

Stem Cells in Dentistry: Knowledge among the Dental Practitioners of Nepal

Dr. Nashib Pandey,¹ Dr. Sushmit Koju,² Dr. Nisha Maharjan,³
Dr. Rajan Chaudhary,⁴ Dr. Rajib Chaulagain⁵

¹Department of Periodontics and Oral Implantology, College of Medical Sciences, Bharatpur, Chitwan, Nepal;

²Department of Oral Pathology, Kantipur Dental College Teaching Hospital and Research Center, Basundhara, Kathmandu, Nepal;

³Department of Oral Pathology, Peoples' Dental College Teaching Hospital and Research Center, Nayabazar, Kathmandu, Nepal;

⁴Health Services Office, Dailekh, Nepal;

⁵Department of Oral Pathology, Chitwan Medical College, Bharatpur, Chitwan, Nepal.

ABSTRACT

Introduction: Dentists are expected to play a major role in advancing the field of stem cell research as well as directing and implementing future stem cell therapies in dentistry. Accordingly, good basic knowledge and a positive attitude toward stem cells and their potential applications are essential among the dentists.

Objective: This study aimed to assess the prevalence of knowledge on stem cell among the dental practitioners.

Methods: A descriptive cross-sectional study was conducted among the registered dental practitioners in Nepal. An online questionnaire was created with the help of Google forms between 27 October, 2021 to 22 July, 2022 after receiving ethical approval from the Institutional Review Committee of a tertiary care center. The questionnaire was designed after reviewing pertinent literatures. Convenience sampling method was used. Data from Google forms were entered in Microsoft Excel version 2016 and were analysed with IBM SPSS v.20.

Results: Among the total of 280 responses received, the prevalence of good knowledge about stem cells was found to be 53 (18.93%) (14.34- 23.52, 95% Confidence Interval). Majority of the respondents with good knowledge score were female 41 (77.36%). Almost all of the respondents knew about the term stem cells and its sources. But very few 68 (24.29%) of them knew about the availability of stem cell banks in Nepal.

Conclusions: The prevalence of good knowledge about stem cell in dentistry was found to be less than half the sample size. Hence, there is a need to cover stem cells related information in dental curricula in Nepal.

Keywords: Dental education; knowledge; Nepal; stem cells.

INTRODUCTION

Stem cells are unspecialised/undifferentiated cells, which have the potential to generate differentiated cell types that carry out different functions.¹ Stem cell-based tissue engineering is an emerging science to replace or repair lost or damaged tissues or even organs in humans. Considering the stem cell-based researches, there are also numerous possible applications in the branch of dentistry.²

Dentists are expected to play a major role not only

in advancing the field of stem cell research but also in directing and implementing future stem cell therapies in dentistry.³ The knowledge and awareness of stem cells and its importance for the development is necessary in the professional field.

Thus, this study aimed to assess the prevalence of knowledge on stem cells in dentistry among the online respondent dental practitioners.

METHODS

A descriptive cross-sectional study was conducted among the registered dental surgeons working in different dental setups throughout Nepal over a period of 27 October, 2021 to 22 July, 2022 after receiving ethical approval from the Institutional Review Committee (IRC), Kantipur Dental College Hospital (KDCH) (IRC-KDCH, Ref: 27/021). A structured and self-reported survey questionnaire

Correspondence

Dr. Nashib Pandey

Email: nashibpandey@gmail.com



Citation

Pandey N, Koju S, Maharjan N, Chaudhary R, Chaulagain R. Stem Cells in Dentistry: Knowledge among the Dental Practitioners of Nepal. J Nepal Soc Perio Oral Implantol. 2023 Jan-Jun;7(13):20-5.

containing informed consent and other measures was provided on the Google form platform.

Data were collected using the same platform. Dental practitioners of Nepal who agreed to participate in the study were instructed to fill the questionnaire. Incomplete forms and those not willing to participate in the study were excluded. Online informed consent was obtained before proceeding with the questionnaire. Convenience sampling method was used. Point estimate and 95% Confidence Interval were calculated.

