)	

Table II: Decision based on number, size and type of exposure

Experience	**Exposure ≤ 1mm**		**P value**
	DPC	**RCT**	
10 Years or less	79(16.5%)	401(83.5%)	.0001
Over 10 Years	35(38.9%)	55(61.1%)	
Exposure > 1mm			
10 Years or less	6(1.3%)	474(98.8%)	0.35
Over 10 Years	0(0%)	90(100%)	
Double exposure			
10 Years or less	29(6.0%)	451(94.0%)	0.381
Over 10 Years	4(4.4%)	86(95.6%)	
Carious exposure			
10 Years or less	70(14.6%)	410(85.4%)	.0001
Over 10 Years	30(33.3%)	60(66.7%)	
Mechanical exposure			
10 Years or less	200(41.7%)	280(58.3%)	.0001
Over 10 Years	10(11.1%)	80(88.9%)	

Table III: Distribution and comparison of dentist preferences in case of technique and material choice

Experience	**Total caries excavation, definitive restoration**	**Partial caries excavation, definitive restoration**	**P- value**	**Partial caries excavation, temporary restoration**	**P- value**	**Total caries excavation, temporary restoration**	**P- value**
≤10 Years	190(33.3)	60(10.5)		140(24.6)		90(15.8)	
>10 Years	60(10.5)	10(1.8)		0 (0)		20(3.5)	
	250(43.9)	70(12.3)	.0001	140(24.6)	.0001	110(19.3)	.0001
Experience	**Calcium Hydroxide**	**Calcium Hydroxide, MTA**	**P- value**	**MTA**	**P- value**	**Others**	**P- value**
	N(%)	**N(%)**		**N(%)**		**N(%)**	
≤10 Years	240(42.1)	150(26.3)		70(12.3)		20(3.5)	
>10 Years	20(3.5)	30(5.3)		40(7.0)		0(0)	
	260(45.6)	180(31.6)	.0001	110(19.3)	.0001	20(3.5)	.0001

DISCUSSION

In the questionnaire the participating dentists were asked about their preference of treatment option when; there is single pulp exposure or double, exposure is less than 1 mm or greater than 1 mm, exposure is mechanical or carious, and exposure is in the patients of under or over 30 years of age. One query was about the choice of material for DPC.

Previous studies reported that number and size of the exposure do not influence the treatment decision[10,11], but an author contradicted these findings as he believed that more microorganisms enter into the pulp if the exposure size is big or if there is more than one exposure.[4] The responders of this study perhaps go behind Cox's philosophy as 80-94% of them perform RCT in case of exposure, may it be single or double whereas in case of exposure size greater than 1mm almost all of them have a preference to perform RCT. Turkish dentists also prefer to perform RCT in situations where perforation size is big[6].

There has been controversy over the healing ability of pulp exposed by caries excavation or iatrogenic injury during tooth preparation for prosthodontics reasons. Previously it was believed that owing to a greater number of bacteria present in the carious pulp exposure than in fresh pulp exposed mechanically heals quickly.

On the contrary, some studies reported that the type of exposure does not affect the clinical outcome of DPC.[12,13] Responding dentists in this study showed liking of taking no risk and treat their patient with RCT. The logical reason behind it may be that dental practitioners commonly encounter failed DPC as its failure rate has been reported between 44.5% - 82%.[14] It is worth mentioning here that current research reveals that post-pulp capping failure occurs because of non-sterile procedures and bacterial infiltration of the pulp through dentinal tubules that lead to slow deterioration of pulp.

Age of the patient is considered another divisive factor which affects the treatment decision of the dental clinicians. Many

researchers are of the opinion that young teeth are a better candidate for DPC than older teeth.[6,15] Some related studies have entirely conflicting outcomes, thereby believing that age has no impact on the success of DPC[6,10] Merely 11% of participants of this study opt for DPC in the patients with age above 30 years, whereas 89% have faith that age is a critical factor and therefore refrain from doing DPC.

In one study, the author reported that the practising dentists, to avoid the anticipated failure, prefer to perform RCT as they have greater belief in its immediate and long-term successful outcome. The findings of the present study endorse the results of Lawrence's study as most of the responders irrespective of their experience and gender prefer to opt for RCT over DPC. The results of two mentioned studies are contradicted by a study done in Norway, which reports that the majority of responding dentists of that study prefer to perform DPC even in case of carious exposure[16]. The most probable reason for this disagreement may be the use of material for DPC. In most western countries, MTA and Biodentine are used for this purpose, whereas, among Pakistani dentists, CH alone is the material of choice. It is confirmed by finding of the study that majority of the respondents use CH as capping material. The findings in this regard are consistent with several studies done in Pakistan, France and Turkey[6,14,17]. Although CH for DPC has been used for many decades, it does have considerable demerits which include; lack of intrinsic sealing and adhesive ability and deprived physical properties along with a tendency to dissolve over a period of time.[4] Moreover, hard tissue bridge formed under CH contains porosities and tunnel defects. These defects in dentin provide a passageway for the access of microbes which negate the purpose of doing vital pulp capping. The ultimate goal of DPC is providing robust biocompatible seal which protects the dentin-pulp complex from bacteria and harmful agents. The tunnel defects in CH cause secondary pulp infection and consequent failure of the DPC.

