Practice of Dental Pulp Protection Methods among Various Teaching Institutions in Pakistan

Asaad Javaid1 BDS, MCPS, MDS
Maaz Asad2 BDS, MDSc
Sharukh Khan3 BDS, MDSc (Research Scholar)
Marwah Berkth4 BDS, MDSc (Research Scholar)

ABSTRACT: Pulp is a vascular and vital part of a healthy tooth. Pulps of teeth with breached enamel become vulnerable to infections and succeeding necrosis if the lost tissue remains unreplaced. The dentists replace it using restorative materials which are not friendly to the pulp. Pulp protection measures are therefore necessary to be taken to save pulp vitality during a restorative procedure. Concepts about pulp protection have changed with time. Previously, pulp was considered under threat due to toxicity or heat conductivity of restorative materials. It is now believed that ingress of bacteria under a restoration causes pulp inflammation. The materials with enhanced sealing ability protect pulp very effectively. Contemporary pulp protection protocols were therefore, put forward 12-14 years ago. This study is designed to assess clinical execution of these protocols in Pakistani institutions of undergraduate dental education.

METHODS: A meticulously designed questionnaire was circulated in various dental schools situated in various cities of Pakistan. Data collected was analyzed with the help of a biostatistician using SPSS version 18.

RESULTS: If the remaining dentin thickness is more than 1.5 mm, there is no need to use any cement base or liner for pulp protection. 89 % of respondents do not care about dentin thickness before using liners / bases. Materials employed for cavity lining may be a cement, varnish or dentin adhesive. 70 % of them consider it essential to give cement lining under the restorations. A vast majority uses Calcium Hydroxide as base and 90 % of them cover the whole exposed dentin with it. Dentin sealer and Dentin adhesives are not used as pulp protecting agent respectively by 76 % and 63 % of participants of the study.

CONCLUSION: Contemporary protocols for pulp protections are not being followed in the institutions which participated in the survey.

KEYWORDS: Pulp protection, cavity liner & bases.


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INTRODUCTION

Pulp is a soft, highly vascular and vital part of a tooth which maintains the health of a tooth. Nature has protected this delicate tissue within a shell of two very hard tissues – enamel and dentin to keep its vitality intact. Breach of integrity of the hard tissues which most commonly occurs due to caries may threaten pulp vitality1.

Pulp of a tooth with breached enamel and dentin remains vulnerable to undergo bacterial infection and subsequent necrosis if the lost tissue is not compensated. To protect the vitality of pulp, deposition of secondary and reactionary dentin takes place as a natural defense mechanism2 but most of the time operative intervention by a dentist is necessitated. The dentists restore the lost tooth tissue either with metallic or resin based permanent restorative materials. Before placing these materials in a prepared cavity as a definitive restoration, a dentist has to execute pulp protection protocols. Conventionally, various dental cements have been used as liners /bases under an intracoronal restoration for protection of the pulp from the so-called inherent hazards of the restorative materials. The old pulp protection protocols were based on the fact that low pH restorative materials provoke pulp reactions3-5 or cause toxicity to pulp because of higher thermal conduction through amalgam and presence of monomer in resin composites.
In recent past, concepts of pulp protection associated to the use of liners and bases have been revisited\(^6,7\). Extensive work done on this issue has changed the entire philosophy of using bases and liners and contemporary pulp protection protocols have been evolved. According to these protocols, bases are now restricted to be used to block the undercuts in a cavity. Calcium Hydroxide liners are used as a therapeutic agent only when the remaining dentin thickness (RDT) is less than 0.5 mm. Owing to superior sealing ability glass ionomer cements are used as cavity sealers under amalgam and composite restorations when the RDT is more than 0.5mm and less than 1.5mm. Liners or bases are not needed at all when the RDT is more than 1.5 mm\(^3\). The current understanding about safety of vital pulp developed as it is now a proven fact that pH, thermal conductivity, chemical insult and other attributes of restorative materials do not endanger the pulp health\(^9,10\). On the contrary, ingress of microorganisms or their by-product under a restoration through microleakage that occurs at the restoration-cavity interface causes pulp inflammation and subsequent pathology\(^11,12\). The materials with better sealing ability protect the pulp more effectively\(^13,14\). It is therefore emphasized more on unblemished sealing of cavity walls and floor which is possible with easily flowable materials than traditional lining/basing with cements. Despite the fact that new recommendations for pulp protection methods were given more than 15 years ago, undergraduate students in Pakistan are still seen employing the old methods during their clinical sessions. The logical reason behind this students’ practice may be the teaching trends about pulp protection in their dental schools. In the schools, undergraduates are probably still taught that prior to placement of a definitive restoration a medicament must be placed on dentin surface to protect it from adverse effects of final restoration.