The sample size was calculated using the following formula:

$$n = Z^2 \times p \times q / e^2$$

$$= 1.96^2 \times 0.50 \times 0.50 / 0.06^2 = 267$$

Where,

n = minimum required sample size, Z=1.96 at 95% Confidence Interval (CI), p= prevalence taken as 50% for maximum sample size calculation, q= 1-p, e = margin of error, 6%

The minimum required sample size was 267. However, final sample size taken was 280 due to a greater number of responses obtained.

The questions in the questionnaire have been developed after reviewing pertinent literatures³⁻⁵ and the permission to use the questionnaire have been

obtained from the authors of previous publications which have used a similar questionnaire. The questionnaire was designed in English and comprised of a series of questions pertaining to sociodemographic characteristics, the knowledge of dentists, and their perceptions regarding stem cell and its use in dentistry. Participants were also asked about their interest in attending an advanced course about stem cells and their applications. Suggestions for improvement in the questionnaires were incorporated by subject experts and modified accordingly. The respondents were clearly informed about the background and objectives of the study on the first page of the online questionnaire. They were also informed that they were free to withdraw at any time, without giving reasons, and the study maintained their privacy and confidentiality of the collected information. This questionnaire consisted of two sections: the first consisted of the sociodemographic and professional aspects and the second section consisted of 12 item questions related to the knowledge. The number one (1) was allotted for the correct answer and zero (0) for the incorrect answer. A total of 12 scores was given for the knowledge part of the questionnaire. The level of knowledge was interpreted based on Bloom's cut-off point,⁶ as good if the score was between 80 and 100% (9.6-12 points), moderate if the score was between 60 and 79% (7.2-9.48 points), and poor if the score was less than 60% (<7.2 points).

Table 1: Various knowledge statements used in the questionnaire for data collection.

S.N.	Knowledge statement
1	Stem cells are unspecialised type of cells capable of forming any cell type. (Yes)
2	Human sperms and eggs considered a source of adult stem cells. (Yes)
3	Stem cells obtained from adults are specialized cells that can form either bone or cartilage only. (No)
4	Embryonic stem cells can be obtained from umbilical cord. (Yes)
5	Stem cells obtained from dental tissues are considered adult stem cells. (Yes)
6	Dental pulp of exfoliated deciduous teeth is considered a useful source of stem cells. (Yes)
7	Dental stem cells can form neural cells. (Yes)
8	Dental stem cells can be retrieved from apical papilla of the tooth. (Yes)
9	Potential application of stem cells - root formation following trauma (Yes)
10	Autologous transplant of adult stem cells can fail mainly because of immunogenic reaction. (Yes)
11	Dental implants derived from stem cells are now available to replace missing teeth. (Yes)
12	Stem cell banks are now available in Nepal. (Yes)

Data from Google forms were entered in Microsoft Excel version 2016 and were analysed with IBM SPSS (International Business Machines Corporation, Statistical Package for the Social Sciences), version 20.0 (IBM Corp., Armonk, N.Y., USA). Frequency distribution as well as Point estimate were calculated from the data.

RESULTS

Among 280 responses obtained the prevalence of good knowledge about stem cells was found to be 53 (18.93%) (14.34-23.52, 95% CI) based upon Bloom’s cut-off point. Majority of the respondents with good knowledge about stem cells in dentistry were female 41 (77.36%) (Figure 1).

The age of the participants having good knowledge

about stem cells in dentistry ranged from 24 to 36 years. Out of the total 53 respondents, 30 (56.60%) respondents from Bagmati province and none of the respondents from Karnali Province had a good knowledge about stem cells in dentistry. A total of 26 (49.05%) had less than two years of dental practice experience followed by 2-5 years of dental practice experience which included 25 (47.17 %). Table 2 shows the various characteristics of the respondents with good knowledge on stem cell in dentistry.

