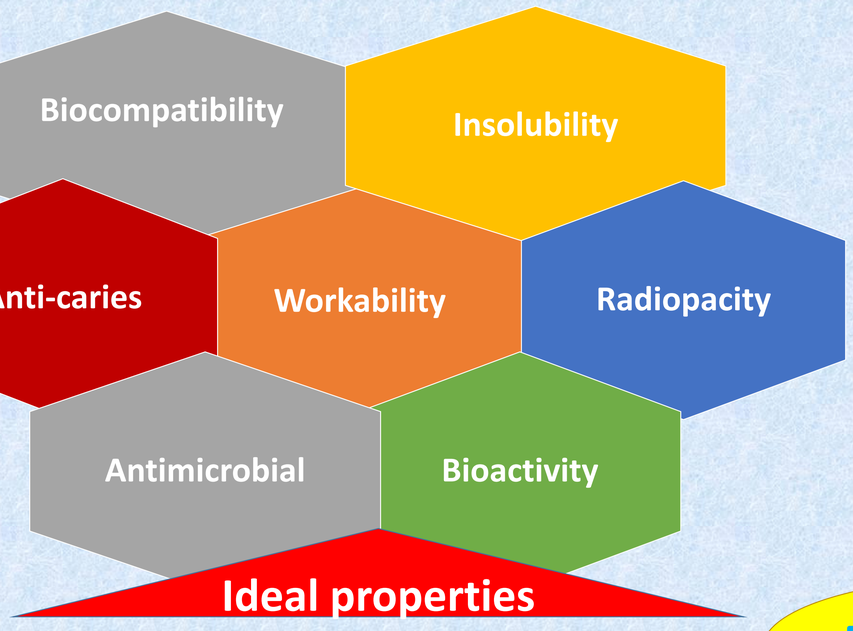
Comparison of four dental pulp-capping agents by cone-beam computed tomography and histological techniques

A split-mouth design ex-vivo study

Background

Dental pulp capping is done to preserve vital teeth when the pulp is exposed due to caries, trauma, or instrumentation



PULP CAPPING AGENTS

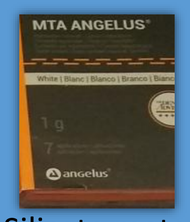
Calcium hydroxide

- Gold Standard
- Affordable, good bridge formation
- Tunnel defects seen

Biodentine

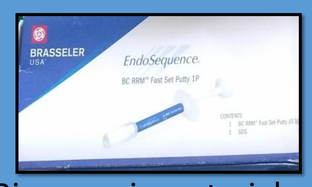
- Synthetic Bioceramic
- Wide applications
- Superior bridge formation

Mineral trioxide aggregate (MTA)



- Silicate material
- Superior bridge formation
- Handling issues, tooth staining

Endosequence root repair material (ERRM)



- Bioceramic material
- Recently developed
- Biocompatible, antibacterial
- Long term studies needed

METHODS

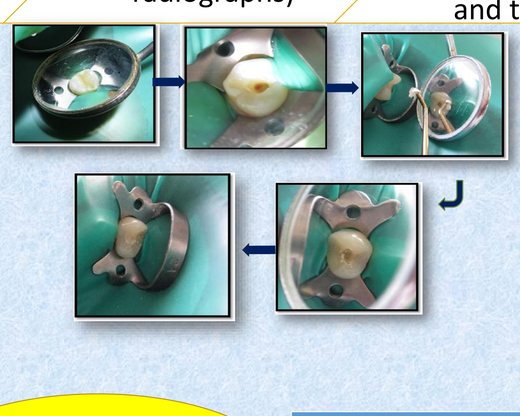
Study design, protocol preparation, Ethical Clearance → Patients recruited based on inclusion and Exclusion criteria → Randomization of patients and teeth → Pre-intervention protocols applied (vitality testing, radiographs) → Intervention according to protocol. Pulp capping done in standardized manner and teeth restored → Teeth extracted after 8 weeks, preserved and processed for CBCT imaging and histological evaluation → CBCT and histological evaluation, scoring, data analysis, statistics

