

Knowledge, attitude and opinions of endodontists towards regenerative endodontic procedures: A web-based survey

¹P. Karunakar, Professor and HOD, Department of Conservative Dentistry and Endodontics, Panineeya Institute of Dental Sciences and Research Centre, Hyderabad, Telangana, India

²M.S Rangareddy, Professor, Department of Conservative Dentistry and Endodontics, Panineeya Institute of Dental Sciences and Research Centre, Hyderabad, Telangana, India

³Umrana Faizuddin, Professor, Department of Conservative Dentistry and Endodontics, Panineeya Institute of Dental Sciences and Research Centre, Hyderabad, Telangana, India

⁴MD. Abdul Wahed, Reader, Department of Conservative Dentistry and Endodontics, Panineeya Institute of Dental Sciences and Research Centre, Hyderabad, Telangana, India.

⁵Chigurupati Swetha, Senior Lecturer, Department of Conservative Dentistry and Endodontics, Panineeya Institute of Dental Sciences and Research Centre, Hyderabad, Telangana, India

⁶Anumanchi Sai Sravani, Post Graduate student, Department of Conservative Dentistry and Endodontics, Panineeya Institute of Dental Sciences and Research Centre, Hyderabad, Telangana, India.

Corresponding Author: Anumanchi Sai Sravani, Post Graduate student, Department of Conservative Dentistry and Endodontics, Panineeya Institute of Dental Sciences and Research Centre, Hyderabad, Telangana, India.

Citation of this Article: P. Karunakar, M.S Rangareddy, Umrana Faizuddin, MD. Abdul Wahed, Chigurupati Swetha, Anumanchi Sai Sravani, “Knowledge, attitude and opinions of endodontists towards regenerative endodontic procedures: A web-based survey”, IJDSIR- July - 2023, Volume – 6, Issue - 4, P. No. 167 – 178.

Copyright: © 2023, Anumanchi Sai Sravani, et al. This is an open access journal and article distributed under the terms of the creative common’s attribution non-commercial License. Which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given, and the new creations are licensed under the identical terms.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Background: The role of Regenerative Endodontic Procedures in future dental treatment is huge through the regeneration of tissues such as the alveolar bone, periodontal ligament, enamel, dentin and even a whole tooth.

Aim and objectives: To understand the level of knowledge, opinion and attitude of endodontists towards regenerative procedures and protocols in India.

Material and methods: The present cross-sectional study was done among endodontists, who were approached through mail or direct appointment. A 30-item self-administered questionnaire was used: the first section assessed the subject characteristics, the second,

third and fourth sections assessed the levels of knowledge, opinion and practices regarding regenerative endodontic procedures respectively.

Results: More than 80% of endodontists have knowledge of procedures that come under regenerative endodontic procedures. Upon categorization of subjects based on their level of knowledge, it was noticed that 61.4% of endodontists had fair knowledge, 35.9% with good knowledge and only 2.6% of them had poor knowledge. Around 90% of the endodontist opined that the prognosis of REPs is variable. REPs being unpopular treatment modality (54.2%), higher costs (32.7%) and fear of failure (13.1%) were considered to be the biggest obstacles for people in using stem cell banking. On a negative note, around half of the endodontists haven't done any case of REPs in their practice.

Conclusion: Endodontists had good theoretical knowledge and a positive attitude, but their level of implementing REPs into practice is very poor.

Keywords: Regenerative endodontics, Stem cells, Dental pulp, Knowledge

Introduction

The field of regenerative dentistry refers to the application of biological therapeutic techniques to replace, repair or preserve tissue and improve its function. Its role in future dental treatment is huge, through the regeneration of tissues such as the alveolar bone, periodontal ligament, enamel, dentin and even a whole tooth.¹ Regeneration of the dentin-pulp complex is the long-term goal of endodontics and restorative dentistry. Recently, increasing interest in applying the concept of tissue engineering has led clinicians to incorporate newer and alternative treatment modalities in endodontics.²

