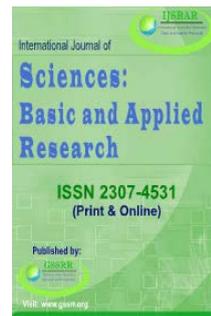


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## A Survey of Knowledge and Practice of Regenerative Endodontics Among Nigerian Dental Residents

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### Abstract

The aim of this survey was to assess the knowledge, attitude and practice of regenerative endodontics among dental residents in selected Nigerian hospitals. A self-administered questionnaire was used for the survey. It consisted of three parts; part A asked questions about dentists profile and knowledge, part B sought the dentist's opinion, beliefs and judgement regarding the use of RE procedures while part C consisted of questions based on clinical practice. The results shows that the majority (91.2%) have heard about REPs which was mainly through postgraduate training but 91.9% were willing to attend courses on REPs. Most (89.1%) of participants believed that stem cell banking will be useful to regenerate dental tissues, however only 42.4% claimed to have been using some type of regenerative therapy in their practice and 28.9% considered tribiotic paste and pulpal regeneration as optimal treatment for necrotic immature teeth while 36% considered CaOH +MTA+ obturation material as the best option. As a final conclusion we can say that these results reflect that dental residents are optimistic about the use of regenerative endodontic procedures; however, a need for more research and regular training was felt.

**Keywords:** dental residents; knowledge; practice; regenerative endodontics.

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## **1. Introduction**

The regeneration or replacement of oral tissues affected by inherited disorders, trauma and neoplastic or infectious diseases is expected to solve many dental problems. The endodontic specialty may be able to adopt many of the new scientific advances emerging from regenerative medicine, thereby developing regenerative endodontic procedures (REPs) and improving patient care [1]. REPs are biologically based procedures designed to predictably replace damaged, diseased or missing structures such as dentine, root structures and cells of the pulp-dentine complex [1]. Regenerative endodontic techniques are diverse and can include direct pulp capping, revascularization, apexogenesis, apexification, and even stem cell therapy and tissue engineering. Pulp capping and partial pulpotomy as well as root canal revascularization have been in use since 1970s [2,3], though recent inventions such as stem cell engineering are still undergoing a lot of research. Traumatized immature teeth could benefit from regenerative endodontic procedures such as revascularization [4-11] and partial pulpotomy [12-14]. Certain guidelines and recommendations [15,16] have recently been developed for successful outcome of REPs.

Due to the increased interests and activities that are ongoing in this field, the authors in [17] conducted a survey of dental practitioners' opinion towards REPs and reported that 89% of the participants would be willing to save teeth and dental tissues for stem cell banking even though only 14% of the study population had used umbilical cord or stem cell banking for themselves or a relative. In a recent survey of dental residents' expectations [18] for RE also reported that 83.9% had no continuing education/training in stem cells or REPs, with 96.8% willing to receive training to be able to provide REPs and 49.1% of dentists already using membranes, scaffolds or bioactive materials to provide dental treatment. The majority of the participants in the two studies indicated that they would want regenerated therapy to be incorporated into Dentistry. These two surveys were carried out in the United States of America. A search through the literature showed that there is no documented study on the knowledge and practice of regenerative endodontics among Nigerian dentists. It was thus the aim of this survey to investigate knowledge, attitude and practice of regenerative endodontics in our environment.

## **2. Materials and methods**

A modified version of the questionnaire that was used at the Endodontic College of Diplomates Summer Conference [17] was used for this survey. The questionnaire was self-administered and divided into 3 parts. Part A asked questions about dentist's professional status and knowledge of REPs. Part B sought the dentist's opinion, beliefs and

judgement regarding the use of REPs, and part C consisted of questions based on current endodontic practice. The residents involved in this study were those who must have rotated through the specialties where immature teeth or necrotic pulp are being treated. Questionnaires were sent to the six well recognised (oldest) and accredited training centres through the resident doctors that came to attend update courses of either West African College of Surgeons or National Postgraduate Medical College. Ethical approval for the study was obtained University Of Ibadan / University College Hospital Institutional Review Committee.

