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Awareness of Stem Cells and its Application among General Public in Chennai

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Authors' contributions

This work was carried out in collaboration among all authors. Author AJ designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft manuscript. Authors MJ and SP managed the analyses of the study. Author MJ managed the literature searches. All authors read and approved the final manuscript.

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Original Research Article

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ABSTRACT

Aim: To assess the awareness about stem cells and its application among the general public in Chennai.
Introduction: Stem cells are very unique cells and have been isolated from the dental pulp, exfoliated deciduous teeth, the periodontal ligament, the dental follicle and the dental papilla. Adult stem cells can differentiate into many dental components such as dentin, periodontal ligament, cement and dental pulp tissue but not into enamel.
Methodology: A cross sectional questionnaire based study was carried out among the general public in Chennai. This study included 110 participants.
Results: Male participants between the age group of 21-40 years were more aware about stem cells and its sources and its various applications.
Conclusion: The results of this study demonstrated a satisfactory level of awareness among the general public regarding stem cells.

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1. INTRODUCTION

Stem cells that have attained a large focus of attention in today's regenerative medicine are defined as clonogenic unspecialized cells that can generate into one or more specialized cell types [1]. Stem cells are very unique cells that have the potential to repair and regenerate into several distinct cell types in the body like tooth, bone cartilages, skin, adipose tissue, and glands. On the basis of cell maturity, they may be (a) Embryonic stem cells, (b) Adult stem cells. Embryonic stem cells are pluripotent stem cells derived from the inner cell mass of the blastocyst, an early stage embryo. Adult stem cells are undifferentiated cells, found throughout the body after embryonic development, that multiply by cell division to replenish dying cells and regenerate damaged tissue. They are also known as somatic stem cells [2,3].

With respect to medicine, stem cell–based treatments are being used to treat Parkinson's disease, neural degeneration following a brain injury, cardiovascular disease, diabetes mellitus, and autoimmune diseases [4].

Human stem cells have been isolated from the dental pulp, exfoliated deciduous teeth, the periodontal ligament, the dental follicle and the dental papilla. Adult dental stem cells can differentiate into many dental components such as dentin, periodontal ligament, cement and dental pulp tissue but not into enamel [5].

In 2003, Dr. Songtao Shi, announced the discovery of dental pulp stem cells (DPSCs). Seo, *et al*., in 2004, demonstrated that periodontal ligament itself contains progenitors that can be activated to self-renew and regenerate tissues like cementum and alveolar bone [6]. In 2005, Morsczeck*et al*., isolated the stem Cells from the dental follicle of human third molars, which expressed the stem cell markers [7]. Kerkis in 2006 discovered immature DPSCs, "a pluripotent sub-population of DPSCs" using dental pulp organ culture [5]. In 2006, Sonoyama et al., isolated a new population of dental stem cells, and named stem cells from the apical part of the papilla (SCAPs). SCAPs are nothing but clonogenic fibroblast-like cells, but have a comparatively higher proliferation rate than DPSCs [8]. An amazing property of DPSCs is their ability to regenerate a dentin pulp complex found in normal human teeth [9]. This has given rise to increasing popularity of tooth banking and harvesting of DPSCs.

Dental stem cells have an advantage over epithelium stem cells in treating many diseases as they are less likely to develop into teratomas or any other tumors when transplanted. However, the limitation of using dental stem cells is that it is difficult to harvest a large quantity of stem cells from the teeth, the requirement of a professional is higher for extraction, isolation, and culture, and it also takes a longer time to culture mesenchymal stem cells from the dental tissue [10].

Although tooth banking is currently not very popular the trend is gaining acceptance mainly in the developed countries. Lifecell is India's first and largest stem cell bank established in 2004, in Chennai [11,12]. However, the knowledge and awareness about stem cells seems to be poor among Indians. Our team has extensive knowledge and research experience that has translated into high quality publications [13–32]. Hence, this study was conducted to assess the awareness about stem cells and its application among the general public in Chennai.

2. MATERIALS AND METHODS

2.1 Study Design and Study Setting

A cross sectional survey was conducted among the general public using a self-administered questionnaire. The questionnaire was assessed by experts in the field for validity and reliability.

2.2 Sampling

A total of 110 participants enrolled for this study. Simple random sampling method was used for sampling in this study. The sampling bias is minimized by including all available data with no sorting process.

