Histological Analysis of Human Pulp by Comparing Propolis with Mineral Trioxide Aggregate as a Direct Pulp Capping Agent in Primary Molars

Mubashir Rasheed[1], Mohammad Moazzam[2], Rabia Ijaz[3], Babra Marium Anwari[4], Irsam Haider[5], Omer Yousaf[6], Sohail Abbas Khan[7]

Corresponding Author:

Dr. Mubashir Rasheed
BDS. MDS Master of Dental Surgery
(Operative Dentistry)
Assistant Professor (operative Dentistry Deptt, College of dentistry. Sharif Medical & Dental college. Lahore
Cell # 0300-4413413

Email: mubashir_rasheed@hotmail.com

ABSTRACT

Objective: Evaluation ofhistological pulp response to two direct pulp capping agents (Propolis and MTA) in primary molars.

Methods: This research work was conducted in the Paedriatic Dentistry department and Oral Pathology department at de'Montmorency College of Dentistry, Lahore, from July 2017 to December 2017. In this study Propolis and Mineral Trioxide Aggregate (MTA)were used as direct pulp capping (DPC) agents in primary molars. Thirty eight human vital primary first molars were selected from patients aged 8 years via random sampling. They were divided into two groups of nineteen each. After pin point exposure, the teeth were directly pulp capped with above mentioned materials. Teeth were extracted after fifteen days for histological examination ofinflammatorypulpal cell response.Data was entered on standard proforma and statistically analyzed.

Results: Grade-1 inflammation was observed in 15 teeth (78.9%) , after 15 days in Propolis group, 1 tooth (5%) was in grade-2inflammation and three teeth (15.7%) were in grade-3inflammation. In Mineral Trioxide Aggregate group, 14 teeth (73.7%) were reveling grade-1inflammation, three teeth (15.7%) were in grade-2inflammation and two (10.5%) were in grade-3inflammation.

Conclusion: The effects of Propolis and Mineral Trioxide Aggregate (MTA) on pulpal tissue are comparable to each other. Propolis is a cheaper material as compared to other direct pulp capping materials and easily available to mankind. It is recommended as a natural pulp capping material and suggested for further investigations in treatment of dental diseases.

Keywords: Direct pulp capping. Propolis.Mineral Trioxide Aggregate.Inflammation.

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INTRODUCTION

Despite advancements in dentistry, tooth lost at a premature age is still there, so maintenance of teeth at primary stages is absolutely necessary until their natural exfoliation. If primary teeth are lost prematurely, it may result in so many functional and esthetic issues along with the risk of malocclusion. Therefore, the vitality of primary tooth must be preserved,till the time of their natural exfoliation which is crucial factor for maintenance of the integrity of arch. Vital pulp therapy (VPT) is a way of saving primary teeth. VPTincludesdirect pulp capping (DPC), pulpotomy and pulpectomy.DPC or pulpotomy are used for retention of primarydentition by most of the dentists[1].

DPC is more conservative than pulpotomy or pulpectomy.[2]It involves putting a biocompatible material on the pulpal exposure site. The advantages of this therapy are to protect the pulp against invasion of microorganisms resulting in dentine bridge formation which leads to maintenance of healthy pulpal tissue.[3]Elementsaffecting pulp healing are bacteria penetrating filling-tooth junction, harmful effects ofmaterials,vulnerability of dentaloperations andcondition of the pulp.[4]It is an established fact that the microorganisms are responsible for peri-radicular diseaseand theyusuallyaccess through carious lesions.An adequate coronal seal and regenerative capacity of peri-radicular tissues are mandatoryfor healing of dental pulp and formation ofreparative dentine.[5]

Numerous materials have been nominated for protection of exposed pulps. $Ca(OH)_2$ cement isregardedas a benchmark for DPCas suggested by different studies. In 1930, Herman introduced $Ca(OH)_2$ as a DPC agent.[2] Numerous publicationsshowedastounding outcomesusing $Ca(OH)_2$ for DPC in milk

teeth. However, somedisadvantages with $Ca(OH)_2$cementare the formation of channels in the tertiary dentine, scleroseddentine obliterating the chamber, enhanceddisintegrationinoral fluids, absence of adhesion and degenerationfollowing acidetch.[6]

Due to restricted properties, different materials have been developed for DPC;one of them is MTA. MTA is considered to be a better material for pulp capping. MTA is cementmadeoftri-calcium oxide, tri-calcium aluminate, tri-calcium silicate, silicate oxide and bismuth.Itactivates regeneration of pulp, periodontal-ligament (PDL) and alveolar bone. However, it is high-pricedwithextensive setting time and possible discoloration.[7,8]