The data collected were analysed using SPSS version 19. Descriptive statistics were employed, and chi square test was used to test the strength of association between two variables with  $p \leq 0.05$ .

### **3. Results**

A total of 125 correctly filled questionnaires were returned out of the 155 sent out, giving a response rate of 80.7%. Some residents gave more than one reply to each question in some instances or did not reply to a question or more.

#### *3.1 Professional status and knowledge of REPs*

The majority (77.6%) of the participants were male while the remaining (22.4%) were female giving a male to female ratio of 3.5:1. Most (66.1%) of the participants were in the age group 25-35 years. Maxillofacial surgery had higher number (39.8%) of residents followed by orthodontics (13.8%), while the least (4.8% each) represented fields of practice were general dental practice and Periodontics. Majority (81.5%) of the participants have practised for at least 10 years. (Table 1)

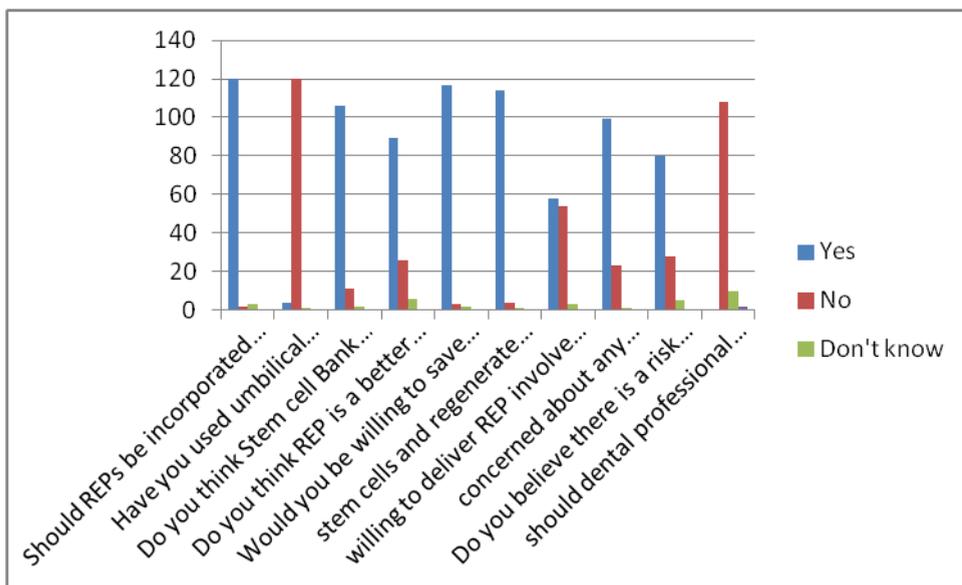
The majority (91.2%) of the participants have heard about the REPs, the source of which was mainly through postgraduate training. Most (47.4%) of the participants read scientific journal every week, while majority (91.9%) were willing to attend training courses in REPs.

#### *3.2 Ethical Opinions, Beliefs and judgments*

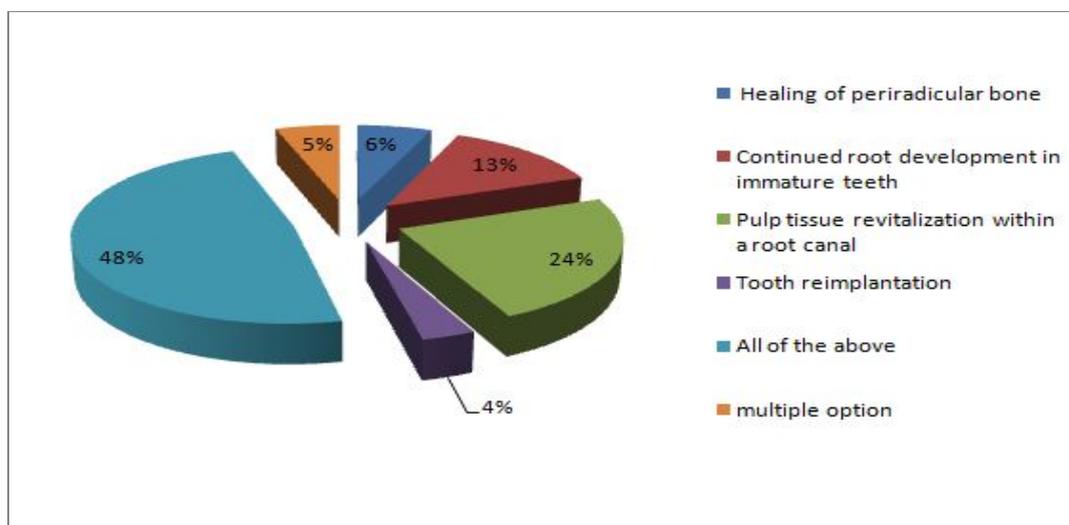
Almost all (96%) of the respondents were of the opinion that regenerative endodontics should be incorporated into dentistry and the majority (89.1%) of the participants thought that stem cell banking will be useful to regenerate dental tissues (Fig1). The majority (73.6%) believed that regenerative endodontic therapy could be a better option than implant while more than half (73.6%) of the participants thought REPs may be a successful and better treatment option than implant replacement.

