

## A Survey of Hamadan dental residents opinions toward regenerative endodontics in 2010-2011 school year

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**Abstract:** The aim of this study was to access the dental residents opinions toward regenerative. 100 Residents in all departments of Hamadan dental school in 1391-92 school year were evaluated by using an standard questionnaire that include 32 questions. %69/6 female and %92.4 were in the range of 25 to 35 years old. Census sampling method was applied and the data were analyzed using  $\chi^2$  statistics at a significance of  $P < .05$  by the software 18-SPSS. %84/8 of residents had no continued education in stem cells or regenerative endodontics procedures. %83/5 residents were willing to undergo extra training to provide regenerative endodontic procedures for patients. %44/3 of residents predicted outcomes of regenerative dental treatment successful while %49/4 of them was unsure about outcome of these treatments. Most of residents believed that regenerative procedures should be incorporated into dental treatments. They were optimistic about the future use of these treatments and they were willing to undergo extra training in this field. Nevertheless, they also need more evidence for the effectiveness and safety of regenerative treatments before offering these treatments to their patients.

**Keywords:** Regenerative endodontics, Resident, Opinion

### INTRODUCTION

Endodontic root canal therapy is performed to remove damaged pulp for the purpose of preventing further infection. The tooth might be saved by filling the root

canal with gutta-percha [1]. The next innovation in endodontic is expected to be the use of regenerative endodontic procedures (REPs). REPs are biologically based procedures designed to replace damaged, diseased, or missing structures such as dentin, root structures, and cells of the pulp-dentin complex [2]. These tissues might be replaced with live, viable tissues of the same origin for the purpose of restoring normal physiologic functions of the pulp-dentin complex [2]. Regenerative endodontic can include all the various procedures needed to regenerate the pulp-dentin complex. The procedures can include blood clot revascularization, implanted tissue engineered dental pulp constructs, and stem cell therapy [3-7].

The field of regenerative endodontic is a new frontier in clinical practice. Information concerning the views of dental practitioners toward regenerative procedures is scarce, but it is essential to the widespread acceptance and delivery of regenerative procedures to dental patients. Only a single previous study has surveyed the opinions of endodontists toward REPs [8],

and that survey was conducted in 2012 and was limited to the members of the College of Diplomats of the American Board of Endodontic. There is a need to survey the broader opinions of dental residents, because they might provide a different view of the future use of REP.

The principles of ethics and code of professional conduct policy established by the American Dental Association does not address topics such as regenerative medicine or the usage of stem cell therapies for dental treatment [9]. The willingness of endodontists and other specialist dentists to accept training to deliver stem cell therapies and REPs to their patients is unclear. The ethics of using stem cell therapies to accomplish dental treatment is controversial [8]. The confidence of dental practitioners to deliver reliable regenerative therapies to their patients is unknown. The costs of dental treatment are known to be a deciding factor in patient acceptance [10]. However, it is not clear how the cost of regenerative procedures will

influence its use, or what price practitioners will charge for providing regenerative procedures.

## MATERIALS AND METHODS

Human subject's institutional review board approval was granted to recruit dentist subjects to participate in the survey. 100 Residents in all departments of Hamadan dental school in 2012-2013 school years were evaluated. A total of 100 questionnaires were distributed, with 79 completed questionnaires being returned with the informed consent of participants. The survey was 21% similar to that used previously by Epelman *et al* [8] and contained a total of 31 questions and consisted of 3 parts. Part A was composed of questions regarding professional status, Part B included ethical opinions, beliefs, and judgments, and Part C asked questions regarding clinical practice. The surveys were collected, and the data were analyzed by the percentage of the total responses for the purpose of gaining insight into the opinions of the dentists. We used commercially available software SPSS for windows 18 software (SPSS Inc, Chicago, IL) to analyze the survey responses. We analyzed the responses of the dental specialists separately by using  $\chi^2$  statistics at a significance of  $P < .05$ .

## RESULT AND DISCUSSION

The overall response rate to the questionnaire was 79%. In some instances, the dentists might have given more than 1 reply to each question or did not reply to a question. The results of the survey questions are shown in Table 1. Many of the participants were female (69.6%) and between the ages of 25–35 years (92.4%). Most of the participants were relatively new to the profession, with only 0–10 years in practice (92.4%). Most of the participants (92.4%) had never owned a dental practice. Three-fourths of the participants (75.9%) were reading scientific dental journals every week. A majority of the participants (84.8%) had never received any previous education regarding stem cells and/or regenerative dental treatments.