Lately, an organic product named Propolis (Russian penicillin) has demonstrated strong antimicrobial and anti-inflammatory properties. Propolis is physically, a resinous wax-like substanceused to fill up cracks, which differs from yellowish to brown in colour,and is collected by bees from plants and buds.Usually, rawPropolis constitutes 50 percent resin/ balsam, 30 percent wax, 10 percent essential & aromatic oils, 5 percent pollen, 5 percent substances and fragments of wood. Flavonoids and phenolic acids are biologically active molecules in Propolis. Flavonoids have anti-bacterial,anti-oxidant, anti-fungal,anti-inflammatory and anti-viralproperties. Propolis has the property to stop themanufacturing of prostaglandins. It contributes to the immunesystem by enhancing phagocytosis and cell immunity.Moreover, it containszincand iron which help inproduction of collagen.[3, 9]

It is hypothesized that DPC with Propolishelps in healing of dental pulp in primary dentitionby enhancing inflammatory response.Hence, this research was done toevaluate histologically theinflammatory response of healthy pulp in primary teeth toPropolisusing as a DPC agent in comparison to Mineral Trioxide Aggregate (MTA).

METHODS

After the approval ofEthical Committee of Post Graduate Medical Institute, Lahore,an informed written consent was taken from the patient's parents prior to study. Confidentiality of the data and its usage for the study purpose only, wasensured to the patients/parents.

This experimentalstudy was conducted in the Paedriatic Dentistry department and Oral Pathology department at de'Montmorency College of Dentistry, Lahore. Thirty eight human vital first primary molars were selected from thirty eightpatients, 8 years of age, whom first primary molars needed to be extracted for orthodontic reason (Space-supervision for mesial-step class-1 cases)[10].The teeth were allotted to two experimental groups with 19 teeth in each groupusing balloting method.Clinically and radiographically, following criteria was used to select the teeth.

Inclusion Criteria:

1. Age of patient 8 years
2. Vital soundprimary teeth
3. Space-supervision for mesial-step class-1 cases
4. Permanent canine having 6+ or 7Nolla's stage
5. Possible to restore the tooth
6. Tenderness to percussion is nil

Exclusion Criteria:

1. Patient complaining ofabrupt pain
2. Absence ofsuccedaneous tooth

The procedurestarted with the application of local anesthetic (Lidocaine HCL2%)(Medicaine). A 0.2% chlorhexidine rinse wasdone. Primary first molar isolated with cotton rolls and high volume suction. Class-I cavitieswere made using sterile diamond straight fissure bur (0.8mm X 3mm) (Shofu, Japan). Pulp was exposed with a sterile round diamond bur (Shofu, Japan). Hemostasiswasgained by sterile saline moistened cotton pellets. After the bleedingstopped, the exposedareawascapped with materials directly contacting the pulp tissue.

In **Group I**: 100% Propolis extract powder wasmanipulated with 96% ethyl-alcohol on a pad of paper with the help of spatula, and direct pulp capping was done.

In **Group II**: Pro Root Mineral Trioxide Aggregate (MTA) (Angelus) was mixed and used for direct pulp capping.

After thatthe teeth lined with Resin Modified Glass Ionomer Cement(GC Universal Restorative) and restoration was done with Nano Hybrid Composite Resin (Meta Biomed Nexcomp). After 15 days, teeth were extracted under local anesthesiafor orthodontic reason as mentioned earlier. Once extraction was done, the apical thirds of the teeth were removed and fixed in 10% formalin. 20% formic acid was used to demineralize the teeth for 6-8 weeks following which the teeth were washed with distilled water and dehydration was donein ascending grades of N-butyl alcohol & embedded in paraffin.

A microtome was used to cut serial sections of 6 μm in width, which were then stained

with haematoxylin and eosinon gelatin-coated slides. An experienced pathologist examined and evaluated the slides according to the following criteria:

Inflammatory Cell Response Grading[3]

Grade 1: No/ few inflammatory cells

Grade 2:< ten inflammatory cells

Grade 3: Abscessin1/3 or more of the coronal pulp

Grade 4: Complete necrosis of pulp[3]

Grade 1 and 2 were taken as a satisfactory response.

Grade 3 and 4 were taken as an unsatisfactory response.

STATISTICAL ANALYSIS

Data was entered on standard proforma and analyzed using Statistical Package for the Social Sciences (SPSS version 19) and was presented as frequencies.