Majority of the respondents, that is, 239 (85.36%) were known about the term stem cells. They were also aware about the sources of the stem cells as well as the mentioned derivatives. But very few 68 (24.29%) of them were aware about the availability of stem cell banks in Nepal.

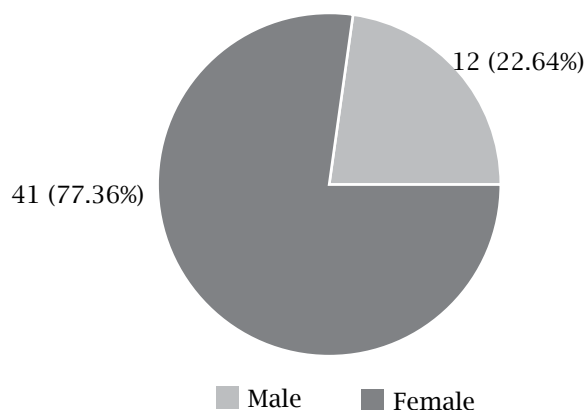


Figure 1: Gender wise distribution on good knowledge about stem cells in dentistry (n= 53).

Table 2: Distribution of Study Participants with good knowledge on stem cell in dentistry based on various characteristics.

Characteristics		n= 53 (%)
Gender	Female	41 (77.36)
	Male	12 (22.64)
Age group	21-25	13 (24.53)
	26-30	37 (69.81)
	>30	3 (5.66)
Practice years	< 2 years	26 (49.05)
	2-5 years	25 (47.17)
	6-10	1 (1.89)
	>10	1 (1.89)

Characteristics		n= 53 (%)
Province	Number 1	3 (5.66)
	Madhesh	3 (5.66)
	Bagmati	30 (56.60)
	Gandaki	7 (13.21)
	Lumbini	9 (16.98)
	Sudurpaschim	1 (1.89)
Work place	Government	6 (11.32)
	Private	40 (75.47)
	Medical/Dental college	7 (13.21)

DISCUSSION

The current study investigated the level of knowledge which revealed the prevalence of good knowledge scores about stem cells to be 53 (18.93%). There have been reports of inadequate stem cell awareness among various health professionals around the world.^{3,4} Similar study using self-administered questionnaire conducted in Qassim, Saudi Arabia⁷ showed almost similar results in regard to the prevalence of good knowledge scores about stem cells i.e., 31.2%. Study in recent dental graduates in Saudi Arabia³, found that 47.5% of the respondents have not been exposed to a sufficient amount of information about stem cells and their potential application in dentistry. Hence, they recommended that dental students should be exposed to and motivated by the principles of regenerative dentistry during their academic years to be prepared for future practice utilizing stem cells.³

Categorizing participants based on knowledge showed number of females were more than male in all the levels of knowledge. However, this might be due to the distribution of the sample which showed greater participants from female. Other studies also showed a similar distribution of participants among the gender.^{4,7,8} The study also showed that the maximum number of participants were from the Bagmati province. The least participants were from Karnali and Sudurpaschim. Data on dentists in Nepal showed that these two provinces have very few dentists.⁹ The distribution of dentists is similar to the findings reported in the study.

Based on the questionnaire, more than 85% participants were aware of the term stem cells. The stem cells reside in a closed microenvironment called a stem cell niche.¹⁰ This is composed of heterologous cell types, extracellular matrix, and soluble factors to support the maintenance and self-renewal of the stem cells.¹¹ Stem cells can be categorised into embryonic and adult stem cells.¹ Pluripotent embryonic cells are derived from the inner cell mass of mammalian blastocysts and can be maintained indefinitely in culture.¹² The adult type of stem cells can be derived from the tooth structure whose sources can be dental pulp, exfoliated primary teeth, periodontal ligament, apical papilla, and dental follicle progenitor cells.² The study focused on sensitizing this particular topic while filling out forms for the survey and may

be the source of encouragement to undergo further training and lectures on stem cells and regenerative procedures in the field of dentistry.

