

Perception And Attitude Of Health Professionals Of Pakistan Towards Stemcells From Human Exfoliated Deciduous Teeth (SHED) Practice

Research Article

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Abstract

The application of SHED is a novel advancement in the field of medicine. To estimate its successful execution in Pakistan, it is important to estimate Pakistani health professionals' perception and attitude towards SHED practice, at earliest. Therefore, this study was conducted, to assess the interest among dental and medical professionals of Karachi towards SHED (Stem cells from exfoliated deciduous teeth), their perception of its uses in medical science and its prospective future in Pakistan. A cross-sectional study was conducted among medical and dental professionals working in urban areas of Karachi. A convenient sampling procedure was used, where 247 out of 270 distributed questionnaires were received back (Response rate: 91.48%). Moderate interest was demonstrated by both types of professionals towards SHED. Dental professionals have exhibited significantly ($p=0.015$) more (moderate to high) interest (81.2%), than medical professionals (64.9%). Both dental (63.2%) and medical (59.6%) professionals agreed on primary teeth banking. Both groups (dental 48.1% and medical 47.4%) were not sure about an acceptance of SHED by the society of Pakistan, as an ethical practice. According to this study, not many Pakistani health professionals are aware of the term SHED and they seem unsure about its recognition in Pakistan, as an ethical practice. Thus, it is recommended that health professionals of Pakistan should be educated regarding benefits of SHED and its limited ethical concern, to help them develop confidence in its use.

Keywords: Perception; Dental Stem Cells; SHED (Stem Cells from Exfoliated Deciduous Teeth); Tooth Bank.

Introduction

The discovery of stem cells is a significant advancement in regenerative medicine [1]. There are primarily two types of stem cells, namely embryonic stem cells (ESCs) and adult stem cells (ASCs) or somatic cells, depending on the developmental stage from which they are obtained [2]. Dental stem cell (DSC) is a type of ASC, which based on its origin is further classified into: dental pulp stem cells (DPSCs), stem cells from human exfoliated deciduous teeth (SHED), periodontal ligament derived stem cells (PDLSCs), dental follicle stem cells (DFSCs), tooth germ progenitor cells obtained from third molars (TGPCs), immature dental pulp stem cells from deciduous teeth (IDPSCs) and stem cells from the api-

cal papilla (SCAP) [3-7].

So far, the best multipotent and proliferative results from any DSCs that have been observed are from SHED, evolving tissue engineering and regenerative medicine [8, 9]. SHED has demonstrated MSC (mesenchymal stem cells) like capacity for self-renewal and multilineage differentiation potential [10]. They have shown abilities to repair damaged tooth structures, promote bone regeneration and treat neural tissue injury or degenerative diseases [11]. SHEDs are also easier to obtain, carrying no major ethical constraints [3]. Therefore, they are more favourable to use in medicine than any other stem cells.

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The application of SHED in Pakistan could be a promising novel advancement in the field of medicine. However, complete awareness and specialized skills in this area are required. Thus, to estimate its future successful execution in Pakistan, it is important to estimate Pakistani health professionals' perception and their attitudes towards SHED practice.

Therefore, this study was conducted to estimate the interest in SHED, among medical and dental professionals from Karachi and perception of its use in medical sciences including research and tissue regenerative/reconstructive therapies. Moreover, the study also aimed to estimate choices towards donation of exfoliated primary teeth in stem cell banks when given a chance. The objectives of this study are as follows:

- To assess perceptions of use of SHED in medical sciences, among medical and dental professionals
- To assess attitude towards storage of primary teeth in stem cell bank, among medical and dental professionals
- To assess perceptions related to future application of SHED in Pakistan among medical and dental professionals
- To assess the level of interest among medical and dental professionals towards subject of SHED

Material and Methods

Study design and Sampling: This cross-sectional study was conducted among medical and dental professionals working in random private and public health-care setups, including educational institutions, clinical offices and tertiary care in urban areas of Karachi. A convenient sampling procedure was used. Medical and dental professionals, currently practising in their respective fields were included as study participants. Minimum sample size of 150 was required, using 95% confidence level, 5% bound on the error of estimation and using 89% prevalence of interest in stem cells, [12, 13]. Finally, 135 professionals in each medical and dental group were recruited, making actual sample size of 270.