The management of immature permanent teeth with pulpal necrosis is challenging, and historically,

apexification followed by root canal treatment has been the treatment of choice with a success rate of 95%. However, it is associated with certain drawbacks like longer time for the formation of calcified barrier, multiple appointments, effect on mechanical properties of dentin and increased risk for cervical root fractures.³⁻⁴ In contrast, regenerative endodontic therapy has the potential for continuation of root development and formation of vital pulp tissue, which is capable of mounting an immune response and signalling tissue damage. Regenerative endodontic therapy has been defined as "biologically based procedures designed to replace damaged structures, including dentin and root structures, as well as cells of the pulp-dentin complex".⁵ The key elements of the Regenerative Endodontic Procedure (REP) are stem cells, growth factors and scaffolds. Stem cells are either undifferentiated embryonic stem cells or adult dental pulp stem cells which can divide continuously and have angiogenic capacity. Scaffolds provide the physicochemical environment for cell organization, proliferation, differentiation and vascularization. Growth factors are proteins that bind to receptors on the cell and act as signals to induce cellular proliferation and/or differentiation.⁵ Regenerative endodontic procedures achieve pulp-dentin regeneration through procedures that range from the simplest blood clot revascularization method, partial pulpotomy and apexogenesis to the most complex treatment, which involves creating tissue-engineered dental pulp constructs in the laboratory and implanting them into cleaned and shaped root canal regenerative procedures.⁶⁻⁷

Presently, the concept of regenerative endodontics aims to heal apical periodontitis, to promote normal pulpal physiological functions, continued root development, immune competency and normal nociception of tooth.

However, the field of regenerative endodontics remains uncharted territory in clinical practice for a majority of endodontic practitioners in India. Though regenerative procedures are slowly gaining acceptance, information regarding the views of endodontists is scarce but essential for the widespread practice of these procedures. Hence the present study aimed to understand the level of knowledge, opinion and attitude of endodontists towards regenerative procedures and protocols in India.

Materials and methodology

A cross-sectional study was conducted to assess the level of knowledge, opinion and attitude of endodontists towards regenerative procedures and protocols in India. Ethical clearance for the study was obtained from the institutional review board of Panineeya Mahavidyalaya Institute of Dental Sciences. Upon the agreement and explanation of the study procedures, subjects willing to participate signed the consent form. The anonymity and confidentiality of respondents were maintained and participation was voluntary.

A pilot study was conducted among 30 endodontists to check for the feasibility of the study and to obtain an estimate of the sample size. The subjects participating in the pilot study were excluded from the final study sample. Internal reliability and validity of the questionnaire were determined and were found to be good with a Cronbach's alpha of 0.832. With a confidence level of 95% and at 5% precision, the estimated sample size was 151. A simple random sampling method was used to achieve the estimated sample size. All the participants were approached with the questionnaire either by mail or by meeting directly. Participants who did not give consent and partially filled out questionnaires were excluded from the study.

A 30-item self-administered questionnaire was used based on the previous studies^{6,8,9} comprising four

sections. The first section assessed the subject characteristics such as age, gender, years of practice, practice hours per week and whether they received any continued education on regenerative endodontic procedures. The second, third and fourth sections assessed the levels of knowledge, opinion and practices regarding regenerative endodontic procedures. All the questions were close-ended. Furthermore, for each knowledge question, a score of 1 is given for the correct response and the overall knowledge score ranges from 0 to 15 and then accordingly categorized as poor (0-5), fair (6-10) and good (11-15) knowledge.

The collected data were analysed using the Statistical Package Social Sciences (SPSS) version 21.0. Descriptive analysis was done to calculate the distribution, mean and standard deviation. Inferential statistics were done using the Mann-Whitney U test, Kruskal Wallis test and Chi-Square test. Statistical significance was set at $p \leq 0.05$.

Results

Participants profile

Out of 160 endodontists, 153 of them completed the questionnaire and were included in the study (response rate-95.6%). The study population included 62(40.5%) males and 91(59.5%) females.

More than 3/4th of the endodontists was in the younger age group (25-35 years - 73.9%) and had 0-10 years of practice (76.5%). The majority of endodontist practice for more than 20 hours per week (62.1%). Around 60% of the subjects received continued education in regenerative endodontic therapy, 28% have not and 11.8% of them were not sure.

Knowledge of REPs

More than 80% of endodontists have knowledge that revascularization with a blood clot, stem cell implantation, scaffold implantation, 3D cell printing and

gene therapy are the procedures that come under regenerative endodontic procedures (83.7%). Most of the dentists had knowledge that the dentin pulp complex can be grown from the stem cells (90.8%) and the incompletely developed teeth with open apex are ideal to go for revascularization procedure (94.8%) as the stem cells have the potential for continued root development (98.7%) and can give cementum like structures (83.7%). The dentists were well aware of the teeth that are not suitable for harvesting pulpal stem cells (80.4%).

