

## Current Status and Opinions of Private Dental Practitioners and Dental Faculty Regarding Dental Stem Cells.

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**Background:** Stem cells are clonogenic undifferentiated cells which are capable of self renewable. Dental stem cells are type of adult stem cells that exhibits multipotent differentiation capacity and is drawing world wide attention because of its various applications in dentistry.

**Aim:** To assess and compare the knowledge and attitude about dental stem cells among dental practitioners and dental faculty.

**Methodology:** The study was a questionnaire based study where in the questionnaire regarding dental stem cells were given among 100 dental private practitioners from Nagpur and dental faculty comprising of MDS and BDS faculty from 3 different dental colleges. The questionnaire was developed to assess the knowledge and attitude of private dental practitioners and dental faculty.

**Keywords:** Dental stem cells, dental practitioner's and dental faculty.

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### I. Introduction

Stem cells also known as progenitor cells that have the potential to develop into many different cell lineages. Stem cells are broadly classified as embryonic and adult, depending on the developmental stage from which they are obtained. Embryonic stem cells are derived from blastocysts which are obtained from *in vitro* fertilization in the laboratory or from aborted fetus. Adult stem cells are stem cells obtained from any postnatal organ<sup>1</sup>.

In recent years, studies have shown that oral tissues are a source of stem cells. Dental stem cells are type of adult cells that exhibits multipotent differentiation capacity and is drawing world-wide attention because of its various applications in dentistry such as continued root formation, regeneration of an immature tooth with extensive pulp damage, periodontal regeneration and stem cell based therapies<sup>2,3,9</sup>.

There can be multiple factors that can produce alveolar bone resorption such as dental extractions, loss because of severe cavities, trauma, or root fracture or even because of periodontal diseases. In edentulous patients, bone resorption continues throughout life, which makes it difficult to substitute the missing teeth with dental implants. Tissue engineering therapies and stem cells are promising way to achieve alveolar bone regeneration and solve large periodontal tissue defects and finally to substitute a lost tooth itself.<sup>6</sup>

Dental stem cells are easy to obtain as compared to other sources of stem cells and have the added advantage of having fewer ethical concerns. This has given rise to increasing popularity of tooth banking and harvesting of dental stem cells. But still there is a need to spread more knowledge about the advances in application, storage, banking and guidelines related to dental stem cells<sup>1</sup>. So, the present study was planned to assess and compare the knowledge and attitude about dental stem cells among dental practitioners and dental faculty.

### II. Methodology:

This study was a cross-sectional observational type of questionnaire-based study which was conducted from June-August 2019. The study protocol was reviewed and approved by the Institutional Ethical committee after which, the pre-validated questionnaires regarding dental stem cells were distributed among 100 private dental practitioner's from Nagpur and 100 dental faculty (BDS and MDS) including postgraduate students from 3 different dental colleges of Nagpur, namely, VSPM dental college, SDKS dental college and Government dental college and hospital. The questionnaire consisted of 20 questions. The questionnaire included both close-ended and self-administered questions. The questionnaire data was entered into Microsoft Excel 2010 and analysed using SPSS version 17 software (SPSS Inc., Chicago, IL, USA). The Pearson's Chi-square test and percentages of the total were used for analysis to gain insight into the knowledge and attitude about dental stem cells among dental practitioners and dental faculty.

### **III. Results:**

Among the dental faculty, 87% participants believed that stem cells could be easily obtained while all (100%) private practitioners confirmed the same. All (100%) dental faculty participants were willing to save teeth & tissue for further regenerative treatment while 95% of private practitioners were willing to do the same.

95% dental faculty in comparison to 93% private practitioner confirmed that stem cells could be useful for regeneration of dental tissues. In table 1, a larger number of the dental faculty (86%) understood that there exist ethical concerns on use of stem cell for regeneration of dental tissues as compared to 79% of private practitioner. The difference of opinion was found to be of statistically significant ( $p < 0.05$ ) where dental faculty had better understanding of ethical concerns. Practice of recommending patients to store dental stem cells was similar in both groups i.e. around 87% did it on a regular basis.