The dental stem cells have already been used successfully for the regeneration of neural tissue.¹³ The participants also knew about the fact that the stem cells could be used for the formation of both bone and cartilage. The undifferentiated mesenchymal cells exist in the pulp and have the ability to differentiate into odontoblast-like cells, which are responsible for new dentin formation following any dental injury. The periodontal ligament stem cells are multipotent and show a differentiation ability into cementoblast-like cells, adipocytes, and fibroblasts. Dental follicle stem cells can generate cementum, bone, and periodontal ligament.¹⁴

More than (245, 87.50%) of the total respondents are interested in attending an advanced course about stem cells and their applications. A study conducted in Kerala, India⁵ showed that 84% of dentists never received any training on handling and processing of oral stem cells, however among the total participants 89% were interested in attending training workshops. They found that the postgraduate students were significantly aware than undergraduate students. They concluded that the syllabus for the undergraduate should include the topic of stem cells.⁵

Among the graduating students of Ahmedabad and Gandhinagar district of India¹⁵ only 15.52% of the total participants were aware that the deciduous tooth can be the best source for stem cells. However, the result of the present study revealed that 72.50% (203) of the participants were aware about this source. The study¹⁵ found that 65.2% of the students considered dental pulp stem cells to be an emerging branch in dentistry and 75% of the graduating students wanted stem cells to be added as part of their syllabus.

Similarly, a study in Iran found majority (82.1%) of dental residents believed that regenerative treatments should be included in dental practice.⁸ 63.1% thought that dental pulp stem cell banking would be useful to regenerate dental tissues. More than half of the participants (51.2%) were not sure whether regenerative procedures would be successful. Only (68, 24.29%) of the participants were aware about availability of stem cell banks in Nepal according to the findings of the present study.

Stem cell therapy is a challenge in developing countries like Nepal. The main challenges in developing countries are lack of trained/qualified personnel, poor economic condition, cost, and quality which subdues the use of stem cells as a regenerative therapy for the treatment of diseases.¹⁶ Nepal also lacks adequate government guidelines for stem cells use and legal support. In addition, lack of infrastructure, poor transfusion services, and lack of international collaboration support strategies also prevail.¹⁶ Also, the lack of adequate knowledge about stem cell therapy due to people's belief in primitive therapy and traditional cultural issues¹⁴ are equally affecting the establishment of stem cell therapy.

The stem cell-based regenerative field is complex and multidisciplinary. Its development resides in the collaboration between clinicians and researchers from diverse fields, whose goal will be to develop regenerated dental and craniofacial tissues.¹⁷ The various potential fields where stem cell therapy can be used is during repair and regeneration of dental tissues. The stem cells obtained from dental tissue can be used not only for dental bioengineering, but it has also shown to be used in treating heart diseases, regenerating neural tissue, and repairing cranial defects.¹⁸ Whole tooth bioengineering has given hope to dental replacement and regenerative therapy.¹⁹ Hence, dental practitioners are expected to possess the required knowledge about stem cells and their applications in dentistry to advance the utilisation of stem cells in dentistry and medicine.³

Despite having certain limitations, we hope that this study has been able to sensitise the topic of “stem

cells in dentistry” to the dental graduates of Nepal who are interested to adopt recent therapeutic options to their patients. Convenience sampling method used in this study might not have included the sample population homogenously and the use of online source to acquire data might have excluded those not using it. Hence, conduction of further studies addressing such issues are recommended by the authors.

CONCLUSIONS

The prevalence of good knowledge about stem cells in dentistry was found to be almost similar to the studies conducted in similar settings in other countries. There is a need to cover stem cells related information in dental curricula in Nepal. The results and recommendations put forward in this study can be utilised in reforming the course syllabus of dentistry in Nepal. The findings can also be useful in selecting the topics for continuing dental education in Nepal.

ACKNOWLEDGEMENTS

The authors would like to thank all the dental practitioners who participated in this study. We would like to thank Dr. Anju Khapung, Dr. Arjun Hari Rijal, Dr. Alka Gupta, Dr. Ankit Jaiswal, Dr. Bhanu Bhakta Poudel, Dr. Nehal Shah, Dr. Namrata Pradhan, and Dr. Santosh Rimal for their help in data collection as well as reviewing the questionnaire.