More than half of the subjects considered that the pulp tissue revitalization is the most valuable outcome of the regenerative endodontic procedures (62.1%), whereas 30% of them reported continued root development and a very small percentage of them reported that healing (7.8%) and tooth reimplantation (1.3%) as the most valuable outcomes. Also, majority of them considered placing of tribiotic paste and pulp revascularization and a few considered Ca(OH)₂ application followed by MTA apical plug and backfilling with obturation material (28.8%) as the optimal treatment for necrotic immature teeth.

On a negative note, only half of them had an awareness of AAE's protocol for regenerative endodontics (58.8%). The consideration for the need for mechanical preparation of teeth was even-handed. Only a small percentage of endodontists had knowledge of the irrigants to be used (24.2%), the type of anaesthetic required (30.7%), the type of intracanal medicament (48.4%) and the follow-up period following the placement of intracanal medicament (43.1%) while undergoing REP.

The mean comparison of knowledge based on the variables considered in this study revealed significant differences only with regard to age, wherein higher means were noticed among the younger age group

(10.23±2.32; p=0.016). Further, subjects who received continued education on REP had significantly higher means of knowledge (10.4±2.45; p =0.002). (Table-2) Upon categorizing subjects based on their level of knowledge, it was noticed that 61.4% of endodontists had fair knowledge, 35.9% had good knowledge and only 2.6% had poor knowledge. Younger age group endodontists (43.3%), with the practice of 0-10 years (41.9%) and who received continued education (45.7%) were significantly having good knowledge. (Table-2) (fig 1).

Opinion towards REPs

It was noticed that more than 90% of the endodontist's opined that the prognosis of REPs is variable. The majority of them also considered that, in comparison to root canal treatment, the cost of the REPs should cost less (83%) and the dentist should get the chance to regulate the dental stem cell banks (91.5%). REPs being unpopular treatment modality (54.2%), higher costs (32.7%) and fear of failure (13.1%) were considered to be the biggest obstacles for people in using stem cell banking. All the endodontists opined for the continuation of research in stem cells. (Table-3) (Fig-2)

Attitude and Clinical Practice of REPs

On a negative note, around half of the endodontists haven't done any case of REPs in their practice. Among the endodontists who practiced REPs, 34% had done 1-3 cases, 9.2% had done 4-6 cases and only 6.5% had done more than 6 cases. Around 90% of them or their relatives had not used any kind of stem cell banking and 88.2% of them are willing to collect dental tissues for stem cell banks. (Table-4)

Discussion

Regenerative endodontics is a wide field and area of research, knowing the dentist's knowledge, attitude and belief are of particular significance as it will influence

diagnosis and treatment planning and work toward patient's benefit. In the current study, a self-administered 30-item questionnaire adopted from previous studies^{6,8,9} was used to obtain the data. The questionnaire was tested for its validity and internal reliability and was found to be good.

In the current study, the majority of the subjects were younger adults and have less than 10 years of experience, which indicates that our study population would constitute the next generation of dentists. Similar findings were reported from previous studies by Ez-Abadi et al¹⁰ and Manguno et al⁸. In contrast, those evaluated in the study by Epelman et al⁶ had over 21 years of clinical experience.

The number of subjects who received continued education in regenerative endodontic therapy in our study was comparably more (60%) than previous reports by Ez-Abadi et al¹⁰ (23.8%), Chakravarthy et al¹¹ (17.1%) and Manguno et al⁸ (16.1%). This might be due to a lack of adequate knowledge and insufficient instruction of residents elucidating the educational shortcomings in their dental schools. Further, Adhikari et al¹² also reported that around 53% of them had never received continued education about the application of REPs which might suggest that this topic has not got a place in mass discussions among clinicians.

Healing of periapical lesions, continued root development in immature teeth, pulp tissue revitalization and avulsed tooth reimplantation come under the umbrella of regenerative endodontics. In this study, healing of periapical lesions (62.1%) and continued root development in immature teeth (28.8%) are only considered to be the most valuable outcomes of REPs. On the other hand, more than 50% of the Nepali¹² and Karnataka endodontists¹³ were congruent with the view

that all fall under regenerative endodontics with equal value.