When attitude regarding learning about stem cell banking was evaluated between the two groups it was seen that almost all of the dental faculty (99%) were interested in attending workshops on dental stem cells while only 84% private practitioners were interested in attending workshops. Most of the dental faculty (95%) in comparison to 80% private practitioner understood that regenerative dental treatment was a better option. When belief about stem cell clinic for future dental treatment was compared, it was equal (77%) in both the groups. Most of the dental faculty (74%) in comparison to 66% private practitioner were willing to invest for stem cell banking. There existed statistically significant difference ( $p < 0.05$ ) between dental faculty and private practitioner regarding to knowledge about terminologies of stem cells (89% and 61%) as shown in table 2. Most of the dental faculty (61%) in comparison to 40% private practitioner are aware of dental stem cell banks in Nagpur.

Table 3 shows that, there was a significant difference in the knowledge of dental faculty and private practitioners when information regarding stem cells banking and source of stem cells was evaluated. 84% of dental faculty was aware of dental stem cells can be used for regeneration of non-dental tissues. ( $p < 0.05$ )

According to dental faculty participants the ideal tooth sample for dental stem cells was permanent posterior (57%) followed by primary anterior, permanent anterior and least in primary posterior while private practitioners chose ideal tooth as permanent anterior followed by primary anterior, permanent posterior and least in primary posterior.

Participants from dental faculty had better information about viability of stem cells i.e. 82% of the dental faculty in comparison to 75% private practitioner.

### **IV. Discussion:**

Research in the field of dental stem cells has been advancing at a fast pace. The first commercial tooth bank was established as a venture company at National Hiroshima University of Japan in 2004.<sup>8</sup> The discovery of stem cells in the pulps of permanent and deciduous teeth and the possibility of using dental stem cells for tissue engineering has prompted much research in this field. Dental stem cells have the potential to be utilized for medical applications like heart therapies,<sup>15</sup> for muscular dystrophy therapies<sup>16</sup> and for bone regeneration<sup>17, 18</sup>. Stem cells from human exfoliated deciduous teeth can be used to generate cartilage<sup>19</sup> as well as adipose tissue.<sup>20</sup> In 2008 first advanced animal study for bone grafting was announced resulting in reconstruction of large size cranial bone defects in rats with human dental pulp stem cells.<sup>21</sup> Applications of dental stem cells in the development of non-dental organs in our was known more in dental faculty when compared to private practitioners. As this a recent advancement, there is a possibility that this topic might not have been a part of dental education curriculum. The general population is becoming increasingly aware about dental stem cells through media such as advertisements and news. Dental professionals are approached by patients for further information regarding the same. The dental professionals are also approached by dental stem cells companies for promotion of dental stem cell collection and storage. It is therefore essential that dentists should be aware and have knowledge regarding the sources, storage and applications of dental stem cells. Hence, this study was conducted to assess and compare the knowledge and attitude regarding dental stem cells among private dental practitioners and dental faculty. Among dental faculty sample, maximum number of dentists who participated in this survey read scientific journals on a regular basis indicating that they are keeping abreast with latest dental advancements and research. A similar type of study done by Parita et al showed that journals and internet were the major source of information among dentists.<sup>1</sup> All dental faculty subjects when compared to private practitioners were willing to save the teeth & tissue for further regenerative treatment and both the groups believed that stem cell therapy did not pose a health hazard and only 5% of private practitioners had ethical concerns with the use of stem cells in dentistry. This reflects the attitude of the dental faculty to provide the best and most effective care to their patients. Whereas, RA Basson et al<sup>2</sup> in his study found that majority of the dentists agreed that the dental stem cell banking will be useful for regeneration of dental tissues but most of them were concerned about potential health hazards regarding the use of stem cells as a part of regenerative dentistry. About 100% dental faculty and 89% private practitioner in the present study believed that high cost