Conflict of Interest: None

REFERENCES

1. Nuti N, Corallo C, Chan BM, Ferrari M, Gerami-Naini B. Multipotent Differentiation of Human Dental Pulp Stem Cells: A Literature Review. *Stem Cell Rev Rep*. 2016;12(5):511-23.
2. Gronthos S, Mankani M, Brahimi J, Robey PG, Shi S. Postnatal human dental pulp stem cells (DPSCs) in vitro and in vivo. *Proc Natl Acad Sci USA*. 2000;97(25):13625-30.
3. Alhadlaq A, Al-Maflehi 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;31(1):66-75.
4. Sede MA, Audu O, Azodo CC. Stem cells in Dentistry: knowledge and attitude of Nigerian Dentists. *BMC Oral Health*. 2013;13(1):1-8.
5. 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.
6. Bloom BS. Learning for mastery. Instruction and curriculum. regional education laboratory for the carolinas and virginia, topical papers and reprints, number 1. *Eval Comment*. 1968;1(2):1-11.
7. Tork HMM, Alraffaa SM, Almutairi KJ, Alshammari NE, Alharbi AA, Alonzi AM. Stem cells: knowledge and attitude among health care providers in Qassim region, KSA. *Int J Adv Nurs Stud*. 2018;7(1):1-7.

-
8. Akram Rahavi Ez-Abadi, Arezoo Ebn Ahmady, Fahimeh S. Tabatabaei. Dental residents' knowledge and attitude towards stem cells and regenerative dentistry. *J Dent Sch.* 2017;35(3):99-107.
 9. Shrestha RM, Shrestha S, Kunwar N. Dentists in Nepal: A Situation Analysis. *J Nepal Health Res Council.* 2017;15(2):187-92.
 10. Yu D, Silva GA. Stem cell sources and therapeutic approaches for central nervous system and neural retinal disorders. *Neurosurg Focus.* 2008;24(3-4):E11.
 11. Scadden DT. The stem-cell niche as an entity of action. *Nature.* 2006;441(7097):1075-9.
 12. Thomson JA, Itskovitz-Eldor J, Shapiro SS, Waknitz MA, Swiergiel JJ, Marshall VS, et al. Embryonic Stem Cell Lines Derived from Human Blastocysts. *Science.* 1998;282(5391):1145-7.
 13. Mead B, Logan A, Berry M, Leadbeater W, Scheven BA. Concise review: dental pulp stem cells: A novel cell therapy for retinal and central nervous system repair. *Stem Cells.* 2017;35(1):61-7.
 14. Yen AH, Sharpe PT. Stem cells and tooth tissue engineering. *Cell Tissue Res.* 2008;331(1):359-72.
 15. Bhatt R, Bhatt A, Gurjar D, Dave L. Evaluating awareness on dental pulp stem cells and its applications amongst graduating dental students of Ahmedabad and Gandhinagar district: A cross-sectional survey. *Adv Hum Biol.* 2014;4(3):54-9.
 16. Saud B, Malla R, Shrestha K. Stem Cell Therapy in Nepal Challenges and Opportunities. *J Stem Cell Res Dev Ther.* 2019;5:022.
 17. Sreenivas SD, Rao AS, Satyavani SS, Reddy BH, Vasudevan S. Where will the stem cells lead us? Prospects for dentistry in the 21st century. *J Indian Soc Periodontol.* 2011;15(3):199-204.
 18. Park YJ, Cha S, Park YS. Regenerative applications using tooth derived stem cells in other than tooth regeneration: A literature review. *Stem Cells Int.* 2016;2016:e9305986.
 19. Garcia-Godoy F, Murray PE. Status and potential commercial impact of stem cell-based treatments on dental and craniofacial regeneration. *Stem Cells Dev.* 2006;15(6):881-7.
-