**Table 1: Demographic Data and knowledge about REPs**

<b>Professional status and knowledge about REPs</b>	<b>N</b>	<b>%</b>
<b>Gender</b>		
Male	97	77.6
Female	28	22.4
<b>Age Group</b>		
25-35	82	66.1
36-45	42	33.9
46-55	1	0.8
<b>Field Of Practice</b>		
Endodontics	10	8.1
Prosthodontics	10	8.1
Paediatric dentistry	12	9.8
Maxillofacial Surgeon	49	39.8
Orthodontics	17	13.8
Oral pathology/Oral medicine	7	5.7
General dental Practice	6	4.8
Periodontics	6	4.8
Community Dentistry	7	5.7
<b>Number of year of practice</b>		
0-10 years	101	81.5
11-20 years	23	18.5
<b>Location of practice</b>		
General/state hospital	1	0.8
Teaching Hospital	124	99.2
<b>Most common payment plan used in your practice?</b>		
Fee for service	120	96
Insurance Scheme	5	4
<b>Frequency of reading scientific dental journals</b>		
Every week	55	47.4
Every month	43	37.1
Every year	11	9.5
Within past 5 years	5	4.3
Never	2	1.7
<b>Have you heard about Regenerative Dental Treatment?</b>		
Yes	114	91.2
No	9	7.3
<b>Source of knowledge of Regenerative endodontics</b>		
Undergraduate training	5	4.3
Postgraduate training	64	55.7
Dental Journals	4	3.5
Dental conference	1	0.9
CME	5	4.3
Others	2	1.7
Multiple option	34	29.6
<b>Willingness to attend a training course</b>		
Yes	114	91.9
No	10	8.1



**Fig 1 Respondents judgment and beliefs about REPs**



**Fig 2: Respondents' choice of most valuable options of regenerative endodontic treatments**

Also, a majority (95.8%) of the participants thought stem cells and regenerative treatments should be tested on animals prior clinical testing, still the majority (95%) would be willing to save teeth for REPs. Though, a higher percentage (80.5%) were concerned about potential hazards with use of stem cell as part of regenerative dentistry, 24.8% of them were not. A high majority (70.8%) of the participants believed there is a risk that stem cell clinics

will deliver future dental treatments majority, thus 90% of the respondents thought the dental professional associations should regulate the use of stem cell and regenerative. (Fig1) More than half of the participants (56.4%) believed that regenerative stem cell therapies will be used in dentistry within the next 10 years and 41.3% thought it will take the next 10 years for new teeth to be grown in a laboratory while 35.5% thought this may be possible in the next 11 to 20 years and 71.5% of the respondents thought the greatest obstacles to a patient accepting REPs would be the high cost of treatment (Table 2).