Disinfection is of utmost importance in the success of any regenerative endodontic procedure for which sodium hypochlorite (NaOCl) (53.6%) and Chlorhexidine (CHX) (17.6%) are the most commonly used irrigants in the present study. Around 1/3rd of the Chennai endodontists also use saline apart from NaOCl and chlorhexidine¹⁴. Whereas, the majority of endodontists in studies conducted by Adhikari et al (57.4%)¹² and Ariwala et al (35.9%)¹⁵ recommended both NaOCl and EDTA irrigants during regenerative endodontic procedures. As a higher concentration of NaOCl has adverse effects on the survival and differentiation of stem cells, EDTA helps in the release of growth factors and thereby promotes the adhesion, migration and differentiation of dental pulp stem cells onto dentin.¹⁶⁻¹⁷

The majority (53.6%) of the respondents considered triple antibiotic paste and pulpal revascularization as the ideal treatment option for necrotic immature teeth. This agrees with a study conducted by Adhikari et al¹² and Assiry A et al¹⁸. More than 20% of the present study endodontists and more than half of the participants in studies by Utnej et al⁹ and Mayya et al¹³ still consider the application of calcium hydroxide followed by MTA apical plug to be the optimum treatment for necrotic immature teeth. This gives an insight into the fact that they are not trained in performing advanced regenerative endodontic techniques.

The TAP (ciprofloxacin, metronidazole, and minocycline) has been commonly used as an intracanal medicament in 51-80% of the REPs cases and its efficacy in disinfecting the root canals is well established.¹⁹ However, TAP is associated with tooth discoloration. Calcium hydroxide, though it has less antibacterial efficacy, several advantages like no

discoloration, better stem cell proliferation, easier removal of paste, and less likely to reduce fracture resistance make it a useful intracanal medicament. Further, the addition of antibiotics to Ca (OH)₂ might play a beneficial effect, but the studies on its efficacy are limited. A meta-analysis presented that TAP contributed to a higher percentage of root wall thickening while Ca(OH)₂ induced a higher percentage of apical closure.²⁰ In the present study, only 1/3rd of the endodontists use TAP and the rest use either TAP, calcium hydroxide or Ca (OH)₂ along with antibiotics.

Intracanal calcification is one of the most common issues associated with revascularization procedures, which might result from ectopic bone formation and cementogenesis inside the root canals.²¹⁻²² Researchers identified these calcifications in 62.1% of revascularization cases, which progresses with time.²³ Song et al²⁴ reported that these calcifications occurred more frequently in cases medicated with Ca(OH)₂ (76.9%) than with TAP (46.2%). On a positive note, more than 80% of the present study endodontists had knowledge of revascularization-associated intracanal calcifications (RAIC). This awareness might be one of the reasons for the low utilization of Ca(OH)₂ as intracanal medicament by present study endodontists.

In immature teeth, as the apical diameter exceeds the file diameter, mechanical instrumentation of the canal becomes challenging. Also, canal preparation might weaken the fragile and thin dentinal walls. The AAE guidelines also suggests no mechanical instrumentation. However, bacterial biofilm is likely to remain within dentinal tubules which may lead to a failure in REPs, thus minimal instrumentation should be considered.²⁵ A comparable response is seen in the present study, wherein half of the endodontists suggest for mechanical instrumentation of the root canal prior to REPs.

Categorization of study subjects based on their responses to knowledge revealed that the majority of them had fair knowledge (61.4%) and more than 1/3rd had good knowledge (35.9%). A similar but comparably lower number of subjects had a fair level of knowledge on stem cells in a study by Adhikari et al.¹² Comparably, a higher percentage of participants had good knowledge (45.8%) in a study by Mayya et al.¹³ As all the above studies were conducted among professionals, they might have better exposure to clinical practice and conferences. On the other hand, Sede et al²⁶ showed poor knowledge about the use of stem cells in dentistry among a group of Nigerian dentists and by Goyal et al²⁷ among practitioners of Ajmer City. Chakravarthy et al¹¹ observed 64.8% of them remained unaware of the various application of dental stem cells, which might be due to the difference in their sample characteristics.