Most of the dentists (91.1%) agreed that regenerative therapy should be incorporated into dentistry, and the majority (36.7%) believed that it would take more than 20 years for regenerative stem cell therapies to be used in dentistry. Many of the dentists (59.5%) believed that it would take more than 21 years before a dentist would be able to routinely implant new teeth grown in a laboratory. A large majority of the dentists (83.5%) were willing to attend training or continuing education courses to be able to apply regenerative dental treatments. Most of the dentists (91.1%) believed that the biggest obstacle to patient acceptance of regenerative dental treatments would be a higher cost of the treatment. Most dentists (91.1%) indicated that they would be willing to save teeth and dental tissue for regenerative dental treatment,

and a majority (83.5%) thought that regenerative dental treatments would be a better treatment option than tooth implant replacement. Most dentists (98.7%) agreed that stem cell and regenerative treatments should be tested on animals before clinical testing.

Many dentists (78.5%) were willing to deliver dental treatments involving embryonic stem cell sourced from a human fetus to their patients. In regards to the future of regenerative treatments, majority of dentists (57%) believed that there is no risk in stem cell clinics delivering future dental treatments. The majority of dentists (89.9%) held the opinion that dental professional associations Most dentists (65.8%) did not use any type of regenerative procedures in their practice, and a majority (64.5%) did not have an assessment of regenerative dental treatment outcomes.

Many dentists (70.9%) had the opinion that after nonsurgical root canal treatment, the healing of the periapical tissues would be enhanced by tissue engineering. When asked which regenerative endodontic treatment was the most valuable, a majority of dentists (38%) responded that all of the following treatments were valuable: healing of periradicular bone, continued root development in immature teeth, pulp tissue revitalization within a root canal, and tooth reimplantation. The survey questions asked what percentages of certain cases were present in their practice. Most dentists (69.6%) indicated that less than 25% of their cases involved necrotic immature teeth; a majority of dentists (82.3%) denoted that less than 25% involved avulsed or traumatized teeth, and many dentists (48.1%) pointed out that 26%–50% of their cases involved periradicular lesions. Many dentists (48.1%) believed that the optimal treatment for necrotic immature teeth is the use of calcium hydroxide, followed by mineral trioxide aggregate apical plug and backfilling with an obturation material. In regard to monetary issues about stem cell treatments most (69.9.0%) stated that they would provide regenerative treatments regardless of whether they increased their income. For regenerative treatments a majority of dentists (64.5%) held the opinion that the cost for regenerative dentistry should be more than current treatment.

Many dentists (39.2%) indicated they would recommend stem cell and regenerative dental treatments to their patients if it was safe and reliable. The present study is the second survey of the opinions of dental residents toward REPs. It has provided a valuable insight into the ethical opinions, beliefs, and judgments of delivering stem cell therapies to dental patients. The survey provides evidence that dentists want to be at the forefront of treatment development and are interested in procedures that regenerate tooth structure. Stem cell therapies and regenerative treatments have been under development since human embryonic stem- cell lines were first isolated more than a decade ago [11]. The

participants thought that the healing of the periapical tissues would be enhanced by tissue engineering after nonsurgical root canal treatment. The dentists also thought that the healing of the periapical bone, continued root development in immature teeth, pulp tissue revitalization within a root canal, and tooth re-implantation were all valuable regenerative endodontic treatments. The dentists were optimistic about the future of the profession, its incorporation of regenerative therapies, and the expected benefits for patients.

The majority of dentists had very little clinical experience; most reported having a decade or less of experience in the dental profession, indicating that they are part of the latest generation of dental practitioners which was similar to the current study [12]. This compares with the previous survey of members of the College of Diplomates of the American Board of Endodontic who were in mid-career or late career, with an average of more than 21 years of experience [8]. Many of the dentists who participated in the current survey indicated that regenerative therapies would be used in the next 11–20 years. It is reasonable to assume that these dentists would be some of the first to be delivering regenerative therapies to their patients. A majority of dentists (75.9%) read scientific dental journals every week. Similar results were reported by Manguno *et al.* [12] and Epleman *et al.* [8], indicating that they were well-educated in recent advancements and research in the field of dentistry. Most of the dentists (84.8%) specified that they had not yet received a continuing education regarding stem cell and regenerative therapies. These results are in agreement with findings by Manguno *et al.* [12] while the study conducted by Epleman [8] only (56.4%) participants had received continued education in stem cells and/or regenerative dental treatments. A reason for this is that they were relatively new to the dental profession, and they had not yet had the opportunity to attend many training courses. Many of the dentists expected to be implanting new teeth grown in a laboratory in the more than 21 years; Whereas in the study conducted by Manguno and Epleman believed that it would take between 11 and 20 years before a dentist would be able to routinely implant new teeth grown in a laboratory.