Data collection and Questionnaire: The data collection was done using self-constructed questionnaires. The questionnaire comprises 17 questions, which were primarily derived from previous dental surveys using careful consideration for question type, wording and layout. The questionnaire was designed to collect data including; demographic background and field of speciality of participants. Besides that, it has questions regarding awareness of term SHED, use of SHED in medicine for research purpose and for regenerative therapy, interest level on a Likert scale of 5, attitude towards stem cell donation/storage in stem cell bank and

future of SHED practice in Pakistan.

Statistical Analysis: Data obtained was analysed using SPSS software 21. For descriptive statistics, variables were categorized; and frequencies and percentages were calculated. Proportions in response between dental and medical groups were compared using chi-square test. Pvalue of <0.05 was considered statistically significant.

Ethical consideration: Verbal consent was taken prior to data collection from every participant. Ethical clearance was obtained from the Ethical Review Committee of Jinnah medical and dental college, Karachi, Pakistan. The ethical protocol number is (000025/20). This study was conducted between December 2019 to June 2020.

Results

A total of 247 completely filled, out of 270 distributed questionnaires were received back by the researcher. The completely filled forms were received from 114 medical and 133 dental professionals, making response rate of 91.48%. Age and gender distributions are given in Table 1.

More than half of participants, [56.68% (n=140)] had never heard about term SHED before, and majority of them are medical professionals [30.7% (n=76)] as shown in Table 2. Only 43.3%, (n=107) of all professionals were familiar with the term SHED and the most frequent source of information was the internet [51.40% (n=55)], followed by the Journal/Article [29.90% (n=32)] (Figure 1).

Both professional groups have shown moderate level of interest towards SHED (38.6% medical and 36.1% dental), which is level 3 on Likert scale (Figure 2). Significant difference (p=0.015) in the interest towards SHED was observed between the two groups, where dental professionals have exhibited more interest (moderate to high) in SHED [81.2% (n=108)] than medical professionals [64.9% (n=74)] as presented in Table 3.

Both groups of professionals, (dental 77.4%, n=103 and medical 76.3%, n=87) believed that SHED should be used in regenerative or reconstructive therapy (Table 4). About half of the medical professionals (49.1%, n=56) believe that the stem cells from exfoliated primary teeth can be useful in recovery from the neural and degenerative diseases, whereas, most dental professionals (47.4%, n=63) were not sure about it (Table 4). Both dental 60.2% (n=80) and medical 58.8% (n= 67) professionals, believe in possibility of

Table 1. Age and gender distribution of the participants.

Field of study	Specialty	Frequency	Percent	Age (SD)	Gender	N(%)	Total (%)
Medical	Non-specialist	39	34.2	32.8 (10.6)	Male	59 (51.8)	114(46.2)
	Specialist	75	65.8				
	Total	114	100		Female	55 (48.2)	
Dental	Non-specialist	58	43.6	27.4 (3.7)	Male	49 (36.8)	133(53.8)
	Specialist	75	56.4				
	Total	133	100		Female	84 (63.2)	
Total participants=							247

using stem cells from primary teeth for the research purposes (Table 4).

Both dental (63.2%, n=84) and medical (59.6%,n=68) professionals agreed on recommending their patients, to donate their child's exfoliated teeth, along their own child's primary teeth (dental 60.2n=80 and medical 58.8% n=67) instem cell bank (Table 5). However, majority 50.6%, (n=125) of respondents had no idea aboutmedico-legal implications of SHED's donation in stem cell banks (Table 5).

Both groups, (dental 48.1%, n=64 and medical 47.4%, n=54)

were not sure about an acceptance of SHED by the society of Pakistan, as a legal or ethical practice (Table 6). Moreover, more than half of them 54.7% (n=135) believed that there is a chance of misuse of stem cells, donated for research and therapeutic purposes (Table 6). High positive response was received from both groups, [dental; 83.5% (n=111) and medical; 70.2%(n=80)], when asked about creating awareness among the populace of Pakistan regarding the benefits ofSHED practice, however, significant difference (p=0.015) appeared in responses. Overall, most of the respondents have considered internet (38.5%) as the medium of choice for raising SHED awareness, followed by social media(30.8%) (Table 6).

Figure 1. Source of information about SHED received from all participants who were aware of term SHED.

