

Regenerative endodontic procedures (REPs) - Giving life to a lifeless tooth: How aware our dentists are

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Abstract

Background: The recent breakthrough of implementation of Regenerative endodontics is unparalleled and the dentists skills and knowledge should be enhanced regarding this biological procedure of replacing damaged /diseased structures including dentine, root and pulp dentin complex and maintaining the final goal of restoring tooth vitality .

Materials and Methodology: A cross sectional study was conducted on 74 dentist through a 10 item questionnaire to assess and compare the knowledge attitude and belief of the postgraduate , junior residents and interns of GDC Srinagar towards the regenerative endodontics .

Results: The questionnaire was responded by 74 respondents amongst which 55.4% of the dentists were males (n=41) and 44.6% were females (n=33). The study sample consisted of respondents amongst which 47.3% were still doing their rotational internship, 29.7% were junior resident and 23.0% were post graduates.73.1% stated high cost as greatest obstacle in stem cell therapy , 14.9% stated fear of stem cells to be an obstacle and 1.4% stated host immune response to be the threat why dentist don't opt for regenerative endodontic therapy.

Conclusion: There was a positive attitude towards the regenerative endodontic procedures, its application and interest seems increasing about the stem cell therapy as more and more dentists want to attend CDE programs on regenerative endodontic procedures.

Clinical significance: Regenerative endodontic therapy is based on a conservative biological based approach which can be beneficial over routine invasive procedures done.

Keywords: Regenerative endodontic procedures ,Stem cell therapy , Pulp dentine complex.

Introduction

Regenerative Endodontics covers the creation and replacement of diseased, missing ,or traumatized pulp by new tissues and was described by Murray et al in 2007 as biological procedure in which damaged structures are replaced including dentin and root structures , as well as cells of pulp dentin complex.^{1,2,3}

According to AAE in 2016 goals of regenerative endodontic procedures are : a) Primary goal (essential) which is healing of apical periodontitis b) Secondary goal (desirable) that is to increase root wall thickness and c) Tertiary goal which is to regain a positive response to pulp testing determine the success regenerated procedure .⁴ Currently two major concepts

Questionnaire

Name _____ Age / Sex :

Qualification :

- a) Post graduation in pedodontics and preventive dentistry
- b) Post graduation in other specialty
- c) Junior resident
- d) Intern

Q1. Have you attended CDE (continuing dental education)on stem cell therapy /regenerative endodontics in past ?

- a) Yes b) No

Q2 .Do you prescribe regenerative endodontics in your clinical setup and if yes is that successful ?

- a) Yes I practice and the outcome is successful
- b) No I've never practiced
- c) Yes I practice but I wasn't happy with the treatment outcome

Q3. What do you think will be the greatest obstacle in stem cell therapy treatment in dentistry?

- a) high cost b)fear of stem cells c)others specify

of regenerative endodontics :Guided tissue regeneration and tissue engineering come into play .⁵

This survey was done with the aim of analysing how aware the dentists are related to regenerative endodontic procedures and comparing their qualification wise knowledge.

Materials And Methodology

A cross sectional survey was carried 74 postgraduates , house surgeons and interns of Government Dental College and Hospital , Srinagar who were working in hospital settings . An ethical clearance was taken under order no GDC/Pedo/831. The faculty members of GDC Srinagar , dental students and dentist working in private dental setup were excluded. A 10 item questionnaire was developed to access and evaluate knowledge ,education , checking awareness , preparedness and skills of dentist in managing the regenerative procedures . The data was fabricated into excel sheet and subjected to statistical analysis.

Q4. Which of the following is valuable for regenerative treatment ?

- a) Healing of Peri radicular bone
- b) continued root development in immature tooth
- c) pulp tissue revascularization within root canal
- d) tooth reimplantation
- e) all of the above

Q5. The pioneer work of regenerative endodontics /revascularization was done by ?

- a) Banchs and Trope in 2004
- b) Obsty in 1996
- c) Iawa et al in 2004

Q6. Which of the following is optimal treatment modality for immature necrotic tooth ?