2.3 Data Collection

A questionnaire based online survey was conducted among 110 individuals. The survey was created on Google Forms platform. A total of 15 questions were asked related to stem cells and its applications.

2.4 Statistical Analysis

The collected data was tabulated and analysed with Statistical Package for Social Sciences for Windows, version 20.0 (SPSS Inc., Vancouver

style) and results were obtained. Categorical variables were expressed in frequency and percentage. Chi- square test was used to test association between categorical variables. Chi-square tests were carried out using age, gender as independent variables and questions as dependent variables. The statistical analysis was done by Pearson Chi- squared test. P value < 0.05 was considered statistically significant.

3. RESULTS AND DISCUSSION

This study included 110 participants, out of which 56.4% of them were males and 43.6% were females (Fig. 1). Most of the participants were between the age group of 20-40 years (60%), followed by participants below 20 years of age (22.7%), and 41-60 years (17.3%) (Fig. 2). Majority of the participants (71%) have heard about stem cells. There are different sources of stem cells such as bone marrow, fat, umbilical cord, blood, most of the participants think that the major source of stem cells is bone marrow (32.7%). There are various types of stem cells such as hematopoietic, mesenchymal, neural, and epithelial; the majority of the participants were aware about all of these types of stem cells (36.4%).

There was a slight predominance where 58.2% participants believed that stem cell therapy is invasive. There was not much of a difference in the awareness level between males and females as both were equally knowledgeable about stem cells, its sources, and its various benefits and its usage in cancer treatment (Figs. 3, 4, 5). Approximately, the majority of the participants belonging to the 21-40 years of age group were aware about the stem cells (Fig. 6) and believed it was beneficial (Fig. 7) and could be used in cancer treatment such as bone regeneration, tissue regeneration, stem cell transplant (Fig. 8).

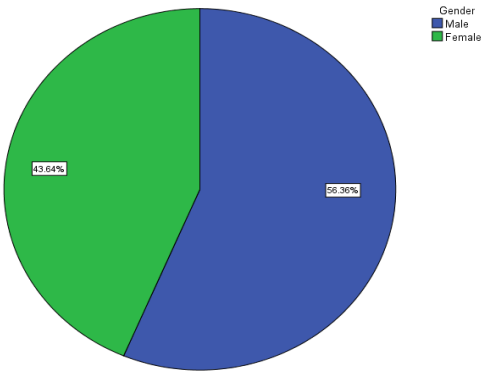

Fig. 1. Distribution of participants based on gender

Blue colour denotes 'Males' (56.36%), and green colour denotes 'females' (43.64%).

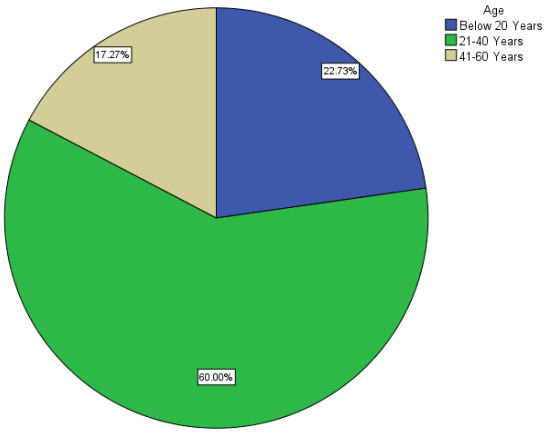

Fig. 2. Distribution of participants based on their age groups

Blue colour denotes 'below 20 years' (22.73%), green colour denotes '21-40 years' (60%), and beige colour denotes '41-60 years' (17.27%).

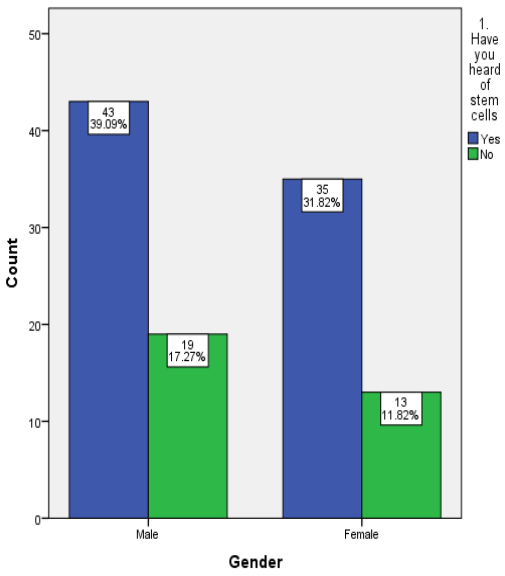

Fig. 3. Association between the gender and awareness about stem cells

X-axis denotes the gender and Y-axis denotes the responses of the question "Have you heard of stem cells". Blue colour denotes 'Yes', green colour denotes 'No'. Males had a higher percentage of awareness about stem cells (39.09%). The Chi square test was done and the association was found to be not statistically insignificant, p = 0.68 (p>0.05).