Most of the subjects opined that the prognosis of REP's is variable and the cost of treatment should be less when compared to root canal treatment. The cost of treatment was believed to be more by 31.1% of residents, for regenerative treatment than the present procedures in a study by Krishna Prasada and Bukhari.²⁸ The present study subjects opined that the biggest obstacles for people to use stem cell banking are; not being a popular treatment, higher cost and fear of failure. Studies among dental residents, lack of knowledge, higher costs and fear of stem cells were considered as barriers.^{9,28}

On a negative note, around half of the endodontists haven't done any case of REPs in their practice. Among the endodontists who practiced REPs, 34% had done 1-3 cases and only 6.5% had done more than 6 cases. Similarly, low levels of practice were reported by Ez-Abadi et al¹⁰ and by Goyal et al²⁷, while in studies by Epelman et al⁶, Lin et al²⁹ and Utneja et al⁹ half of the participants reported practicing dental regenerative

procedures. The study by Naylor et al³⁰ showed that only 40% of respondents were using these techniques.

The present study acknowledges certain limitations; firstly, a smaller sample size might limit the generalizability of the findings. Secondly, the self-reported nature of the questionnaire may be subject to recall bias and the subjective nature of satisfaction.

Conclusion

Based on the present study findings, it is observed that though the endodontists had good theoretical knowledge and positive attitude, their level of implementing REPs into practice is very poor. However, the enthusiasm for incorporating RETs into their clinical practice was more among the endodontists.

References

1. Tabatabaei F. A review on implications of tissue engineering in different fields of dentistry. *J Dent Med.* 2012; 25:6–13.
2. Jung C, Kim S, Sun T, Cho YB, Song M. Pulp-dentin regeneration: Current approaches and challenges. *J Tissue Eng* 2019; 10:2041731418819263.
3. Andreasen JO, Farik B, Munksgaard EC. Long-term calcium hydroxide as a root canal dressing may increase risk of root fracture. *Dent Traumatol* 2002; 18:134-7.
4. Rosenberg B, Murray PE, Namerow K. The effect of calcium hydroxide root filling on dentin fracture strength. *Dent Traumatol* 2007; 23:26-9.
5. Murray PE, Garcia-Godoy F, Hargreaves KM. Regenerative endodontics: a review of current status and a call for action. *J Endod* 2007; 33:377-90.
6. Epelman I, Murray PE, Garcia-Godoy F, Kuttler S, Namerow KN. A practitioner survey of opinions toward regenerative endodontics. *Journal of endodontics* 2009; 35(9):1204-1210.
7. Garcia Godoy F, Murray PE. Recommendations for using regenerative endodontic procedures in permanent immature traumatized teeth. *Dental Traumatology* 2012; 28(1):33-41.
8. Manguno C, Murray PE, Howard C, Madras J, Mangan S, Namerow KN. A survey of dental residents' expectations for regenerative endodontics. *J Endod.* 2012 Feb;38(2):137-43.
9. Utneja S, Nawal RR, Ansari MI, Talwar S, Verma M. A survey of attitude and opinions of endodontic residents towards regenerative endodontics. *J Conserv Dent.* 2013 Jul;16(4):314-8.
10. Ez-Abadi AR, Ahmady AE, Tabatabaei FS. “Dental Residents’ Knowledge and Attitude towards Stem Cells and Regenerative Dentistry. *J Dent Sch* 2017;35(3):99-107.
11. Chakravarthy D, Selvapandiane V, Radhakrishnan SN, Arumugam B, Shivakumar M. Knowledge and Attitude Levels on Regenerative Endodontic Procedures among the Dental Residents in and around Puducherry. *J Sci Den* 2021;11(2):44–47.
12. Adhikari B, Chaudhary S, Khanal B, Acharya N, Khadka J. Knowledge, Attitude and Practice of Regenerative Endodontics among Endodontists of Nepal. *MedS. J. Med. Sci.* 2022;2(3):18-23.
13. Mayya A, Naik R, Paul MP, Amin S, Mayya SS. Knowledge, attitude, and perception among endodontists toward regenerative endodontics: A cross-sectional survey of four Indian universities. *J Int Soc Prevent Community Dent* 2021; 11:68-76.
14. Sowmya MR, Ajitha P, Haripriya S. Assessment of knowledge, attitude, and practice of dentists residing in Chennai about regenerative endodontics. *World J Pharmacy Pharmaceutical Sci* 2020;9(1):916-928.
15. Ariwala F, Yelapure M, Hegde MN, Devadiga D, Upasana. Regenerative Endodontics-The Future? A