RESULTS

After 15 days in Propolis group, 15 teeth (78.9%) were in grade 1inflammation, 1 tooth (5%) was in grade 2 inflammation and 3 teeth (15.7%) were in grade 3 inflammation. In Mineral Trioxide Aggregate group 14 teeth (73.7%) were in grade 1 inflammation, 3 teeth (15.7%) were in grade 2 inflammation and 2 teeth (10.5%) were in grade 3 inflammation as shown in table 1. Results are also presented as graphical form in figure 1.

Table 1: Inflammatory cell response for two materials after 15 days

Materials		Inflammatory cell response scores				
		Grade 1	Grade 2	Grade 3	Grade 4	Total
Propolis	Count	15	1	3	0	19
	Percentage	78.9%	5.2%	15.7%	0%	100%
MTA	Count	14	3	2	0	19
	Percentage	73.7%	15.7%	10.5%	0%	100%

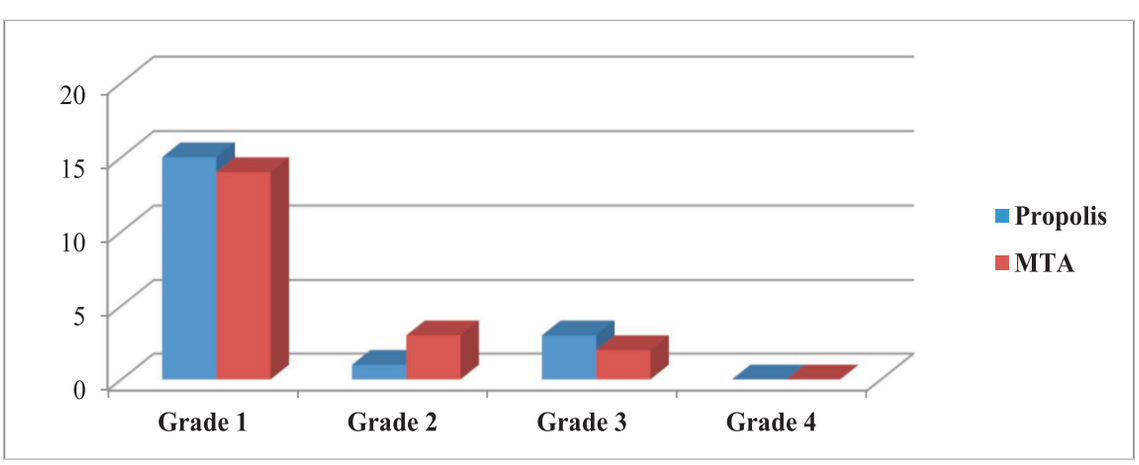

Figure 1: Inflammatory cell response score among two materials after 15 days in graphical form

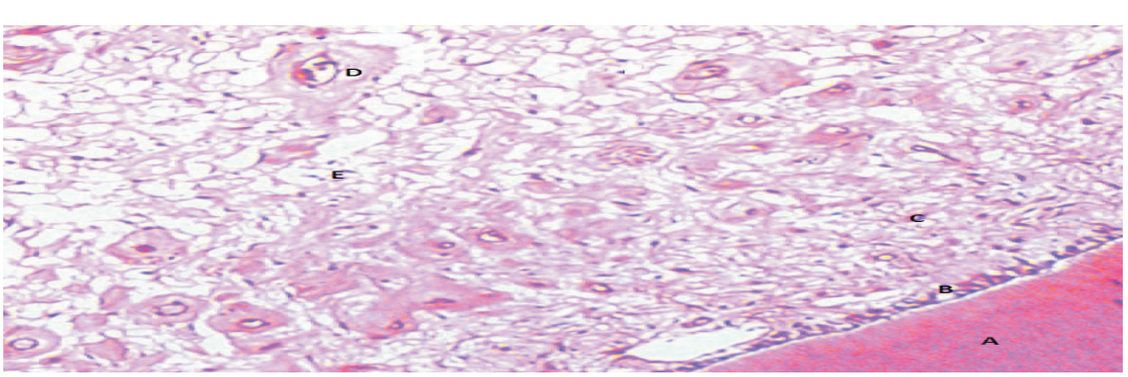

Figure 2:Histological Slide of Pulpal inflammation in primary 1st molar capped with Propolis(A=Dentine, B=Odontoblastic Layer, C=Fibroblasts, D= Venule, E=Mild Inflammation)