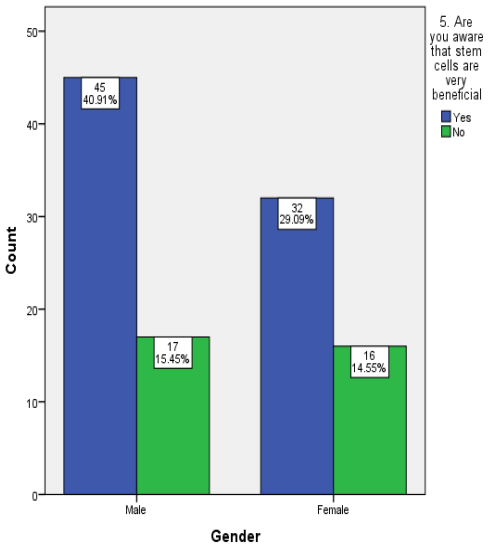

Fig. 4. Association between the gender and awareness on the benefits of stem cells

X-axis denotes the gender and Y-axis denotes the responses of the question "Are you aware that stem cells are very beneficial". Blue colour denotes 'Yes', green colour denotes 'No'. Males had a higher percentage of awareness about the benefits of stem cells (40.91%). The Chi square test was done and the association was found to be not statistically insignificant, p= 0.50 (p> 0.05).

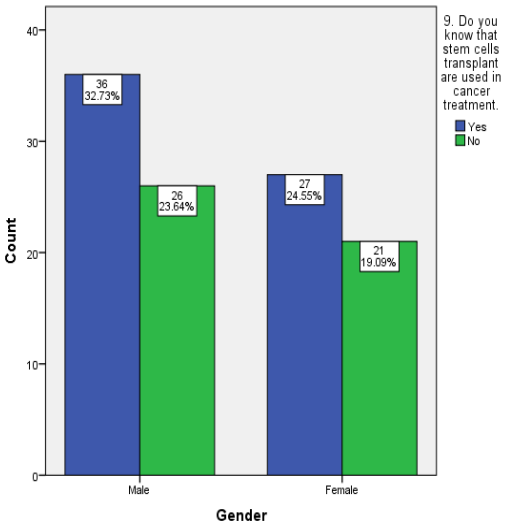

Fig. 5. Association between the gender and the awareness about stem cell transplants in cancer treatment

X-axis denotes the gender and Y-axis denotes the responses of the question "Do you know that stem cell transplants are used in cancer treatment". Blue colour denotes 'Yes', green colour denotes 'No'. Males had a higher percentage of awareness about the use of stem cell transplant in cancer treatment (32.73%). The Chi square test was done and the association was found to be not statistically insignificant, p = 0.84 (p> 0.05).

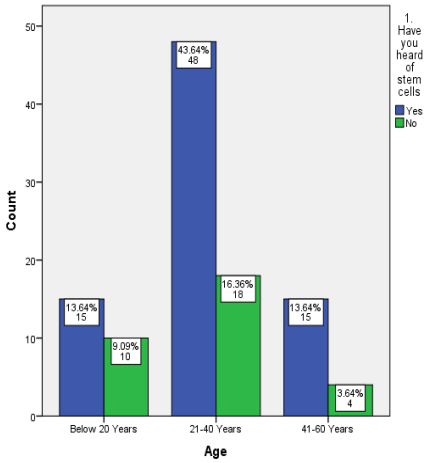

Fig. 6. Association between the age group and the awareness about stem cells

X-axis denotes the age groups and Y-axis denotes the responses of the question " Have you heard of stem cells". Blue colour denotes 'Yes', green colour denotes 'No'. 21-40 years age group were more aware about stem cells (43.64%). The Chi square test was done and the association was found to be statistically insignificant, p = 0.34 (p> 0.05).