- Questionnaire Based Study. *Indian J Public Health Res Dev.* 2020 Jan 31;11(1):363–8.
16. Lin LM, Kahler B. A review of regenerative endodontics: current protocols and future directions. *J Istanb Univ Fac Dent.* 2017 Dec 2;51(3 Suppl 1): S41–51.
17. Martin D, Affonso de Almeida J, Henry M, Khaing Z, Schmidt C, Teixeira F, et al. Concentrationdependent Effect of Sodium Hypochlorite on Stem Cells of Apical Papilla Survival and Differentiation. *J Endod.* 2014 Jan 31; 40:51–5.
18. Assiry AA, Karobari MI, Snigdha NT, Mohamed RN, Basheer SN, Zameer M. Evaluation of Attitude and Knowledge of Endodontic, Pedodontic and SBARD Residents in Saudi Arabia toward Regenerative Endodontics-A National Survey. *Med Kaunas Lith.* 2022 Apr 14;58(4):545.
19. Kontakiotis EG, Filippatos CG, Tzanetakakis GN, Agrafioti A. Regenerative endodontic therapy: a data analysis of clinical protocols. *J. Endod.* 2015; 41:146–154.
20. Baez V, Corcos L, Morgillo F, Imperatrice L, Gualtieri AF. Meta-analysis of regenerative endodontics outcomes with antibiotics pastes and calcium hydroxide. The apex of the iceberg. *J Oral Biol Craniofac Res* 2022;12: 90–98.
21. Zhou R, Wang Y, Chen Y, Chen S, Lyu H, Cai Z, Huang X. Radiographic, Histologic, and Biomechanical Evaluation of Combined Application of Platelet-rich Fibrin with Blood Clot in Regenerative Endodontics. *J Endod.* 2017 Dec;43(12):2034-2040.
22. Martin G, Ricucci D, Gibbs JL, Lin LM. Histological findings of revascularized/revitalized immature permanent molar with apical periodontitis using platelet-rich plasma. *J Endod.* 2013 Jan;39(1):138-44.
23. Wei X, Yang M, Yue L, Huang D, Zhou X, Wang X, et al. Expert consensus on regenerative endodontic procedures. *Int J Oral Sci* 2022; 14:55.
24. Song M, Cao Y, Shin SJ, Shon WJ, Chugal N, Kim RH, et al. Revascularization-associated Intracanal Calcification: Assessment of Prevalence and Contributing Factors. *J Endod.* 2017 Dec;43(12):2025-2033.
25. Lin LM, Shimizu E, Gibbs JL, Loghin S, Ricucci D. Histologic and histobacteriologic observations of failed revascularization/revitalization therapy: a case report. *J Endod.* 2014 Feb;40(2):291-5.
26. Sede MA, Audu O, Azodo CC. Stem cells in dentistry: knowledge and attitude of Nigerian Dentists. *BMC Oral Health.* 2013; 13:27.
27. Goyal AR, Goswami RP, Ganapathy SK, Ojha R, Singhal K, Ahluwalia Y. Knowledge, attitude, and practice toward regenerative endodontics and factors affecting its practice among dental practitioners in Ajmer city: A cross-sectional study. *J Family Med Prim Care* 2019; 8:3225-9.
28. Krishna Prasada L, Bukhari SMU. A survey on knowledge, attitude and beliefs of regenerative endodontics among postgraduate dental residents. *Al Ameen J Med Sci* 2019; 12(1): 49-53.
29. Lin S, Sabbah W, Sedgley CM, Whitten B. A survey for endodontists in today's economy: exploring the current state of endodontics as a profession and the relationship between endodontists and their referral base. *J Endod.* 2015; 41:325–332.
30. Naylor J, Mines P, Anderson A, Kwon D. The use of guided tissue regeneration techniques among endodontists: a web-based survey. *J Endod.* 2011;37: 1495–1498.
-

Legends figures and tables

Table 1: Questionnaire used in the survey

Hello and Good Day to you all. I am A. Sai Sravani Post graduate student in the department of Conservative Dentistry and Endodontics. I am doing a survey regarding knowledge, attitude, and opinion of endodontists towards regenerative endodontic procedures(rep's). I request you all to kindly fill this questionnaire. Thank you very much.