This survey based observational study was planned with the null hypothesis that despite the lapse of more than one decade, the contemporary pulp protection protocols are not being followed by the undergraduate dental students and intern studying or working in various institutions of Pakistan.

**MATERIAL AND METHOD**

Seeking approval from the ethical committee of Baqai Dental College, Karachi, a content validated close-ended questionnaire was meticulously designed by the research team keeping simplicity, viability and precision in its words. Respondents did not have to mention the names on the questionnaire (survey form) to maintain their anonymity. They had to mention the name of their school where they were studying and learning clinical dentistry. As the study is focused on assessing pulp protection practices of young clinicians; clinical dental students of final year and interns were allowed to fill out the survey form. The rationale behind inclusion of merely clinical students and interns was that at this time of their professional career, they are in learning stage. What they learn at this stage, they practice all through their clinical occupancy. The study sample included N=500 respondents from Islamabad, Rawalpindi, Peshawar and Karachi using non-probability convenient sampling technique.

The questionnaire based on two point Likert scale comprised of nine questions regarding clinical practices of the respondents towards pulp protection measures. The queries consisted of items on consideration of remaining dentin thickness before applying a base or liner, choice of applying Calcium Hydroxide or any other cement as a base under direct restorations, consideration of basing/lining as an essential procedure under all direct restorations, applying resin modified GIC with sealer or dentin adhesive in the presence of remaining dentin thickness more than 1.5 mm, time of application sequence of liners or bases, whether or not covering the whole exposed dentin and use of dentin sealer and adhesive for pulp protection.

### Table 1. Showing respondents’ responses.

<table>
<thead>
<tr>
<th>Questions</th>
<th>Yes n (%)</th>
<th>No n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consideration of RDT</td>
<td>50 (11.1)</td>
<td>402 (88.9)</td>
</tr>
<tr>
<td>Application of CaOH under all direct restorations</td>
<td>370 (81.9)</td>
<td>82 (18.2)</td>
</tr>
<tr>
<td>Use of cement other than CaOH under all direct restorations</td>
<td>243 (53.5)</td>
<td>209 (46.4)</td>
</tr>
<tr>
<td>Consideration of cement liner/base as an essential step</td>
<td>318 (70.1)</td>
<td>134 (29.6)</td>
</tr>
<tr>
<td>Use of resin modified GIC if RDT is &gt; 1.5mm</td>
<td>156 (34.5)</td>
<td>296 (65.4)</td>
</tr>
<tr>
<td>Application of base/liner before or after finishing of preparation</td>
<td>240 (53.1)</td>
<td>212 (46.9)</td>
</tr>
<tr>
<td>Covering the whole exposed dentin with CaOH in deep cavities</td>
<td>404 (89.4)</td>
<td>48 (10.7)</td>
</tr>
<tr>
<td>Use of dentin desensitizer for pulp protection</td>
<td>341 (75.4)</td>
<td>111 (24.5)</td>
</tr>
<tr>
<td>Use of dentin adhesive for pulp protection</td>
<td>168 (37.2)</td>
<td>284 (62.8)</td>
</tr>
</tbody>
</table>
telephonically contacted to obtain the consent to participate in the study. The questionnaire was sent through email to those who showed willingness to participate by allowing their final year students and interns to fill out the survey form. The data was analyzed using statistical package for social science 18. Descriptive analysis was obtained and frequency of distribution was calculated in percentage.