**Table 2: Respondents opinion on REPs**

	N	%
<b>How many years do you think it will take for some regenerative stem cell therapies to be used in dentistry?</b>		
0-10 years	66	56.4
11-20 years	34	29.1
>20 years	17	14.5
<b>How many years do you think it will take for dentists to implant new teeth grown in laboratory?</b>		
0-10 years	50	41.3
11-20 years	43	35.5
>20 years	28	23.1
<b>What do you think would be the biggest obstacle to a patient accepting regenerative dental treatment?</b>		
High cost	88	71.5
Fear of stem cells	15	12.2
Others	6	4.9
Multiple options	14	11.4

### 3.3 Clinical Practice

Fifty three (42.4%) of the participants claimed to have been using some type of regenerative therapy in their practice, while 47.2% claimed they do not use any regenerative therapy. About half (53%) of the participants that have heard about REPs do not use it and this is statistically significant ( $p= 0.003$ ) (Table 3). However, only 28.9% of the participants considered tribiotic paste and pulpal regeneration as optimal treatment for necrotic immature teeth while the majority (36%) considered CAO<sub>2</sub>H +MTA apical plug + obturation material as the best option (Table 4).

**Table 3: Comparison between those that have heard with those that use regenerative dental procedures**

	Do you use regenerative procedures			Total
	Yes	No	Don't know	
Have you heard about regenerative treatment				
Yes	<b>48</b>	<b>54</b>	<b>0</b>	<b>102</b>
No	<b>4</b>	<b>4</b>	<b>1</b>	<b>9</b>
Total	<b>52</b>	<b>58</b>	<b>1</b>	<b>111</b>

p=0.003

Only Forty-six (38.3%) of the participants would provide regenerative treatment if only it increases their income, while most dentists (61.7%) were not really concerned about the increase in revenue generation due to regenerative endodontics. A majority of the participants (95%) will refer patients to a stem cell treatment centre if they can't provide the treatment but most (60.7%) of the participants claimed they will recommend regenerative endodontics if only it is the most effective treatment option (Table 4).

More than two-thirds (78.1%) of the participants thought the cost of regenerative should be more than current treatment and thirty-six (34.3%) participants thought patients should be willing to pay more than N20,000 (>\$100) for stem cell banking. Fifty-five (48.2%) of the participants believed all the available options of regenerative treatment are valuable but regrettably, most (61%) of the participants claimed never to have invested in new technology for their hospital (Table 4).

#### **4. Discussion**

The present survey is the first to gather data on dental residents' knowledge and practice of REPs in our environment. A very high percentage of the residents had heard about REPs before and this was during the postgraduate training and only a very few of them during the undergraduate training.

**Table 4: Respondents Clinical Practice regarding REPs**

	N	%
<b>What percentage of cases in your practice involves necrotic immature teeth?</b>		
<10%	68	60.7
11-25%	33	29.7
26-50%	9	8
>50%	0	0
Don't know	2	1.8
<b>What percentage of cases in your practice involved avulsed or traumatized teeth?</b>		
<10%	48	42.1
11-25%	34	29.8
26-50%	23	20.2
>50%	8	7
Don't know	1	0.9
<b>What percentage of cases in your practice involves periradicular lesions?</b>		
<10%	23	20.7
11-25%	31	27.9
26-50%	35	31.5
>50%	20	18
Don't know	2	1.8
<b>What do you consider to be optimal treatment for necrotic immature teeth?</b>		
Calcium hydroxide apexification	15	13.2
Calcium hydroxide application followed by MTA apical plug and backfilling with obturation material	45	39.5
MTA apical plug and backfill with obturation material	19	16.7
Tribiotic paste and pulpal regeneration	33	28.9
Multiple options	2	1.8
<b>Using which payment modality would you be most willing to deliver stem cell and regenerative dental treatment?</b>		
Fee for services	66	54.1
NHIS	15	12.3
Retainership	8	6.6
All of the above	32	26.2
None	1	0.8
<b>What should be your fee for collecting dental tissues for stem cell banking?</b>		
Nothing	22	21
N10,000	16	15.2
N 11,000-20,000	25	23.4
> N 20,000	36	34.3
Don't know	6	5.7
<b>How much do you think your patients would be willing to pay for stem cell banking?</b>		
Nothing	9	8.4
N10,000	25	23.4
N 11,000-20,000	25	23.4
> N 20,000	36	34.3
Don't know	6	5.7
<b>What should the cost for regenerative dentistry be?</b>		
Equal to current treatment	18	15.8
More than current treatment	89	78.1
Less than current treatment	7	6.1