- a) Triple antibiotic paste and pulpal regeneration
- b) Calcium hydroxide apexification
- c) MTA apical plug and backfilling with obturating material
- d) Calcium hydroxide apexification followed by MTA apical plug and backfilling with obturating material

Q7. As stated in revised AAE guidelines the primary goal (essential goal) of regenerative endodontic procedure is healing of apical periodontitis , the secondary goal is to increase root wall thickness /or length and the tertiary goal is to regain positive response to pulp testing .

so that the treatment outcomes should be i) resolution of the clinical signs and symptoms ii) further root maturation iii) return of neurogenesis

- a) Primary goal is correct
- b) Primary and secondary goals are correct
- c) Tertiary goal is correctly mentioned
- d) All goals are correctly mentioned

Q8. The success and failure of regenerative introductive procedure depends upon

- a) no standardise tooth used
- b) inadequate disinfection
- c) insufficient knowledge about SCAP
- d) scaffold used
- e) all of the above
- f) others specify

Q9. Do you think stem cell bank should be useful for tissue regeneration

- a) Yes b) No

Q10. Are you inclined towards receiving more training on REPs?

- a)Yes b) No

Statistical Methods: The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS Version 20.0 (SPSS Inc., Chicago, Illinois, USA). Continuous variables were expressed as Mean±SD and categorical variables were

summarized as frequencies and percentages. Chi-square test or Fisher’s exact test, whichever appropriate, was applied for comparison of categorical variables. A P-value of less than 0.05 was considered statistically significant.

Results

The questionnaire was responded by 74 respondents amongst which 55.4% of the dentists were males (n=41) and 44.6% were females (n=33). The demographic information stated 50% of respondents were less than 25 years , 37.8 % were between 26-30 years and 12.2% were aged between 31-35 years. 47.3% of the respondents were still doing their rotational internship, 29.7% were junior resident and 23.0% were post graduates (**Table 1**)(**Figure 1**).

Variable		Number	Percentage
Age (Years)	≤ 25	37	50.0
	26-30	28	37.8
	31-35	9	12.2
Gender	Male	41	55.4
	Female	33	44.6
Designation	Intern	35	47.3
	Junior resident	22	29.7
	Post graduate	17	23.0

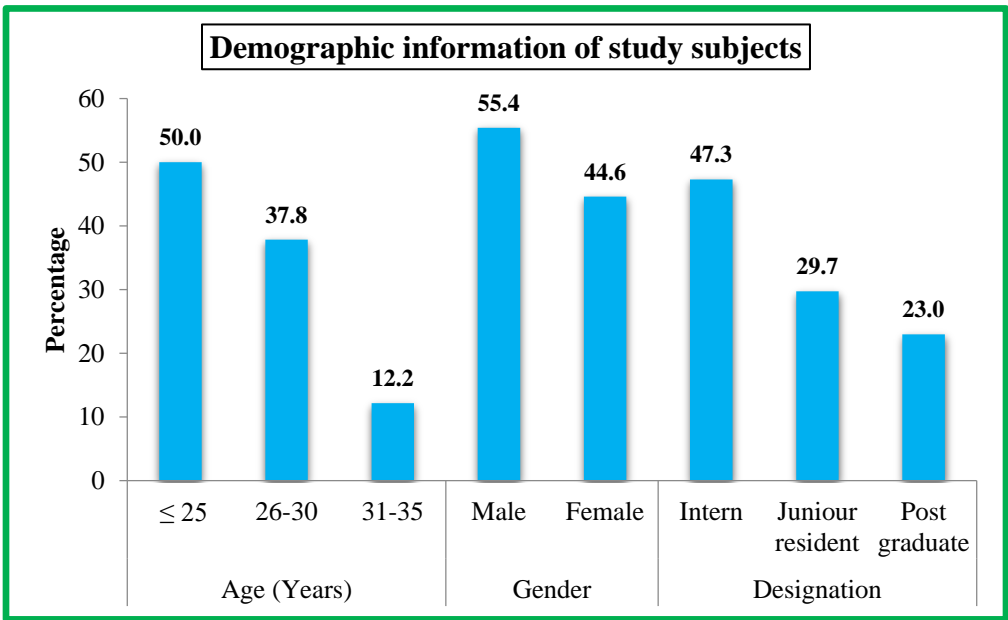


Figure 1: Graphical representation of the demographic data

Knowledge and opinion of dentists on regenerative endodontic procedures is tabulated in Table 2a and 2b.