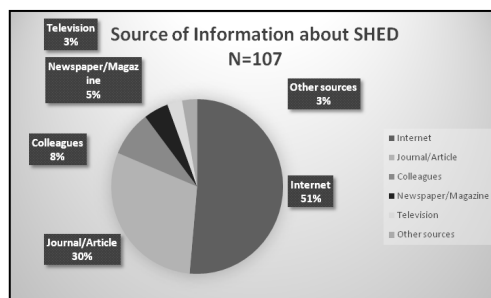


Figure 2. Comparison of rate of interest among medical and dental professionals towards SHED.

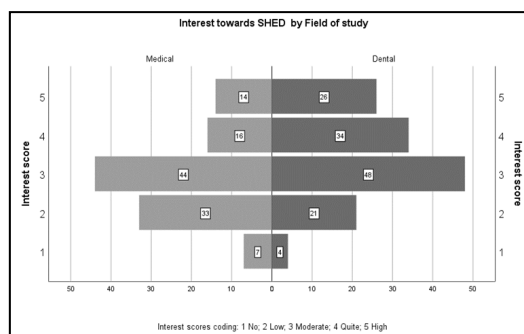


Table 2. Awareness of term SHED among medical and dental professionals.

Question	Responses	Medical N (%)	Dental N (%)	Total N (%)
Have you heard about SHED?	Yes	38 (15.3)	69 (27.9)	107 (43.3)
	No	76 (30.7)	64 (25.9)	140 (56.6)
Total		114 (46.2)	133 (53.8)	247(100)

Table 3. Rate of interest among medical and dental professionals regarding SHED on a numerical scale from 1 (no interest) to 5 (high interest).

Rate of Interest	Dental (N)	%	Medical (N)	%	Total (N)	%	X ²	P value
1: No interest	4	3	7	6.1	11	4.5	12.3	0.015*
2: Low interest	21	15.8	33	28.9	54	21.9		
Total no to low interest	25	18.8	40	35	65	26.4		
3: Moderate	48	36.1	44	38.6	92	37.2		
4: Quite	34	25.6	16	14	50	20.2		
5: High	26	19.5	14	12.3	40	16.2		
Total moderate to high interest	108	81.2	74	64.9	182	73.6		

[Sig*=<0.05]

Table 4. Comparison of dental and medical professionals' responses in each question about use of SHED in medical sciences. (Chi square).

Questions	Responses	Dental (N)	%	Medical (N)	%	Total (N)	%	X ²	P value
Do you think stem cells from exfoliated primary teeth should be used in regenerative or reconstructive therapy?	Yes	103	77.4	87	76.3	190	76.9	1.6	0.428
	No	4	3	1	0.9	5	2		
	Not sure	26	19.5	26	22.8	52	21.1		
Do you believe stem cells from exfoliated primary teeth can be useful in recovery from neural and degenerative diseases?	Yes	55	41.4	56	49.1	111	44.9	2.1	0.335
	No	15	11.3	8	7	23	9.3		
	Not sure	63	47.4	50	43.9	113	45.7		
Do you think primary teeth should be used for stem cells research purposes?	Yes	80	60.2	67	58.8	147	59.5	1.1	0.56
	No	27	20.3	19	16.7	46	18.6		
	Not sure	26	19.5	28	24.6	54	21.9		

[Sig*=<0.05]

Table 5: Comparison of dental and medical professionals' responses in each question about storing exfoliated primary teeth in stem cells bank. (Chi square test).

Questions	Responses	Dental (N)	%	Medical (N)	%	Total (N)	%	X ²	P value
If given a chance in future, would you recommend your patients to donate exfoliated primary teeth of their child in stem cell banks?	Yes	84	63.2	68	59.6	152	61.5	0.7	0.678
	No	17	12.8	13	11.4	30	12.1		
	Not sure	32	24.1	33	28.9	65	26.3		
Would you like to donate your own child's primary teeth for storing in stem cells bank?	Yes	80	60.2	67	58.8	147	59.5	1.1	0.56
	No	27	20.3	19	16.7	46	18.6		
	Not sure	26	19.5	28	24.6	54	21.9		
Do you have any idea about its medico legal application?	Yes	24	18	22	19.3	46	18.6	0.4	0.786
	No	70	52.6	55	48.2	125	50.6		
	Not sure	39	29.3	37	32.5	76	30.8		

[Sig*=<0.05]

Table 6: Comparison of dental and medical professionals' responses in each question regarding SHED's future application in Pakistan (Chi square test).