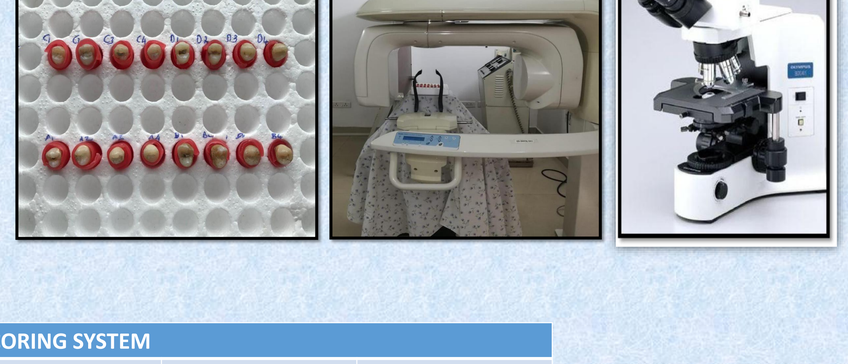
INCLUSION CRITERIA

- Patients willing for voluntary participation and signed informed consent.
- Patients with four premolars to be extracted for orthodontic purpose
- Systemically healthy individuals
- Periodontally Sound Tooth
- Absence of any pathology around area of interest

EXCLUSION CRITERIA

- Tooth with Dental Caries or fracture teeth and previously restored tooth
- Teeth with any other pathology
- Teeth not conducive for rubber dam isolation
- Negative response to pulp vitality testing
- Presence of systemic disease





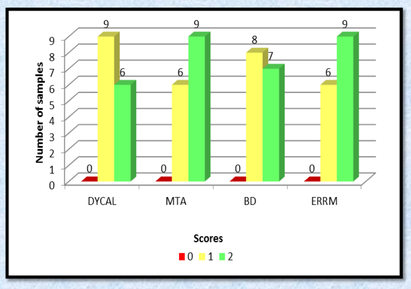
RESULTS

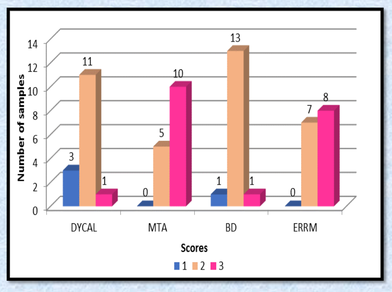
SCORING SYSTEM				
METHOD	0	1	2	3
CBCT	NO BRIDGE	ISLANDS OF CALCIFICATION	COMPLETE BRIDGE	
HISTOLOGY – DENTINAL BRIDGE	CALCIFIED TISSUE	DENTIN-LIKE MATERIAL	TUBULAR DENTIN	
HISTOLOGY – PULP RESPONSE	NO INFLAMMATION	MILD INFLAMMATION	MODERATE INFLAMATION	SEVERE INFLAMMATION

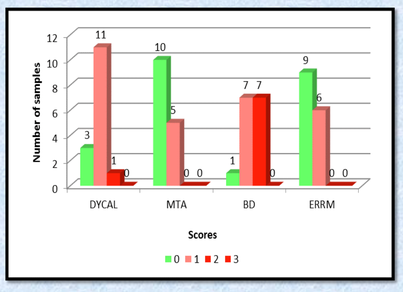
Cone beam CT	SCORES			P value	Post hoc test
	0	1	2		
CH	0	9	6	0.62	Not applicable
MTA	0	6	9		
BD	0	8	7		
ERRM	0	6	9		