87.8% of dentists had never attended an CDE (Continuing Dental Education) on stem cell therapy / Regenerative Endodontics in past (Table 2A) and 89.2% had never practiced REPs in clinical set up.

73.1% stated high cost as greatest obstacle in stem cell therapy , 14.9% stated fear of stem cells to be an obstacle and 1.4% stated host immune response to be the greatest obstacle.

75.7% of dentists stated healing of peri radicular bone , continued root development in immature tooth, tooth reimplantation , pulp tissue revascularization within root canal as the valuable entities for regenerative endodontic treatment (table 2A).

Question	Response	Number	Percentage
Q1	Yes	9	12.2
	No	65	87.8
Q2	Yes I practice and the outcome is successful	7	9.5
	No I've never practiced	66	89.2
	Yes I practice but I wasn't happy with the treatment outcome	1	1.4
Q3	High cost	54	73.0
	Fear of stem cells	11	14.9
	Others specify	9	12.2

Q4	Healing of peri radicular bone	4	5.4
	Continued root development in immature tooth	0	0.0
	Pulp tissue revascularization within root canal	13	17.6
	Tooth reimplantation	1	1.4
	All of the above	56	75.7
Q5	Banchs and Trope in 2004	17	23.0
	Obsty in 1996	42	56.8
	Lawa et al in 2004	15	20.3

Question	Response	Number	Percentage
Q6	Triple antibiotic paste and pulpal regeneration	15	20.3
	Calcium hydroxide apexification	13	17.6
	MTA apical plug and backfilling with obturating material	20	27.0
	Calcium hydroxide apexification followed by MTA apical plug and backfilling with operating material	26	35.1
Q7	Primary goal is correct	7	9.5
	Primary and secondary goals are correct	6	8.1
	Tertiary goal is correctly mentioned	3	4.1
	All goals are correctly mentioned	58	78.4
Q8	No standardise tooth used	1	1.4
	Inadequate disinfection	7	9.5
	Insufficient knowledge about SCAP	3	4.1
	Scaffold used	3	4.1
	All of the above	55	74.3
	Others specify	5	6.8
Q9	Yes	70	94.6
	No	4	5.4
Q10	Yes	70	94.6
	No	4	5.4

78.4 Percent of the dentist rightly cited all the three goals of successful endodontic treatment according to revised American Association of endodontic guidelines (Table 2b). 94.6% of dentist considered stem cell banks to be useful for tissue regeneration in future and 94.6% of the dental graduates wanted more training on regenerative endodontic procedures .