Questions	Responses	Dental (N)	%	Medical (N)	%	Total (N)	%	X ²	P value
Do you think SHED would be accepted by society of Pakistan as a legal or ethical practice?	Yes	50	37.6	39	34.2	89	36	0.8	0.65
	No	19	14.3	21	18.4	40	16.2		
	Not sure	64	48.1	54	47.4	118	47.8		
Do you believe there is a chance of misuse of stem cells donated for research and therapeutic purposes?	Yes	71	53.4	64	56.1	135	54.7	0.3	0.82
	No	15	11.3	14	12.3	29	11.7		
	Not sure	47	35.3	36	31.6	83	33.6		
Do you think it's important to create more awareness among the populace of our country about the potential health benefits of stem cells from primary teeth?	Yes	111	83.5	80	70.2	191	77.3	8.4	0.015*
	No	7	5.3	5	4.4	12	4.9		
	Not sure	15	11.3	29	25.4	44	17.8		
What should be the medium of choice when raising awareness regarding SHED issue?	Internet	47	35.3	48	42.1	95	38.5	6.4	0.26
	Newspaper/ Magazine	9	6.8	11	9.6	20	8.1		
	Television	16	12	7	6.1	23	9.3		
	Telecommunication	4	3	3	2.6	7	2.8		
	Social media	46	34.6	30	26.3	76	30.8		
	Colleagues	11	8.3	15	13.2	26	10.5		

[Sig*=<0.05]

Discussion

The domain of stem cell research has emerged with various medical and dental applications, due to stem cell's abilities to regenerate and repair damaged tissues [14]. Likewise, SHED's various prospective medical and dental uses have necessitated, building an interest in applications of SHED, among medical and dental professionals. Therefore, this study was intended to evaluate interest level and practice of stem cell from human exfoliated deciduous teeth (SHED), among medical and dental professionals of Pakistan. Due to availability of limited previous original studies, specifically related to SHED, results of current study have been compared with results of similarly designed previous studies, however, done on stem cells in general or on DSCs.

According to the results of the current study, more than half of the participants had never heard about SHED before. Interestingly, more medical professionals were unaware compared to the dental professionals. Among all participants, the most frequent source of information was the internet, followed by the journal/article. Likewise, in an Indian study, a large proportion (74%) of dentists was well-aware of dental stem cells (DSCs) and the most frequent source of information was journals, followed by internet [15].

Interest among professionals:

In this study, both medical and dental professionals demonstrated a moderate level of interest in stem cells from exfoliated deciduous teeth (SHED). Comparatively, dental professionals have exhibited more interest (moderate to high) in SHED than medical professionals. This is parallel to another Indian study, where almost all of the responding dentists have shown interest in learning about application of stem cells, when given a chance [16]. A study conducted involving medical doctors of Italy, found that the majority of physicians (70%) were interested in stem cells and believed in the potential benefits of developing stem cells strategies in their country [17]. Similarly, in our study, although, proportion of medical respondents, showing moderate to high interest in the subject of SHED was not high (64%), it was more than half of the respondents.

Use in medicine for therapy and research purpose

SHED has been proven to be beneficial in repairing and treating neural tissue injuries and degenerative diseases [11, 18]. In the current study, majority of medical professionals agreed to the fact that SHED can be useful in recovery from the neural and degenerative diseases. This response is similar to the findings from a study conducted on health care providers in Saudi Arabia, in which prominent number of the health professionals confirmed that stem cells can be used to treat neurological problems such as Alzheimer's and Parkinson's diseases (19). The concept of regeneration instead of repair will be the reason why medical professionals would recommend stem cell-based regenerative treatments to their patients (13). Unlike medical professionals, dental professionals were not sure about the use of SHED to treat neurological and degenerative diseases, in the current study.

Both the professionals in our study, showed willingness to use pri-

mary teeth as a source of stem cells for the purpose of research. Results showed similarity with a survey, conducted on the health professionals in China, in which majority of the participants, expressed high level of interest in stem cell use, for research [20].