On the other hand, Calcium silicate-based materials also known as bioceramics introduced recently have been shown to perform much better for DPC than CH as they possess many advantages which include biocompatibility, low solubility, bioactivity, non-toxicity and biostability. Mineral Trioxide Aggregate (MTA) is a first bioceramic material that exhibits superior sealing ability[18]. Many in-vivo studies reported that MTA performed appreciably better than CH for DPC procedure[2,19,20]. Biodentine is a second-generation bioceramic material that performs like MTA, but unlike MTA, it sets faster and does not discolor[21,22]. A study mentioned that DPC for asymptomatic vital permanent teeth with carious pulp exposure could be treated successfully using Biodentine.[23]

Among participants of the study, negligible number uses bioceramics, and majority utilizes CH. Most likely, the prevalent use of CH for DPC is because this is the technique most dentists learn during their undergraduate dental school days, and they continue practicing what they have learnt and feel at with ease. More use of CH and lesser use of bioceramics for DPC probably creates fear of failure in the minds of the operating dentists and to be on the safe side, they prefer to perform RCT over DPC. One more reason behind not attempting DPC maybe that till past few years, the accepted concept was that if a carious pulp exposure occurs and pulp was normal or reversibly inflamed, the entire pulp tissue was considered inflamed and required to be treated with RCT. The current understanding on pulp pathology has increased the success rate of DPC as it is established that if a pulp has a carious exposure, the tissue adjacent to the exposure is necrotic, followed by a localized inflammation but the rest of the pulp is normal. In a very recent study, authors cited many studies which reveal that the age is not a significant factor in the outcome of DPC as previously only young mature teeth were considered eligible for undergoing DPC[24].

The outcome of a DPC procedure principally depends on the condition of the tooth and the skills of the operator. If the treatment is performed properly under appropriate isolation, the success rate is remarkably high8. In this study, reasons for persistent use of CH and preferring RCT over DPC were not investigated. Further studies are suggested to explore why dentists persistently continue using CH for DPC and why they tend to perform RCT where DPC can be successfully done.

CONCLUSION

It appears as if current evidence-based philosophy of conservative approach to deal with pulp exposures has not yet been completely adopted by responding clinicians and tendency to treat pulp exposure through RCT prevails. RCT is an invasive procedure which makes the treated tooth dead and weak and brittle as pulp of the tooth is removed while performing the RCT. On the contrary, after pulp capping, the pulp of the tooth remains vital and an intracoronal restoration brings it back to perform normal function in the arch. Moreover, pulp capping is far less a conservative procedure than RCT. Most of the dentists still employs CH as material of choice for DPC.