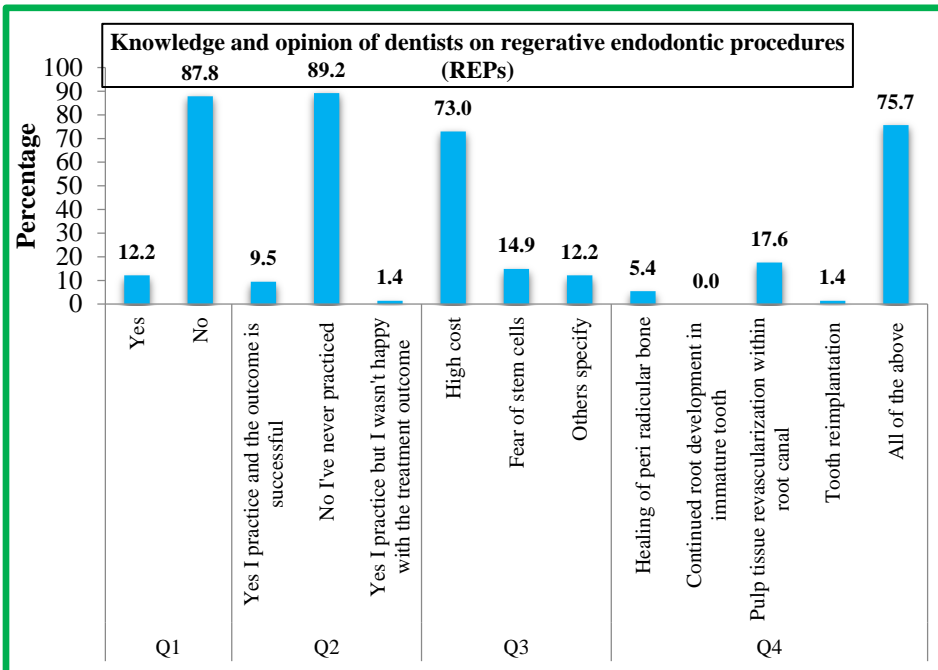


Figure 2 : Graph representing knowledge and opinion of dentists on regenerative endodontic procedures (q1-4).

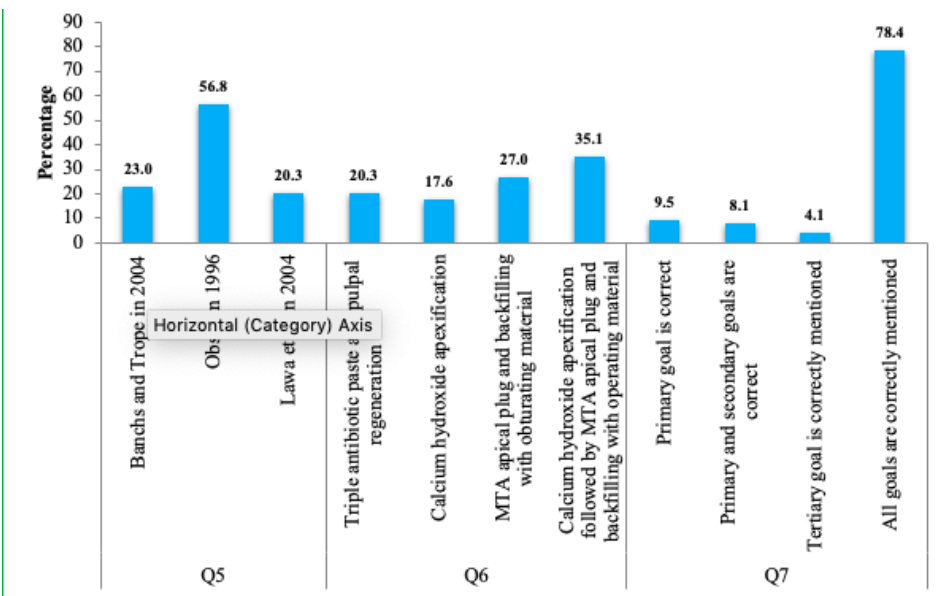


Figure 3 Graph representing Knowledge and opinion of dentists on regenerative endodontic procedures (REPs) (q5-7)