RESULTS

The data was analyzed using SPSS version 18. The responses of participants in relation to the clinical execution of contemporary pulp protection protocols were calculated using frequency distribution.

A total of 500 survey questionnaire were sent to clinical dental students and interns attending dental clinics in various colleges of dental education in Pakistan through their Operative Dentistry teachers. The questionnaire consisted of nine simple queries about pulp protection habits of the respondents with 2-point Likert scale. The options available to the respondents were ‘Yes’ or ‘No’.

452 completely filled up questionnaire were returned at the healthy response rate of 90.40%. Table 1 shows the responses of participants in relation to their clinical practice towards pulp protection.

The first question asked was about consideration of the remaining dentin thickness (RDT) of the tooth under restoration; merely 50 (11%) respondents stated that they take pulp protection measure keeping RDT in view while majority of them 402 (89%) doesn’t consider RDT.

The second and third questions were about use of cement for pulp protection. 370 (82%) of respondents use Calcium Hydroxide cement as a base whereas 243 (54.5%) use cement else than Calcium Hydroxide as a base under all direct restoration irrespective of RDT. In response to a query about using cement liner or base as an essential procedure, 318 (70%) of the participants mentioned that they consider use of cement lining and base as an essential procedure for pulp protection. In response to the question about use of resin modified GIC lining even if the RDT is more than 1.5mm, 156 (34.50 %) dentists responded as ‘yes’ while 65.50 % of them said “No”. Regarding application of base/liner after or before the finishing of preparation, 242 (53%) of the participants were found to use liners/bases after finishing the preparation or placing the bevels while a large number 212 (43%) of them apply liner/bases before finishing of preparation. In response to a question about applying the lining cement on whole exposed dentin on the floor or axial wall or only on the deepest part of the cavity, only 48 (10%) respondents were found to apply it on the deepest part while the rest of 404 (90%) cover the whole exposed dentin. Two separate questions were asked about the use of dentin sealer and dentin adhesive as pulp protecting agents. Lack of application was observed for dentin sealers and dentine adhesive to be used as agents for pulp protection in clinical practice; 76 % were found not using sealer for this purpose and 63% do not use dentin adhesives as pulp protecting agent. See Fig. 1 for graphical representation of the results.

DISCUSSION

Dental students at undergraduate and postgraduate level have been taught in Operative Dentistry curriculum to use cavity liners and bases under direct dental restoration as an essential procedure for pulp protection15, 16. Various cements have been in use as liners /bases which were employed to provide protection to pulp against marginal leakage, toxicity and thermal conductivity of restorative material and post-operative sensitivity. Entire philosophy of pulp protection has been changed and new approach based on total adhesion of restoration to minimal preparation is recommended17.

It is now believed that Remaining Dentin Thickness (RDT) has great influence on vitality of pulp and RDT of 0.5 mm or more reduces the toxicity of substances on the pulp.
thereby saving the pulp from any damage\textsuperscript{10}. It is striking to notice that barely 11\% of respondents consider RDT before applying a liner or a base whereas rest of the 89\% don’t care about this very significant concern.

70\% respondents still believe that applying a cement base under amalgam or composite restoration is absolutely essential whereas current understanding on this issue is that all cavities do not require cement liners or bases. Dentin thickness of 1.5 mm is enough to safeguard the pulp vitality from any chemical, thermal or biological threat. A prepared cavity which has RDT 1.5 mm or more need not be lined or based\textsuperscript{8} but findings of this study show that 34\% of respondents were found using resin modified glass ionomer as a base in such clinical situations. It is speculated that most of the other dentists employ bases of other cements in such cases. This speculation is based on the fact that they consider lining / basing procedure as an essential procedure as revealed by responses of previous question in this regard.