and lack of patient awareness are the barriers in stem cell banking. The additional factors cited such as lack of operator skills and lack of knowledge about the procedure indicate that, even though theoretical knowledge on the subject is being developed in recent years, there is lack of practical knowledge and skills among dentists. Comparable results were found in a survey done by Goyal among the dental practitioners in Rajasthan in the year 2015, where most of them agreed that high cost, lack of awareness, and lack of sufficient knowledge were hindering people from obtaining treatment using dental stem cells<sup>10</sup>. These factors that obstruct the people from obtaining treatment using dental stem cells could be minimized by reasonable charging of fees similar to other standardized management procedures.<sup>11</sup> About 50% of dental professionals in a study done to assess the awareness of stem cell among the dental professionals by Paritk et al<sup>1</sup> believed that the Despite the lack of in-depth knowledge regarding dental stem cell banking, isolation and storage, a majority of dental faculties and private practitioners were keen on recommending dental stem cell storage to their patients. A similar study conducted amongst medical doctors, found that the majority of the physicians interviewed did not have specific knowledge on stem cells, most of those involved did not attend additional training courses regarding stem cells, but most were interested in stem cells, suggesting that they believe in the potential benefits of developing stem cell therapies. 99% of dental faculty group in our study showed a positive attitude towards attending workshop on dental stem cell while only 84% of private practitioners were interested in attending workshops. Most of the dental faculty was more interested in getting themselves trained regarding the harvesting and applications about dental stem cells. This is because faculty training is encouraged in most of the dental college as it is beneficial for both the staff members and the institute. Regenerative capacity of the dental pulp is well known and has been recently attributed to function of dental stem cell. Dental stem cells offer a very promising therapeutic approach to restore structural defects.<sup>9</sup> Dental faculty as compared to private practitioner felt that regenerative dental treatment is better option while remaining were unsure about it. Both the groups equally believed that stem cell clinics will provide the best and most effective future dental treatment to the patients. Subjects who believed that stem cell banking would be useful for regeneration of dental tissue were willing to refer patients to a dental professional who could provide regenerative treatment in cases where they were unable to do so by themselves. Sede et al in their study found that 81% of dentists was aware about stem cells in dentistry.<sup>12</sup> Tooth banks have emerged in all parts of the world including India and marketing strategies are employed to promote tooth banking. Major percentage i.e, 82% of dental faculty had better knowledge than private practitioners (54%) about dental stem cell bank in Nagpur. While, remaining of them were unaware about it. A similar study conducted by Siva Pillai et al found that higher percentage dentists support and encourage stem cell banks in India.<sup>13</sup> These findings were similar to the study conducted Mamatha et al that majority of the dentists supported and encouraged stem cell banks. Stem cells have been isolated from pulp tissue of permanent teeth, from periodontal ligament cells, apical papilla of young permanent teeth, from developing dental follicle, and from primary teeth.<sup>22, 23</sup> Stem cells are obtained from pulp of exfoliating deciduous teeth and have been termed as SHED by Miura et al in 2003.<sup>23</sup> Miura et al. provided evidence that SHED is capable of extensive proliferation and multipotential differentiation. Primary incisors and canines with no pathology and at least one-third of root length remaining are ideal candidates for stem cell isolation and harvesting, while other suggested that primary anterior teeth are ideal sample for dental stem cells.<sup>23</sup> In present study, awareness regarding the ideal teeth used for banking was higher among dental faculty and moderate among private practitioner.

**LIMITATION:** As this study had a limited sample size of 200 subjects, it will be beneficial to conduct similar studies with larger samples and on various ethnic groups.

### **V. Future Prospectives:**

Researchers have observed promising results in several preclinical animal studies and numerous clinical trials are now on-going globally to further validate these findings. The Obama administration has made stem cell research one of the pillars of his health program. The U.S. Army is investing over \$250 million in stem cell research to treat injured soldiers in a project called Armed Forces Institute for Regenerative Medicine. It is likely that the next stem cell advance is the availability of regenerative dental kits, which will enable the dentists the ability to deliver stem cell therapies locally as part of routine dental practice. An innovative method that holds promising future is to generate induced stem cells from harvested human dental stem cells. This approach reprograms dental stem cells into an embryonic state, thus expanding their potential to differentiate into a much wider range of tissue types. Researchers have so far succeeded in making specific dental tissues or tooth like structures although in animal studies but future advances in dental stem cell research will be the regeneration of functional tooth in humans.<sup>9</sup>

### **VI. Conclusion:**

This questionnaire study revealed a good level of awareness among the dental faculty as compared to the private practitioners. This study showed a significant correlation between the academic qualification and the

level of knowledge and awareness among dental faculty. The dental faculty overall had a better knowledge as compared to private practitioners because the curriculum of college include the topics related to dental stem cells, they come across more new researches and studies done by their colleagues and students, get to update their knowledge regarding new advancements through various lectures conducted by the college and also through various scientific journals on a regular basis which are available in college library itself. This urges a need to spread more knowledge about advances in applications, storage and banking related to dental stem cells especially among private practitioners which can be done by conducting seminars and conferences and by adding the topic in under-graduate curriculum. Similar surveys and research must be conducted at different levels to spread awareness globally so that everyone can gain the benefits in future.