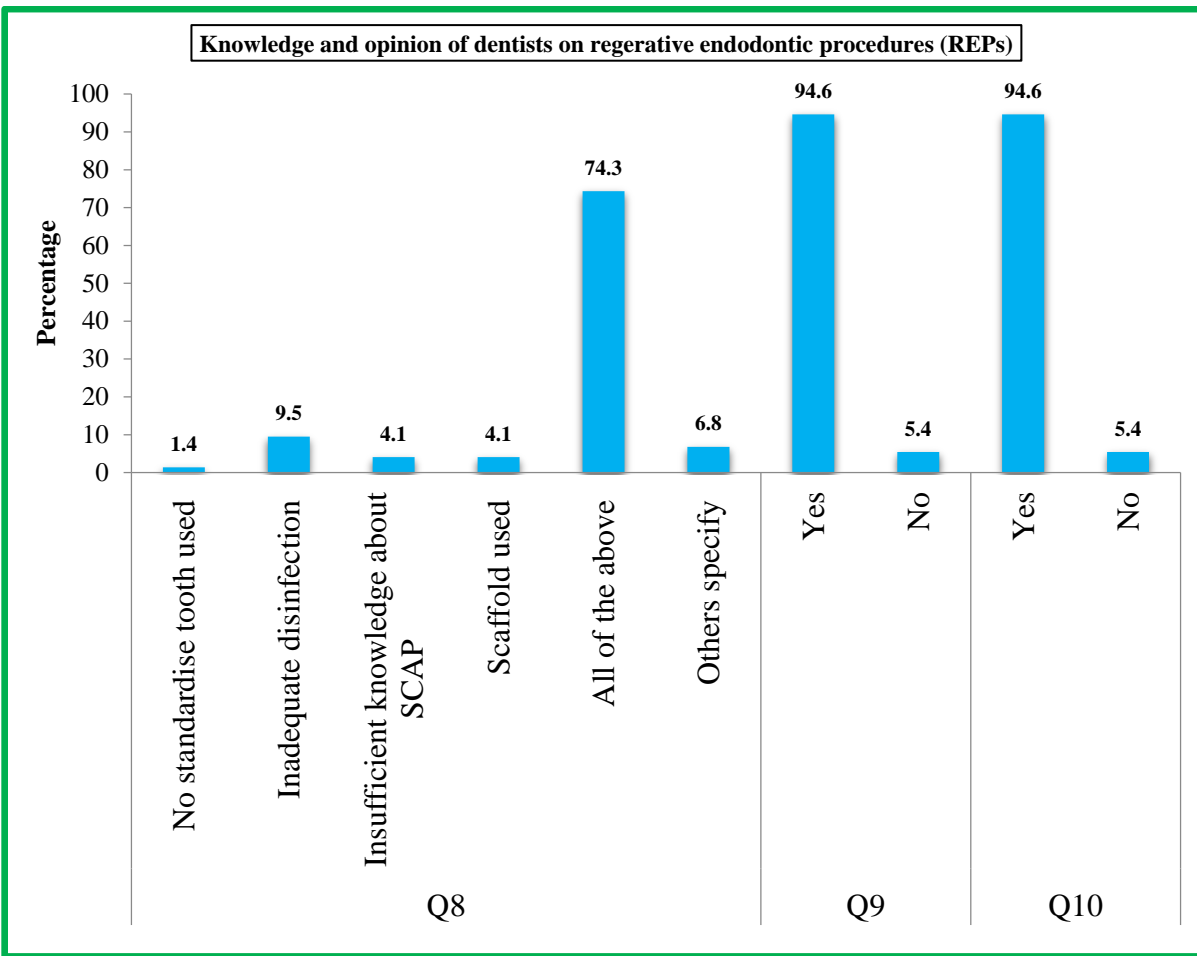


Figure 4 : Graph representing dentists knowledge and opinion regarding REPs (q8-10).

Table 3A and 3B summarises the inter group comparison of Knowledge and opinion of dentists on regenerative endodontic procedures according to designation where Group A is interns, Group B is Junior resident and Group C are post graduates.

97.1% of interns, 86.4% of junior residents and 70.6% of post graduates had never attended CDE on stem cells (Table 3A).

Question	Response	Group A [n=35]		Group B [n=22]		Group C [n=17]	
		No.	%	No.	%	No.	%
Q1	Yes	1	2.9	3	13.6	5	29.4
	No	34	97.1	19	86.4	12	70.6
Q2	Yes I practice and the outcome is successful	2	5.7	3	13.6	2	11.8
	No I've never practiced	32	91.4	19	86.4	15	88.2

	Yes I practice but I wasn't happy with the treatment outcome	1	2.9	0	0.0	0	0.0
Q3	High cost	24	68.6	16	72.7	14	82.4
	Fear of stem cells	6	17.1	3	13.6	2	11.8
	Others specify	5	14.3	3	13.6	1	5.9
Q4	Healing of peri radicular bone	4	11.4	0	0.0	0	0.0
	Continued root development in immature tooth	0	0.0	0	0.0	0	0.0
	Pulp tissue revascularization within root canal	5	14.3	7	31.8	1	5.9
	Tooth reimplantation	1	2.9	0	0.0	0	0.0
	All of the above	25	71.4	15	68.2	16	94.1
Q5	Banchs and Trope in 2004	8	22.9	3	13.6	6	35.3
	Obsty in 1996	22	62.9	10	45.5	10	58.8
	Lawa et al in 2004	5	14.3	9	40.9	1	5.9