Findings of many studies demonstrate that Calcium Hydroxide is not a suitable material for basing as it has short antibacterial effect and high solubility that results in softening of the liner and material loss under the restoration creating a gap between tooth and restoration interface\textsuperscript{9}. Its lack of adhesion, poor cavity-sealing ability, compromised strength also renders it unsuitable for employing it as a base under a restoration\textsuperscript{10}. Its use in deep cavity is not considered a determining factor for success of treatment\textsuperscript{21}. Results of this study show that 82\% of the respondents still use Calcium Hydroxide as a base under all the direct restorations they perform. It is quite obvious that when majority of the dentists uses it as a base, they cover the whole pulpal floor or axial wall. Finding of this study also verifies the statement as 90\% of the participating dentists cover the whole exposed dentin on floor or axial wall. Current recommendation is to apply it only on the deepest portion of the cavity as a therapeutic agent as covering the whole exposed dentin not only compromises the adhesion of restorative material but also creates space for microleakage once the highly resorbable Calcium Hydroxide resorbs.

Coating of dentin adhesives over exposed cavity dentin have been proven and recommended to be used for pulp protection\textsuperscript{22} instead of cement lining or bases. Dentin adhesive has also been successfully used on accidentally exposed pulp\textsuperscript{23}. Its lack of use as pulp protecting agent is found very disappointing as 76\% respondents declined to use it for the purpose.

Published articles on status of using liners and bases are not available. It is an unspoken reality that dental students after successful completion of dental degrees continue to practice what they have learnt in their schools. Findings of the survey gives a reveal that the undergraduate students, in their clinical rotations practice old philosophy of protecting dental pulp. Major consequence of this negligence will be that the students keep cutting cavities using obsolete Black’s principles which involve unnecessary tooth tissue removal to create Macro retentive features for a restoration. Concept of minimally invasive dentistry allows the cavities with lesion-specific caries removal. The size of the cavities prepared on this principle doesn’t afford the luxury of placing liners and bases in all cases.

Who is to be blamed? Definitely teachers involved in teaching of Operative Dentistry; it is therefore, need of the hour that departmental heads and senior teachers of Operative Dentistry should sit together to update and review the subject curriculum to keep their faculty members and students abreast with current research trends and its clinical implication. They must design strategies to consistently update knowledge of junior teachers of the department who accept teaching assignment for the sake of job. Most of them might not be well trained in recently evolved operative procedures. They conduct clinical sessions of undergraduate students with outdated knowledge and continue to spread the same to the upcoming generation of dentists. They must be precisely detailed about it in order to provide the current knowledge about constantly changing clinical procedures and protocols related to Operative Dentistry.

The study could be conducted only in six dental colleges of the country. Future survey studies should be planned on teaching strategies of pulp protection measures involving in all the four provinces of Pakistan in order to gather a comprehensive and representative data. The data on current teaching practices and trends will lead to help the concerned subject specialist to sit together for deliberations on the achieved findings and will

- Initiate debate on curricular changes regarding this issue.
- Focus present-day education needs that will familiarize today’s students for better clinical practice.
- Present evidence to bring compulsory change in dental education programs.

**CONCLUSION**

The current recommendations of pulp protection are being ignored and use of traditional lining and basing procedures are taught in the schools where the survey was done. To assess the teaching trends about pulp protection measures, a survey on knowledge and practices of involved teaching staff should be carried out.

**AUTHORS’ CONTRIBUTION**

Prof. Asaad Javaid conceived and designed the study, also responsible for manuscript write up, revisions and made worthy corrections. Dr. Maaz Asad was responsible for data collection and manuscript write up. Dr. Sharukh Khan participated in data collection and data analysis. Dr. Marwah Berkth helped in reviewing manuscript and making worthy corrections.

**DISCLOSURE**

Declared none.
REFERENCES