1. What is your age group?

- A. 25-35
- B. 36-45
- C. 46-55
- D. 56 and above

2. What is your gender?

- A. MALE
- B. FEMALE

3. Years of practice?

- A. 0-10
- B. 11-20
- C. More than 20

4. Practice hours per week?

- A. Less than 20 hours
- B. More than 20 hours

5. Have you ever received continued education in regenerative endodontic therapy?

- A. Yes
- B. No
- C. Maybe

6. What procedures do you think come under regenerative endodontic procedures?

- A. Revascularization with blood clot
- B. Stem cell implantation
- C. Scaffold implantation
- D. 3d cell printing
- E. Gene therapy

- F. All of the above

7. Which of the following outcomes of regenerative endodontic procedures are most valuable?

- A. Healing of periapical bone
- B. Continued root development
- C. Pulp tissue revitalization
- D. tooth reimplantation

8. What do you think will be the prognosis of reps?

- A. Always successful
- B. Always unsuccessful
- C. Variable

9. In which teeth would you consider revascularization procedure?

- A. Necrotic teeth
- B. Teeth with periapical abscess
- C. Incompletely developed permanent tooth with open apex
- D. Primary dentition

10. What do you consider to be an optimal treatment for necrotic immature teeth?

- A. Calcium hydroxide apexification
- B. Ca(OH)₂ application followed by mta apical plug and back filling with obturation material
- C. Mta apical plug and back filling with obturation material
- D. Tri biotic paste and pulp revascularization

11. Are you aware of aae's (American academy of endodontists) protocol for regenerative endodontics

- A. Yes
- B. No

12. What irritants can be used for cases undergoing regenerative endodontic procedures?

- A. 2.5-5.25% sodium hypochlorite
- B. 0.2-2 % chlorhexidine
- C. 3% hydrogen peroxide

- D. Povidine iodine
E. Any of the above
- 13. What is the aesthetic recommended for regenerative endodontic procedures?**
- A. 3% mepivacaine with vasoconstrictor
B. 3% mepivacaine without vasoconstrictor
C. 2% lignocaine with vasoconstrictor
D. 2% lignocaine without vasoconstrictor
- 14. What kind of intracanal medicament can you use for regenerative endodontic procedures?**
- A. Calcium hydroxide paste
B. Calcium hydroxide paste combined with antibiotics
C. Triple antibiotic paste
D. Any of the above
- 15. How many weeks should you wait for second appointment after intracanal medicament placement?**
- A. Need not wait
B. 1-2 weeks
C. 3-4 weeks
D. More than one month
- 16. Should a tooth undergoing regenerative endodontic procedure be mechanically prepared?**
- A. Yes
B. No
- 17. Do you think there are chances of calcification of teeth even after revascularization?**
- A. Yes
B. No
- 18. have you done any of the regenerative endodontic procedures in your practice?**
- A. Yes
B. No
- 19. How many regenerative endodontic procedure cases have you done till date?**
- A. None
B. 1-3
C. 4-6
D. >6
- 20. when compared with root canal treatment do you think regenerative endodontic procedures should cost.**
- A. More
B. Less
C. Equal
- 21. have you or any of your relatives used any kind of stem cell banking options?**
- A. Yes
B. No
- 22. what kind of dental tissues can be grown from stem cells?**
- A. Enamel only
B. Dentin only
C. Pulp only
D. Dentin - pulp complex
- 23. Do stem cells of apical papilla have the potential for continuing root development and pulp healing?**
- A. Yes
B. No
- 24. can periodontal ligament stem cells give rise to cementum like structures?**
- A. Yes
B. No
- 25. can we harvest pulpal stem cells from teeth with apical abscess, tumours, or cysts?**
- A. Yes
B. No
- 26. would you be willing to collect dental tissues for stem cell banks?**
- A. Yes
B. No
- 27. do you think dental professionals should get to regulate dental stem cell banks?**
- A. Yes
B. No
- 28. what do you think is the biggest obstacle for people using stem cell banking?**
- A. Higher costs
B. Fear of failure
C. Because it's not popular yet, people are sceptical
- 29. do you think research to use stem cells for growing dentin- pulp - cementum complex should be continued?**
- A. Yes
B. No