Group A (Intern); Group B (Junior resident); Group C (Post graduate)

Table 3B: Knowledge and opinion of dentists on basis of designation on regenerative endodontic procedures (REPs) according to designation

Question	Response	Group A [n=35]		Group B [n=22]		Group C [n=17]	
		No.	%	No.	%	No.	%
Q6	Triple antibiotic paste and pulpal regeneration	8	22.9	1	4.5	6	35.3
	Calcium hydroxide Apexification	7	20.0	6	27.3	0	0.0
	MTA apical plug and backfilling with obturating material	10	28.6	8	36.4	2	11.8
	Calcium hydroxide Apexification followed by MTA apical plug and backfilling with operating material	10	28.6	7	31.8	9	52.9
Q7	Primary goal is correct	5	14.3	1	4.5	1	5.9
	Primary and secondary goals are correct	4	11.4	2	9.1	0	0.0
	Tertiary goal is correctly mentioned	2	5.7	0	0.0	1	5.9
	All goals are correctly mentioned	24	68.6	19	86.4	15	88.2

Q8	No standardise tooth used	1	2.9	0	0.0	0	0.0
	Inadequate disinfection	5	14.3	1	4.5	1	5.9
	Insufficient knowledge about SCAP	3	8.6	0	0.0	0	0.0
	Scaffold used	3	8.6	0	0.0	0	0.0
	All of the above	20	57.1	19	86.4	16	94.1
	Others specify	3	8.6	2	9.1	0	0.0
Q9	Yes	32	91.4	21	95.5	17	100
	No	3	8.6	1	4.5	0	0.0
Q10	Yes	33	94.3	21	95.5	16	94.1
	No	2	5.7	1	4.5	1	5.9