Stem cell Bank donation:

Dental stem cells are considered a viable source of ASCs, as they can be easily obtained by tooth extraction [21]. This has led to an increase in the popularity of tooth banking and harvesting of dental stem cells for allogenic and autologous cell therapy [22]. Majority of dental and medical professionals in our study, agreed on recommending to their patients, to donate their child's exfoliated teeth. Similarly, according to Indian studies, majority of health professionals were willing to recommend their patients to donate their teeth for preservation of the dental stem cells [11, 23]. When asked about their own child's teeth, two-third of both the dental and medical respondents agreed on donating their child's exfoliated teeth in stem cell bank, in our study. This is in contrast with the Iranian study, where only 45.2% of the dentists were interested in collecting and storing dental tissues for stem cell banking [24]. Although, health professionals have agreed on donating exfoliated teeth in stem cell bank in our study, majority of them had no idea about medico-legal implications of SHED's donation in stem cell banks.

Ethical practice and future application in Pakistan:

In current study, both professional groups were not sure about an acceptance of SHED by the general public of Pakistan, as a legal or ethical practice. More than half of them believed that there is a chance of misuse of stem cells, donated for research and therapeutic purposes. This is different from Saudi dentists' perception on stem cells, who believed that use of stem cells did not contradict ethical and religious principles [25].

Nevertheless, majority of participants in both groups, (83.5%, dental and 70.2%, medical), agreed on creating awareness among the populace of Pakistan about the benefits of SHED practice, this time resembling the same Saudi study, in which almost all the participants recommended more public awareness programs, about stem cells and their therapeutic applications [25]. In the current study, medium of choice chosen by health professionals to promote SHED awareness was internet, followed by social media. Whereas, according to Indian study, dentists preferred seminars and conferences, to increase dental stem cells awareness followed by journals and advertisements [15].

One of the limitations of this study is narrow availability of original studies related to beliefs and attitude of health care professionals towards SHED. Most of the studies discovered, were focused on dental stem cells, which has led to limited specific comparison in the current study, aiming SHED.

Understanding of SHED practice will open a new era of research and prospective advancement in the treatment of various diseases. However, at present many Pakistani health professionals are still new to the term SHED, according to the study. Moreover, despite showing moderate interest, many health professionals seem unsure about recognition of SHED, as an ethical practice in Pakistan. Thus, it is recommended that health professionals of Pakistan should be educated regarding benefits of SHED and its

limited ethical concern, to help them develop confidence in its use.