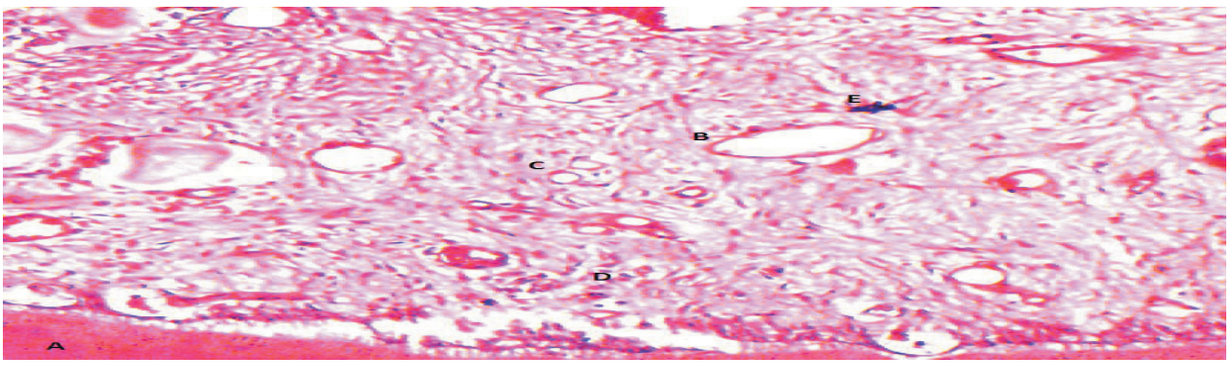

Figure 3:Histological Slide of Pulpal inflammation in primary 1st molar capped with MTA (A=Dentine, B=Venule, C=Arterioles, D=Fibroblasts, E=Few Inflammatory Cells)

DISCUSSION

Dental pulp has the ability of repair and regenerate.Clinicians often disagreed the importance of dental pulp in long term prognosis of tooth.In pulpless/ root filled teeth, bacteriagain access to the root canal system quickly.[11]

Currently all sensibility tests have limitations when it comes to reliability, accuracy and reproducibility.[12]Vitality tests are also not reliable in children due to variable patient's reponse.[13] Assessing inflammation and presence of necrosis on histopathological sections of pulpal specimen remains the most reliable method in determining pulpal health.[12]

In this study Propolis and MTA were used as DPC materials.MTA is a dental material used extensively for vital pulp therapies[14]and Propolis is a natural substance collected by honey bees from various plants[15].In the present study less inflammation was noted in teeth capped with Propolis in comparison to MTA. The differenceindento-pulpal response between the two DPC materials was statistically significant(p-value<0.001*)*. These resultsmay be because of excellent sealing capacity which is crucial in pulp capping.

According to American Academy of Pediatric Dentistry (AAPD) DPC of cariously exposed pulp of a primary tooth is not advisable.[16]Directpulp capping of deciduous dentition has been reported to be significantly less successful in comparison to pulpotomy, despite high healing capacity of vital primary pulp. High failure rates of direct pulp capping in deciduous teeth may be the result of differentiation of mesenchymal cells to odontoclasts which may lead to internal resorption. It has been previously concluded that direct pulp capping of deciduous teeth should be further investigated as a viable treatment option.[16]

In the past different agents have been successfully used for DPC of cariously and iatrogenically exposed deciduous teeth.Caicedo et al reportedMTAas a suitable agent in deciduous teeth for DPC and pulpotomies.[13]

Bodemand his colleagues reported a case of lower first deciduous molar in which MTA was used as directpulp capping material. They found no pathological findings radiographically on 1 year follow up and clinically after 18 months. The tooth remained vital after the procedure.[17]Similarly Tuna and Olmez compared mineral trioxide aggregate and calcium hydroxide in deciduous dentition. The authors reported no clinical or radiographic failure on 1 year follow up.[18]

The present study comparedPropolis and MTA for direct pulp capping in deciduous dentition for the very first time. In the past,Paroliaand colleaguesusedPropolis, MTA and Dycal as direct pulp capping agents in permanent teeth.[3]So this research was conducted to popularize DPC procedure in children and use of a natural material such asPropolis.

This study lacked in obtaining results regarding dentine bridge formation as done by Paroliaet al.[3] The present study was conducted on iatrogenically exposed teeth, whereas, in case of carious exposure, results would have been different. Also, this study was not done on extracted teeth under ideal conditions as done by Paroliaet al.[3]This study was done in vivo making it more realistic.Another limitation of this study was the absence of using rubber dam for isolation. Instead, cotton rolls and high speed suction were used to maintain complete isolation, as done by Ghajariet al.[2]

CONCLUSION

The effects of Propolis and MTAupon pulpal tissue are comparable to each other. Propolis is a cheaper material as compared to other direct pulp capping materials and easily available. It is recommended as a natural direct pulp capping material and suggested for further investigations in treatment of dental diseases.

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