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### QUESTIONNAIRE:

Sr.no	Questionnaire	
1.	Do you think stem cells can be easily obtained?	<ul style="list-style-type: none"> <li>• Yes</li> <li>• No</li> </ul>
2.	Would you be willing to save teeth and dental tissue for further regenerative dental treatment?	<ul style="list-style-type: none"> <li>• Yes</li> <li>• No</li> </ul>
3.	Does high cost and lack of patient awareness are the barriers in stem cell banking?	<ul style="list-style-type: none"> <li>• Yes</li> <li>• No</li> <li>• Don't know</li> </ul>
4.	Do you think dental stem cell banking can be useful for regeneration of dental tissues?	<ul style="list-style-type: none"> <li>• Yes</li> <li>• No</li> </ul>

5.	Do you think any ethical concern regarding use of stem cell for regeneration of dental tissues?	<ul style="list-style-type: none"> <li>• Don't know</li> <li>• Yes</li> <li>• No</li> <li>• Don't know</li> </ul>
6.	Will you recommend patient to store dental stem cells?	<ul style="list-style-type: none"> <li>• Yes</li> <li>• No</li> </ul>
7.	In future are you interested to attend any workshop regarding dental stem cells?	<ul style="list-style-type: none"> <li>• Yes</li> <li>• No</li> </ul>
8.	Do you think that regenerative dental treatment be a better treatment option?	<ul style="list-style-type: none"> <li>• Yes</li> <li>• No</li> <li>• Don't know</li> </ul>
9.	Do you believe stem cells clinic's will deliver future dental treatment?	<ul style="list-style-type: none"> <li>• Yes</li> <li>• No</li> <li>• Don't know</li> </ul>
10.	Are you willing to invest for dental stem cell banking?	<ul style="list-style-type: none"> <li>• Yes</li> <li>• No</li> </ul>
11.	Do you ever come across the term dental stem cells?	<ul style="list-style-type: none"> <li>• Yes</li> <li>• No</li> </ul>
12.	Are there any dental stem cell banks in Nagpur?	<ul style="list-style-type: none"> <li>• Yes</li> <li>• No</li> <li>• Don't know</li> </ul>
13.	Can stem cells be stored in the form of stem cell banking for future use?	<ul style="list-style-type: none"> <li>• Yes</li> <li>• No</li> <li>• Don't know</li> </ul>
14.	Can stem cells be used for the regeneration of non-dental tissues?	<ul style="list-style-type: none"> <li>• Yes</li> <li>• No</li> <li>• Don't know</li> </ul>
15.	Are wisdom teeth rich source of stem cells?	<ul style="list-style-type: none"> <li>• Yes</li> <li>• No</li> <li>• Don't know</li> </ul>
16.	Which is an ideal tooth sample for dental stem cells?	<ul style="list-style-type: none"> <li>• Primary anterior</li> <li>• Primary posterior</li> <li>• Permanent anterior</li> <li>• Permanent posterior</li> </ul>
17.	Can teeth that has become mobile either through trauma or disease be used for dental stem cells recovery?	<ul style="list-style-type: none"> <li>• Yes</li> <li>• No</li> <li>• Don't know</li> </ul>
18.	Which among the following can be used as best medium to store exfoliated teeth?	<ul style="list-style-type: none"> <li>• Hypotonic phosphate buffered saline solution.</li> <li>• Saliva</li> <li>• Milk</li> <li>• Buffered saline solution.</li> </ul>
19.	Is the viability of the stem cells is time and temperature sensitive?	<ul style="list-style-type: none"> <li>• Yes</li> <li>• No</li> <li>• Don't know</li> </ul>
20.	Is the viability of the stem cells is age sensitive?	<ul style="list-style-type: none"> <li>• Yes</li> <li>• No</li> <li>• Don't know</li> </ul>

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