30. please write here any comments you wish to make related to the survey

Table 2: Mean comparison of knowledge based on variables

Variables		Mean	SD	P value
Age	25-35	10.2389	2.32715	0.016*
	36-45	8.2857	2.05421	
	46-55	9.2273	2.13657	
	≥56	8.5000	.57735	
Gender	Male	10.1290	2.39866	0.215
	Female	9.6923	2.27885	
Years of practice	0-10 years	10.0940	2.42111	0.080
	11-20 years	8.6500	1.81442	
	>20 years	9.7500	1.77012	
Practice hours per week	≤20	9.7931	2.53923	0.574
	>20	9.9158	2.20571	
Received continued education	Yes	10.4022	2.45424	0.002*
	No	9.0000	1.82574	
	May be	9.2222	2.04524	

Table 3: Distribution based on responses to opinions

Items	Response	n	%
Prognosis of REPs	Variable	147	96.1
	Always successful	6	3.9
Cost of REPs	More	12	7.85
	Less	127	83.0
	Equal	14	9.15
Dentists should regulate dental stem cell banks	Yes	140	91.5
	No	13	8.5
Biggest obstacle	Because it's not popular,	83	54.2
	Higher costs	50	32.7
	Fear of failure	20	13.1

Research in REPs to be continued	Yes	153	100
	No	0	0

Table 4: Distribution based on responses to attitude

Items	Response	n	%
Done in your practice	Yes	76	49.7
	No	77	50.3
How many REPs been done by you	1-3	52	34.0
	4-6	14	9.2
	>6	10	6.5
	None	77	50.3
You or your relative used stem cell banking for any purpose	Yes	12	7.8
	No	141	92.2
Willing to collect dental tissue for banking.	Yes	135	88.2
	No	18	11.8

Figure 1: Mean comparison of knowledge based on variables

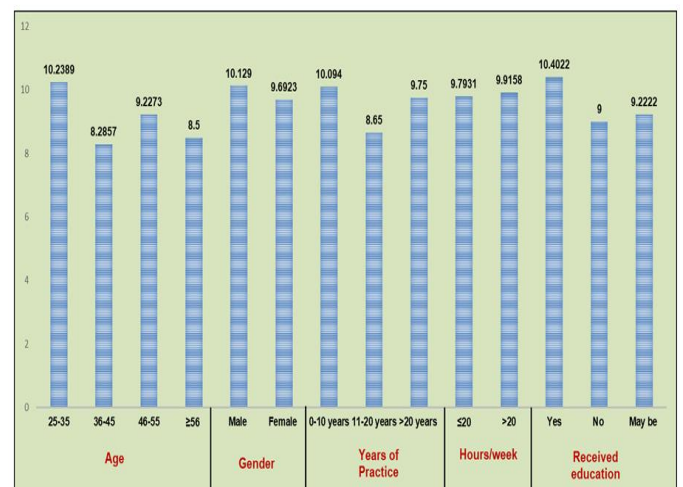


Figure 2: Distribution based on responses to opinions

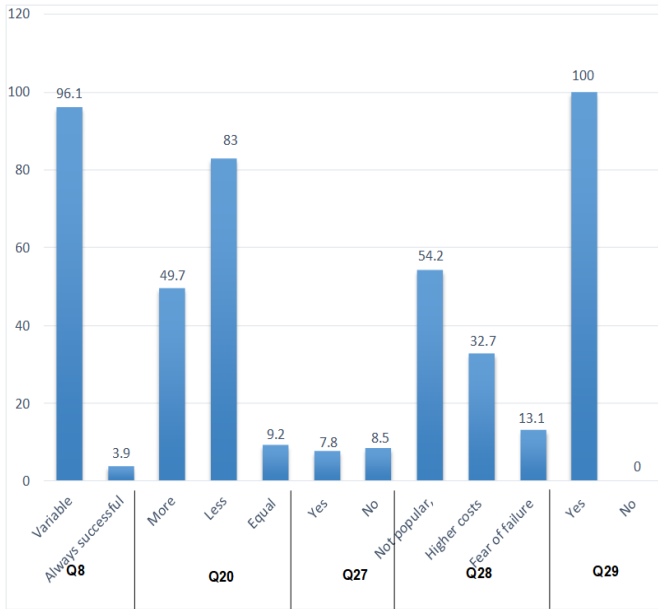


Figure 3: Distribution based on responses to attitude