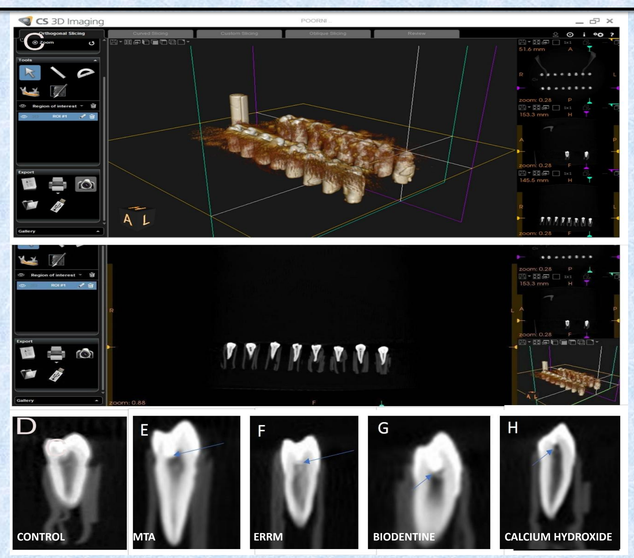
Histopathology	SCORES			P value	Conover p-values, further adjusted by the Benjamini-Hochberg FDR method			
	1	2	3			BD	CH	ERRM
CH	3	11	1	0.001	CH	0.56		
MTA	0	5	10		ERRM	**0.004**	**0.001**	
BD	1	13	1		MTA	**0.0006**	**0.0002**	0.49
ERRM	0	7	8					

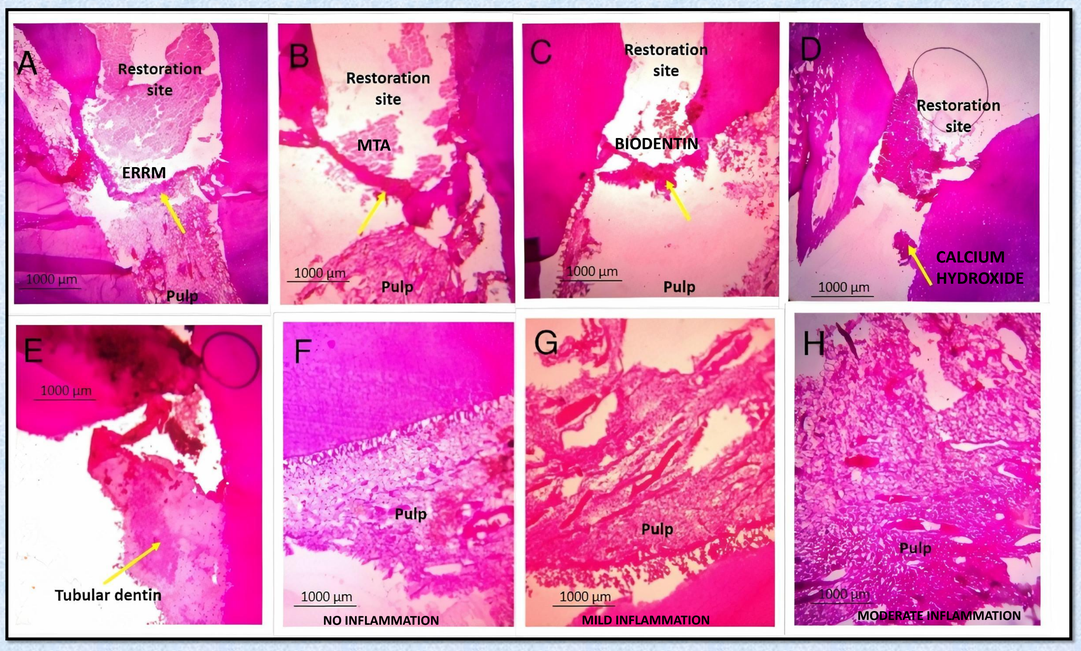
Pulpal response	SCORES				P value				
	0	1	2	3					
CH	3	11	1	0	0.00005		BD	CH	ERRM
MTA	10	5	0	0		CH	**0.028**		
BD	1	7	7	0		ERRM	**0.00004**	**0.024**	
ERRM	9	6	0	0		MTA	**0.00002**	**0.012**	0.71











All four pulp capping materials elicited dentinal bridge formation (60/60)
MTA had the highest scores (10/15) in dentinal bridge formation followed by ERRM (8/15)
Both materials showed more samples with complete dentinal bridges (9/15 each) and favorable pulpal response (15/15)
Teeth capped with calcium hydroxide showed more cases of incomplete bridge formation (9/15) and pulpal inflammation

CONCLUSION

The completeness and quality of dentinal bridge formation is significantly greater in MTA and ERRM compared to calcium hydroxide

ERRM may be a good alternative to MTA