It is estimated that 2 million tooth implants are placed each year in the United States [13]. The increasing placement of implants may compete with some endodontic treatments and even REPs [13]. Most dentists (83.5%) thought regenerative dental treatments would be a better treatment option than a tooth implant replacement. Similar results was reported by Manguno *et al.* and a majority indicated their willingness to save teeth and dental tissues for use in regenerative dental treatments. In a recent retrospective study, it was found that 97% of 1.4 million endodontic cases remain successful after 8 years [14] and a greater than 90% of success or survival rates reported for endodontic treatments and implants [15, 16]. That high standard of

success presents a challenge to tissue engineering researchers and practitioners. Animal testing alternatives and a reduction in the numbers of animals used for research have been implemented in response to public opinion against the use for animals for research [17]. However, despite this trend, many participants thought regenerative treatments should be tested on animals before a clinical trial. Similar results were reported by Manguno *et al.* [12] and Epeleman *et al.* [8]. Another controversial question was the use of embryonic stem cells to accomplish regenerative treatment. The use of embryonic stem cells from a human fetus in research has been restricted according to their type, source/donor, and age. Recent political changes have allowed more types of embryonic stem cells to be used in research [18]. A majority of the participants were willing to deliver regenerative treatments involving embryonic stem cells sourced from a human fetus. However, many of them were concerned about the health hazards associated with their use and thought professional associations should establish regulations regarding the use of stem cells in regenerative dentistry. The opinions of dentists and healthcare providers must be factored into the debate for the future directions for the oversight of stem cell research [19]. Most participants (69.6%) agreed to provide regenerative treatments regardless of whether they increased their income. This reflects the attitudes of participants to provide the best possible treatments for their patients. More than half of the participants indicated that they would be willing to accept a fee for service payment plan as payment for delivering regenerative treatments. Similar results were reported by Manguno *et al.* but Epleman have reported that the majority of participants (47.3%) thought that the cost of REPs should be equal to current treatment costs.

During the introductory phase of regenerative dental therapies, this might be the most widely used form of payment to dentists until the therapies become common and covered by insurance companies and public healthcare/Medicaid. The most likely source of stem cells for regenerative dental treatments would likely be a patient's own stem cells, which can be stored in a dental stem- cell bank. The survey reflected the concerns of the dental residents that they are providing the most effective treatment option.

## CONCLUSION

The survey participants were generally enthusiastic about the introduction and usefulness of REPs. The pioneering nature of this survey prevented comparisons with the opinions, beliefs, and attitudes of endodontists and other health care providers. It is not clear if the same enthusiasm exists among dentists, physicians, and other health care professionals for the introduction of stem cell and regenerative therapies. More survey research among health care providers is necessary to determine ethical guidelines and to assess

the potential acceptance and limitations of delivering stem cell and regenerative therapies to patients.

**Table-1: The survey questions**

**A. Professional status:**

**1-Which is your field in dentistry?**

- a. Endodontists 7.6% (n = 6)
- b. Pediatric Dentistry 6.3% (n = 5)
- c. Orthodontics 16.5% (n = 13)
- d. Periodontics 11.4% (n=9)
- e. Oral medicine 12.7% (n=10)
- f. Oral pathology 8.9% (n=7)
- g. Oral surgery 8.95% (n=7)
- h. Oral Radiology 7.6% (n=6)
- i. Restorative dentistry 10.1% (n=6)
- j. Prosthodontics 10.1% (n=8)

**2-How many years have you been in practice?**

- a. 0- 10 years 92.4% (n = 73)
- b. 11-20 years 6.3% (n =5)
- c. More than 20 years 1.3% (n = 1)

**3-Where is your primary place of practice located**

- a. Rural 22.8% (n = 18)
- b. Urban 46.8% (n = 37)
- c. Suburban 17.7% (n = 5)
- d. Academic environment 17.7% (n = 14)
- e. Military 2.5% (n = 2)

**4- What is your sex?**

- a. Male 30.4% (n = 24)
- b. Female 69.6% (n = 55)

**5- What is your age group?**

- a. 25-35 years 92.4% (n = 73)
- b. 36-45 years 5.1% (n = 4)
- c. 46-55years 2.5% (n=2)
- d. 56 or more 0% (n = 0)

**6-How frequently do you read scientific dental journals?**

- a. Every week 75.9% (n = 60)
- b. Every year 19% (n = 15)
- c. Within the past 5 years 2.5% (n = 2)
- d. Never 0% (n = 0)

**7-Have you ever received continued education in stem cells and/or regenerative dental treatments?**

- a. Yes 11.4% (n = 9)
- b. No 84.8% (n = 67)

**B. Ethical opinions, beliefs and judgment:**

**8-Should regenerative therapy be incorporated into dentistry?**

- a. Yes 91.1% (n = 72)
- b. No 5.1% (n =4)

**9- How many years do you think it will take for some regenerative stem cell therapies to be used in dentistry?**

- a. 0-10 years 34.2% (n = 27)
- b. 11-20 years 24.1% (n = 19)
- c. More than 21 years 36.7% (n = 29)

10- How many years do you think it will take before dentists are able to implant new teeth grown in a laboratory?