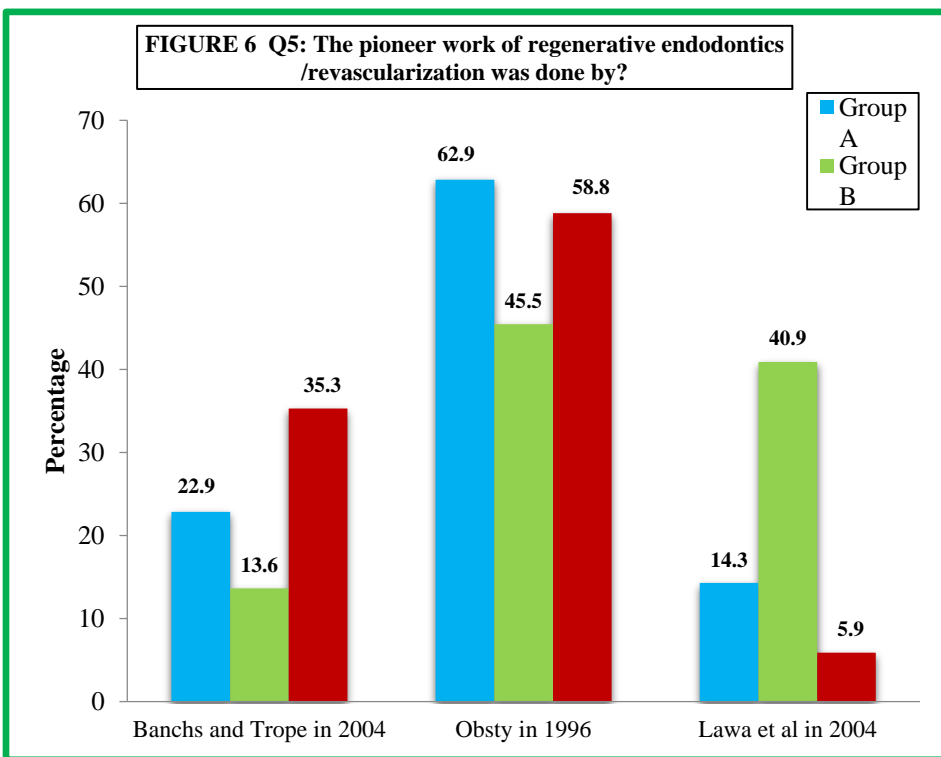
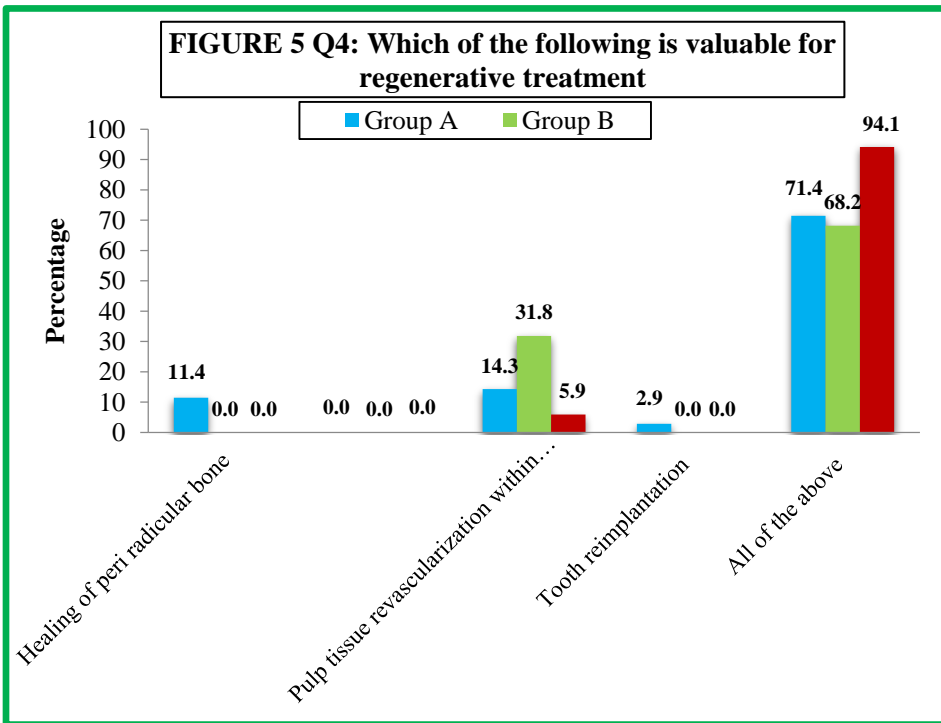
Group A (Intern); Group B (Junior resident); Group C (Post graduate)

The intergroup comparison of knowledge, attitude and practice of dentist has been summarized in **TABLE 3C** and intergroup comparison of knowledge of house surgeon and post graduates was statistically significant ($p=0.046^*$) when asked what parameters are valuable for regenerative endodontics.

(Figure 5).

Question	P-value		
	Group A vs Group B	Group A vs Group C	Group B vs Group C
Q1	0.287	0.112	0.418
Q2	0.442	0.594	0.862
Q3	0.931	0.545	0.703
Q4	0.162	0.275	0.046*
Q5	0.073	0.499	0.032*
Q6	0.322	0.042*	0.005*
Q7	0.375	0.357	0.411
Q8	0.198	0.167	0.439
Q9	0.963	0.542	1.000
Q10	0.847	0.981	1.000

Group A (Intern); Group B (Junior resident); Group C (Post graduate) *Statistically Significant Difference (P-value<0.05);