Conflict of interest: Nil

REFERENCES

1. Alex G. Direct and Indirect Pulp Capping: A Brief History, Material Innovations, and Clinical Case Report. Compend Contin Educ Dent 2018;39(3):182-9.
2. Brizuela C, Ormeño A, Cabrera C, Cabezas R, Silva CI, Ramírez V, et al. Direct Pulp Capping with Calcium Hydroxide, Mineral Trioxide Aggregate, and Biodentine in Permanent Young Teeth with Caries: A Randomized Clinical Trial. J Endod 2017;43(11):1776-80.
3. Bahcall J, Alex G,Trope M. Pulpotomy/Pulp-capping Vs Pulpectomy: The New Endodontic Treatment Conundrum? Compendium 2018; 39 (6):350.
4. Cox CF, Bergenholtz G, Fitzgerald M, Heys DR, Heys RJ, Avery JK, et al. Capping of the dental pulp mechanically exposed to the oral microflora - a 5 week observation of wound healing in the monkey. J Oral Pathol 1982; 11(4):327–39
5. Koopaeei MM, Inglehart MR, McDonald N, Fontana M. General dentists', pediatric dentists', and endodontists' diagnostic assessment and treatment strategies for deep carious lesions. A comparative analysis. J Am Dent Assoc 2017;148:64-74.
6. Hatipoğlu O. Factors affecting the decision-making of direct pulp capping procedures amongst Turkish dental practitioners. Eur Endod J 2018; 3:167-73.
7. Aljanakh M, Mirza AJ, Siddiqui AA, Al-Mansour M, Asad M._Do Dentists in Ha'il Region Follow Contemporary Pulp Protection Protocols? A Saudi Based Study. Int J Dent Sci and Research 2016; 4 (4) 68-71.
8. Daniele L. Mineral Trioxide Aggregate (MTA) direct pulp capping: 10 years clinical results. Giornale Italiano di Endodonzia 2017; 31(1):48–57. DOI:10.1016/j.gien.2017.04.003
9. Popović Bajić M, Danilović V, Prokić B, Prokić B, Jokanović V, Živković S. Direct Pulp Capping Using Biodentine. Serbian Dent J 2014; 61(2):65–74.
10. Miles JP, Gluskin AH, Chambers D, Peters OA. Pulp capping with mineral trioxide aggregate (MTA): a retrospective analysis of carious pulp exposures treated by undergraduate dental students. Oper Dent 2010; 35(1):20–28.
11. Cho SY, Seo DG, Lee SJ, Lee J, Lee SJ, Jung IY. Prognostic factors for clinical outcomes according to time after direct pulp capping. J Endod 2013;39(3):327–31.
12. Al-Hiyasat AS, Barrieshi-Nusair KM, Al-Omari MA. The radiographic outcomes of direct pulp-capping procedures performed by dental students: a retrospective study. J Am Dent Assoc 2006; 137(12):1699–1705.
13. Hørsted P, Søndergaard B, Thylstrup A, El Attar K, Fejerskov O. A retrospective study of direct pulp capping with calcium hydroxide compounds. Dental Traumatology 1985; 1(1):29–34.
14. Stangvaltaite L, Schwendicke F, Holmgren C, Finet M, Maltz M, Elhennawy K, et al. Management of pulps exposed during carious tissue removal in adults: a multi-national questionnaire-based survey. Clin Oral Investig 2017; 21(7):2303–09.
15. Mente J, Geletneky B, Ohle M, Koch MJ, Ding PGF, Wolff D, et al. Mineral trioxide aggregate or calcium hydroxide direct pulp capping: an analysis of the clinical treatment outcome. J Endod 2010; 36(5):806–13.

16. Stangvaltaite L, Kundzina R, Eriksen HM, Kerosuo E. Treatment preferences of deep carious lesions in mature teeth: Questionnaire study among dentists in Northern Norway. Acta Odontologica Scandinavica 2013; 71: 1532–37.
17. Bukhari JH, Bano NZ, Qadir S, Gul H, Kaleem M. Dental pulp treatment options in teaching institutions of Rawalpindi. Pak Oral & Dental J 2016; 36, (4):637-40.
18. Agnes A, Long A, Best S, Lobner D. Pulp capping materials alter the toxicity and oxidative stress induced by composite resins in dental pulp culture. Eur Endod J 2017;2(1):1-6.
19. Hilton TJ, Ferracane JL, Mancl L. For northwest practice-based research collaborative in
evidence-based D. Comparison of CaOH with MTA for direct pulp capping: a PBRN randomized clinical trial. J Dent Res 2013;92(7suppl):S16–22.
20. Taha NA, Khazali MA. Partial pulpotomy in mature permanent teeth with clinical signs indicative of irreversible pulpitis: a randomized clinical trial. J Endod 2017;43(9):1417-21.
21. Parinyaprom N, Nirunsittirat A, Chuveera P, Na Lampang S, Srisuwan T, Sastraruji T, et al. Outcomes of Direct Pulp Capping by Using Either ProRoot Mineral Trioxide Aggregate or Biodentine in Permanent Teeth with Carious Pulp Exposure in 6- to 18-Year-Old Patients: A Randomized Controlled Trial. J Endod 2018;44(3):341-48.
22. Katge FA, Patil DP. Comparative Analysis of 2 Calcium Silicate-based Cements (Biodentine and Mineral Trioxide Aggregate) as Direct Pulp-capping Agent in Young Permanent Molars: A Split Mouth Study. J Endod 2017;43(4):507-13.
23. Lipski M, Nowicka A, Kot K, Postek-Stefańska L, Wysoczańska-Jankowicz I, Borkowski L, et al. Factors affecting the outcomes of direct pulp capping using Biodentine. Clin Oral Investig 2018;22(5):2021-29. DOI:10.1007/s00784-017-2296-7.
Taha NA, Sedgley CM. Conservative management of mature
permanent teeth with carious pulp exposure. JOE 2020; 46(9S):33-41.