References

- [1]. Martinez Saez D, Sasaki RT, Neves AD, da Silva MC. Stem Cells from Human Exfoliated Deciduous Teeth: A Growing Literature. *Cells Tissues Organs*. 2016;202(5-6):269-280. PubMed PMID: 27544531.
- [2]. Fortier LA. Stem cells: classifications, controversies, and clinical applications. *Vet Surg*. 2005 Sep-Oct;34(5):415-23. PubMed PMID: 16266332.
- [3]. Huang YH, Yang JC, Wang CW, Lee SY. Dental stem cells and tooth banking for regenerative medicine. *J Exp Clin Med*. 2010 Jun 1;2(3):111-7.
- [4]. Kerkis I, Caplan AI. Stem cells in dental pulp of deciduous teeth. *Tissue Eng, Part B: Reviews*. 2012 Apr 1;18(2):129-38.
- [5]. Rai S, Kaur M, Kaur S. Applications of stem cells in interdisciplinary dentistry and beyond: an overview. *Ann Med Health Sci Res*. 2013 Apr;3(2):245-54. PubMed PMID: 23919198.
- [6]. Chopra H, Hans MK, Shetty S. Stem cells-the hidden treasure: A strategic review. *Dent Res J (Isfahan)*. 2013 Jul;10(4):421-7. PubMed PMID: 24130574.
- [7]. Arora V, Arora P, Munshi AK. Banking stem cells from human exfoliated deciduous teeth (SHED): saving for the future. *J Clin Pediatr Dent*. 2009 Summer;33(4):289-94. PubMed PMID: 19725233.
- [8]. Nakamura S, Yamada Y, Katagiri W, Sugito T, Ito K, Ueda M. Stem cell proliferation pathways comparison between human exfoliated deciduous teeth and dental pulp stem cells by gene expression profile from promising dental pulp. *J Endod*. 2009 Nov;35(11):1536-42. PubMed PMID: 19840643.
- [9]. Giordano G, La Monaca G, Annibaldi S, Cicconetti A, Ottolenghi L. Stem cells from oral niches: a review. *Ann Stomatol (Roma)*. 2011 Jan;2(1-2):3-8. PubMed PMID: 22238715.
- [10]. Chalisserry EP, Nam SY, Park SH, Anil S. Therapeutic potential of dental stem cells. *J Tissue Eng*. 2017 May 23;8:2041731417702531. PubMed PMID: 28616151.
- [11]. Miura M, Gronthos S, Zhao M, Lu B, Fisher LW, Robey PG, Shi S. SHED: stem cells from human exfoliated deciduous teeth. *Proc Natl Acad Sci U S A*. 2003 May 13;100(10):5807-12. doi: 10.1073/pnas.0937635100. PubMed PMID: 12716973.
- [12]. Chitroda PK, Katti G, Attar NM, Shahbaz S, Sreenivasarao G, Patil A. Stem cells in dentistry: A study regarding awareness of stem cells among dental professionals. *Indian J Dent Res*. 2017 Nov-Dec;28(6):711-716. PubMed PMID: 29256476.
- [13]. Jose N. Assessment of knowledge, attitude, and practice regarding applications of stem cells in dentistry among dental house surgeons, postgraduate students, and teaching faculties in two dental colleges in Ernakulam, Kerala, India. *Int J Oral Care Res*. 2018;6(1):65-8.
- [14]. Lymperi S, Ligoudistianou C, Taraslia V, Kontakiotis E, Anastasiadou E. Dental Stem Cells and their Applications in Dental Tissue Engineering. *Open Stem J*. 2013 Jul 26;7:76-81. PubMed PMID: 24009647.
- [15]. Katge F, Shetty AJ, Rusawat B, Vamsi KC. Knowledge and attitude of Indian dentists regarding dental stem cells: A cross-sectional descriptive survey. *Indian J Dent Res*. 2017 Jul-Aug;28(4):367-374. PubMed PMID: 28836526.
- [16]. Prasada LK, Bukhari SM. A survey on knowledge, attitude and beliefs of regenerative endodontics among postgraduate dental residents. *Al Ameen J Med Sci*. 2019;12(1):49-53.
- [17]. Frati P, Gulino M, Pacchiarotti A, D'Errico S, Sicuro L, Fineschi V. A survey of Italian physicians' opinion about stem cells research: what doctors prefer and what the law requires. *Biomed Res Int*. 2014;2014:480304. PubMed PMID: 24877099.
- [18]. Chai Y, Jiang X, Ito Y, Bringas P Jr, Han J, Rowitch DH, Soriano P, McMahon AP, Sucov HM. Fate of the mammalian cranial neural crest during tooth and mandibular morphogenesis. *Development*. 2000 Apr;127(8):1671-9. PubMed PMID: 10725243.
- [19]. Tork H, Alraffaa S, Almutairi K, Alshammari N, Alharbi A, Alonzi A. Stem cells: knowledge and attitude among health care providers in Qassim region, KSA. *Int J Adv Nurs Stud*. 2017;7(1):1.
- [20]. Luo D, Ran W, Zhao G, Guan C, Wang C, Jia W. Knowledge, attitudes, and beliefs of healthcare workers regarding stem cell research. *Sci China Life Sci*. 2016 Mar;59(3):325-7. PubMed PMID: 26100008.
- [21]. Huang GT, Gronthos S, Shi S. Mesenchymal stem cells derived from dental tissues vs. those from other sources: their biology and role in regenerative medicine. *J Dent Res*. 2009 Sep;88(9):792-806. PubMed PMID: 19767575.
- [22]. Taguchi T, Yanagi Y, Yoshimaru K, Zhang XY, Matsuura T, Nakayama K, et al. Regenerative medicine using stem cells from human exfoliated deciduous teeth (SHED): a promising new treatment in pediatric surgery. *Surg Today*. 2019 Apr;49(4):316-322. PubMed PMID: 30834983.
- [23]. Goswami M, Kumar G, Sharma S. "Dental Stem Cells": Awareness, knowledge, and attitude of dental professionals-A cross-sectional study. *Spec Care Dentist*. 2020 Jan;40(1):90-96. PubMed PMID: 31815303.
- [24]. Ez-Abadi AR, Ahmady AE, Tabatabaei FS. Dental residents' knowledge and attitude towards stem cells and regenerative dentistry. *J Dent Sch*. 2017;35:99-107.
- [25]. Alhadlaq A, Al-Maffehi N, Alzahrani S, AlAssiri A. Assessment of knowledge and attitude toward stem cells and their implications in dentistry among recent graduates of dental schools in Saudi Arabia. *Saudi Dent J*. 2019 Jan;31(1):66-75. PubMed PMID: 30705571.