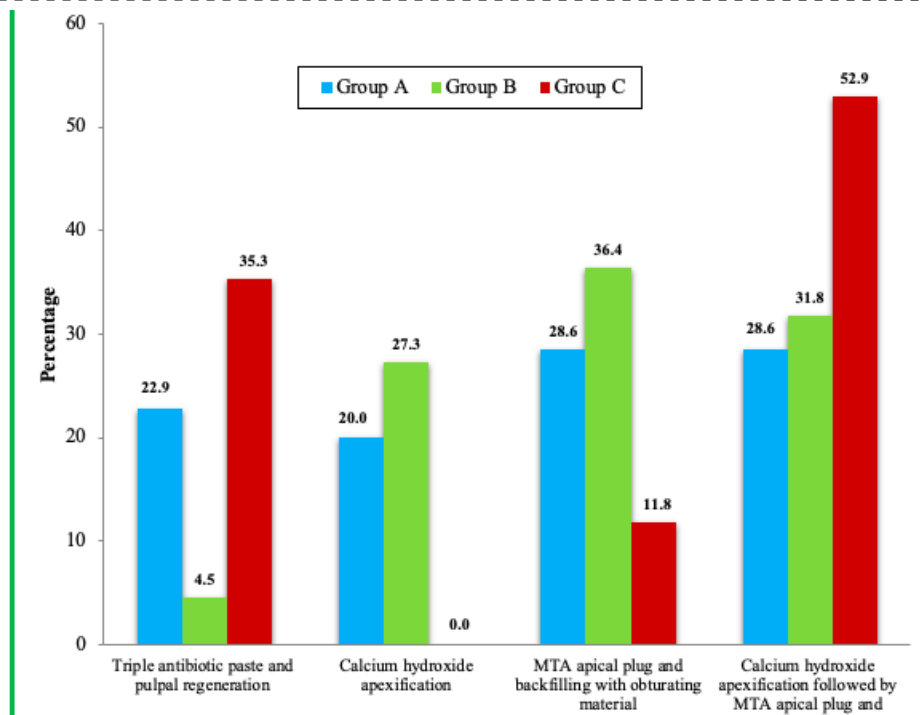


Figure 7: Graph representing Inter group comparison of optimal treatment modality available for necrotic tooth on basis of designation.

Intergroup comparison of various options available in immature necrotic teeth statistical significance was seen between post graduates and interns ($p=0.042$) and post graduates and house surgeons ($p=0.005$) (Figure 7).

Discussion

The advances in the field of dental tissue engineering, use of scaffolds and stem cells emphasize that the future belongs to regenerative endodontic procedure which is bioengineering techniques. Recent advances in the identification and characterization of dental stem cells, and in dental tissue-engineering strategies suggest that within the next decade bioengineering approaches may successfully used to regenerate dental tissues and whole teeth.⁶

The first attempts to regenerate pulp tissues was conducted by Nygaard Ostby in 1961 to induce bleeding after over instrumentation.⁷ In 2004 Banchs And Trope suggested a new treatment procedure called re vascularisation in an immature permanent tooth with apical periodontitis and the term was coined by Iwaya et al in 2001.^{8,9}

Stem cells from human exfoliated deciduous teeth (SHEDS), periodontal ligament stem cells (PDLSCs), dental pulp stem cells (DPSCs), stem cells from apical papilla (SCAPs) and dental follicle stem cells play important role in healing process in REPs by guided endodontic repair as cells differentiate when stimulated.¹⁰

The clinical considerations for regenerative endodontic procedures are disinfection root canal system, scaffold generation by lacerating periapical tissue to induce a blood clot and inducing stem cell therapy within the canal and add adequate seal to prevent reinfection.¹¹

Intergroup comparison of various options available in immature necrotic teeth showed statistical significance between post graduates and interns ($p=0.042$) and post graduates and house surgeons ($p=0.005$) and 94.1% of post graduates stated optimal treatment modality for

immature necrotic tooth to be Calcium hydroxide apexification followed by MTA apical plug and backfilling with obturating material (Figure 4).

The use of PRP (Platelet rich plasma) and PRF (Platelet rich fibrin) or initiating bleeding by laceration help in creation of blood clot or protein scaffold in the canal.¹²

In RET of immature permanent teeth with necrotic pulp the use of triple antibiotic paste (minocycline, ciprofloxacin, metronidazole) have been recommended as an intracanal medication according to AAE 2016.¹³

Conclusion

The participants expressed general optimism and a consensus on need for research and training regarding REP's. The knowledge, attitude and practice of dentists regarding was evaluated in the study and knowledge of post graduates was seen to be statistically significant when compared with interns and house surgeons as treatment option for immature necrotic tooth. All the post graduates considered stem cell banks to be useful for regenerative endodontic therapy and the future belongs to it.

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