- a. 0-10 years 11.4% (n = 9)
- b. 11-20 years 27.8% (n = 22)
- c. More than 21 years 59.9% (n = 47)

11- Would you be willing to attend a training course and/or continuing education courses to apply regenerative dental treatments?

- a. Yes 83.5% (n = 66)
- b. No 15.2% (n = 12)

12-What do you think would be the biggest obstacle to a patient accepting regenerative dental treatment?

- a. Higher cost 91.1% (n = 72)
- b. Fear of stem cells 0% (n = 0)
- c. Other reasons 6.3% (n = 5)

13-Would you be willing to save teeth and dental tissue for future regenerative dental treatment?

- a. Yes 91.1% (n = 72)
- b. No 7.6% (n = 6)

14- Do you think that regenerative dental treatment will be a better treatment option than tooth implant placement?

- a. Yes 83.5% (n = 66)
- b. No 13.9% (n = 11)

15-Do you think stem cells and regenerate treatments should be tested on animals prior to clinical testing?

- a. Yes 98.7% (n = 78)
- b. No 1.3% (n = 1)

16-Would you be willing to deliver dental treatments that involve embryonic stem cells sourced from a human fetus?

- a. Yes 78.5% (n = 62)
- b. No 16.5% (n = 13)

17- Are you concerned about any potential health hazards regarding the use of stem cells as part of regenerative dentistry?

- a. Yes 57% (n = 45)
- b. No 36.7% (n = 29)

18-Do you believe that dental professional associations should regulate the use of stem cell and regenerative dentistry?

- a. Yes 89.9% (n = 71)
- b. No 6.3% (n = 5)

### C. Clinical practice:

19- .Do you use any type of regenerative procedures in your practice, such as membranes, scaffolds or bioactive materials?

- a. Yes 29.1% (n =23)
- b. No 65.8% (n = 52)

20- What is your assessment of regenerative dental treatment outcomes?

- a. Successful 44.3% (n = 35)
- b. Unsuccessful 1.3% (n = 1)
- c. Don't know 49.4% (n = 39)

21- After nonsurgical root canal treatment, would the healing of periapical tissues be enhanced by tissue engineering?

- a. Yes 70.9% (n = 56)
- b. No 12.7% (n = 10)

22- Which of the following regenerative endodontic treatments is the most valuable?

- a. Healing of periradicular bone 10.1% (n = 8)

- b. Pulp tissue revitalization within a root canal 36.7% (n = 29)
- c. Tooth re-implantation 11.4% (n = 9)
- d. All of the above 38% (n = 30)

23- What percentage of cases in your practice involves necrotic immature teeth?

- a. Less than 25% 69.6% (n = 55)
- b. 25%-50% 16.5% (n = 13)
- c. More than 50% 6.3% (n = 5)

24- What percentage of cases in your practice involves avulsed or traumatized teeth?

- a. Less than 25% 82.3% (n = 65)
- b. 25%-50% 5.1% (n = 4)
- c. More than 50% 3.8% (n = 3)

25-What percentage of cases in your practice involves periradicular lesions?

- a. Less than 25% 30.4% (n = 24)
- b. 25%-50% 48.1% (n = 38)
- c. More than 50% 12.7% (n = 10)

26- What do you consider to be the optimal treatment for necrotic immature teeth?

- a. Calcium hydroxide apexification 10.1% (n = 8)
- b. Calcium hydroxide application followed by MTA apical plug and backfilling with obturation material 48.15 (n=38)
- c. MTA apical plug and back-fill with obturation material 13.9% (n = 11)
- d. Tribiotic paste and pulpal regeneration 20.3% (n = 16)

27- Using which payment plan would you be most willing to deliver stem cell and regenerative dental treatment?

- a. Fee for service 11.4% (n = 9)
- b. Dental Insurance 30.4% (n = 24)
- c. All of the above 53.2% (n = 42)
- d. None 0% (n = 0)

28- Would you only provide regenerative dental treatment if you are able to increase your income?

- a. Yes 24.1% (n = 19)
- b. No 69.6% (n = 55)

29- In a case where you can't provide a regenerative treatment, would you be willing to refer your patient to a stem cell treatment center?

- a. Yes 86.1% (n = 68)
- b. No 8.9% (n = 7)

30- What would make you most likely to recommend stem cell and regenerative dental treatments to your patients?

- a. If it is the most effective treatment option 39.2% (n = 31)
- b. It is safe and reliable 30.4% (n = 24)
- c. If it is the most cost-effective option 21.5% (n = 17)
- d. I would never recommend it 0% (n = 0)

31- Please write here any comments you wish to make related to the survey

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