**When was the last time you invested in the new technology (Digitalradiography, Patient record keeping software, Cone beam CT) for your surgery?**

Last year	22	21
Last 5 years	11	10.5
>5years	8	7.6
Never	64	61

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

If it is the most effective treatment option	74	60.7
If it is safe and reliable	31	25.4
If it is the most cost-effective option	12	9.8
I would never recommend it	3	2.5

**Do you use any type of regenerative treatment?**

Yes	53	42.4
No	59	47.2
Don't know	1	0.8

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

Yes	53	46.9
No	59	52.2
Don't know	1	0.9

**What is your assessment of regenerative dental treatment outcomes?**

Successful	40	35.4
Unsuccessful	5	4.4
Don't know	68	60.2

**After non-surgical root canal treatment, would the healing of periapical tissues be enhanced by tissue engineering?**

Yes	84	74.3
No	22	19.5
Don't know	7	6.2

**Would you only provide regenerative treatment if you are able to increase your income?**

Yes	46	38.3
No	74	61.7

**In case you can't provide a regenerative treatment, would you be willing to refer your patient to a stem cell treatment centre?**

Yes	115	65
No		

**Would you be willing to collect dental tissue for stem cell banks?**

Yes	8	83.1
No	20	16.9

This may indicate that the undergraduate curriculum in this environment is yet to incorporate many aspects of the REPs into the teaching. Almost all the participants agreed that regenerative endodontic procedures should be incorporated into dental practice and most of the respondents were willing to attend training course in REPs. This is in agreement with the results of similar survey conducted in the United State [17,18].

The majority of participants in the survey believed that regenerative endodontic therapy will be a better treatment option compared to the implant retained prosthesis. An opinion similar to that expressed in the survey by [17]. With

this overwhelming support for REPs and the willingness to receive training in discipline as well as dentists positive disposition generally towards stem cell banking, patients may have another alternative to implants in the future once the area can be well developed. Also, in agreement with the previous similar studies [17, 18], many dental residents thought that the greatest obstacle to patient's acceptance of the regenerative therapies would be the high cost of treatment. This is particularly important in our own environment where unaffordability of the dental treatments is a major reason for poor utilization of dental services [19].

Although there has been a paradigm shift in the treatment of immature necrotic teeth with the biologically-based principles and regenerative endodontic protocols replacing the traditional apexification procedures in recent times, only 28.9% of the residents still considered tribiotic paste and pulpal regeneration as the optimal treatment for necrotic immature teeth. This is however higher than the percentage (19.4%) obtained from the survey among the dental residents in the United States [17] but compares well with the result of the study among the Endodontists [18]. It is very important that all dentists are aware of the potential benefits (reduced risk of root fracture and premature tooth loss [20] of this new therapy and be willing to include it in their practice in the nearest future. In the present study a statistical significant relationship was seen between those that have heard about REPs and those that include it in their practice. Though the depth of the knowledge could not be ascertained from the present study, the reason for the wide gap in the knowledge and the practice may not be unconnected to the lack of training on this clinical procedure, unaffordability by the patients and unavailability of the needed materials to carry out the procedure.

Majority of the participants believed that payment for stem cell banking should be more than N20,000 (>\$100). This also follows what other surveys have reported, however, in our environment, due to relative unaffordability of dental procedures by patients, the procedure may need to be subsidized or the cost reduced to be able to get patients to do regenerative therapies.

It is not surprising that most (61%) of the participants had never invested in new technology such as the digital radiography, Cone Beam CT etc. Such equipment that would enhance endodontic diagnosis and some other advanced modern technology that would improve treatment outcome are not easy to come by in this environment. Generally speaking, it may take quite some time before full Endodontic Regeneration is widely developed and made available to the patients even if some of them are able to afford it.

## 5. Conclusion

Though Nigerian dental residents have a good theoretical knowledge of regenerative endodontics and were enthusiastic about incorporating it into their clinical practice, a need for regular training was felt.

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