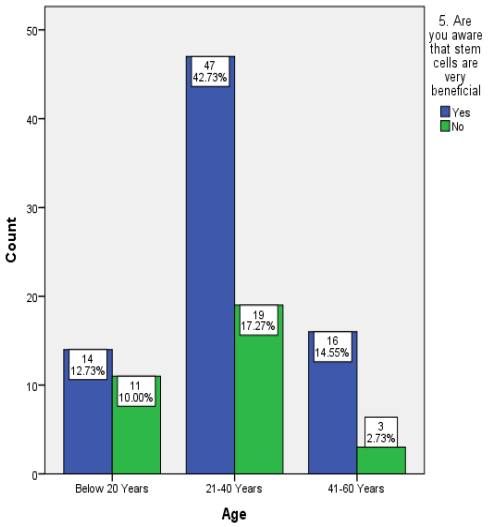

Fig. 7. Association between the age group and the awareness about the benefits of stem cells

X-axis denotes the age groups and Y-axis denotes the responses of the question “Are you aware that stem cells are very beneficial“.Blue colour denotes ‘Yes’, green colour denotes ‘No’. The age group of 21-40 years were more aware about the benefits of stem cells (42.73%). The Chi square test was done and the association was found to be statistically insignificant, p = 0.12 (p> 0.05).

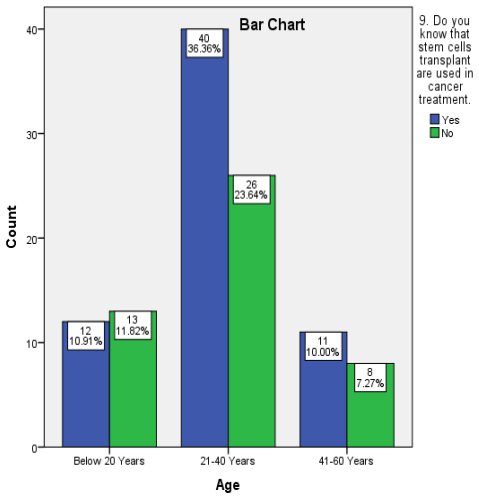

Fig. 8. Association between the age group and the awareness about stem cell transplants in cancer treatment

X-axis denotes the age groups and Y-axis denotes the responses of the question “Do you know that stem cell transplants are used in cancer treatment?”. Blue colour denotes ‘Yes’, green colour denotes ‘No’. The age group of 21-40 years were more aware about the use of stem cell transplant in cancer treatment (36.36%). The Chi square test was done and the association was found to be not statistically insignificant, p = 0.55 (p> 0.05).

Stem cells have proved themselves to be of unique type of cells having specialized capacity to differentiate into a variety of cells, e.g., smooth muscle cells, adipocytes, chondrocytes and neurons. Bone marrow, neural tissue, skin, retina, deciduous teeth which exfoliate and wisdom teeth can be a potential source for stem cells [9,33–35].

In our study, awareness about the beneficial use of stem cells was found to be 70% which was in contrast to the study done by Saran et al in which only 53.7% of the subjects had a clear knowledge that stem cells are beneficial for health. However, the awareness of dental stem cells was found to be moderate in our study population (56.3%) [36].

The clinical benefits of dental SCs are not limited to dental use but can also be used for treating many diseases like myocardial infarction, liver dysfunction, diabetes mellitus [37].

Though India's first and largest stem cell bank - Lifecell was established in 2004,Chennai, only 52% of the participants were aware about the stem cell collection and banking facility.

Dental stem cells/ mesenchymal stem cells are harvested from the deciduous teeth of children in the age group of 6-12 years and are stored for 21 years. Our study showed that 65.4% of the subjects knew that the tooth lost can be regenerated using stem cells. It reflects a clear degree of awareness and knowledge of subjects about Dental Pulp Stem cells [12].

The general population is becoming increasingly aware about stem cells through media such as advertisements and news. However, awareness regarding the importance of dental stem cells has to be increased. This can be done by dental professionals. In a study by FarhinKatge et al the awareness of stem cells in dentists was 79.4% in graduates, 95.1% in postgraduates, and 78.6% in PhD participants [3]. However, the awareness of Dental Stem Cells was lesser among the same. Hence, Awareness and knowledge among dentists regarding sources, applications, and uses of Dental stem cells should be increased in colleges through conferences and continuing education programmes.

It is important that the health professionals update themselves with knowledge regarding stem cells and Dental Stem Cells for the benefit of a larger population. Stem cell therapy is an emerging therapeutic modality and is believed to be one of the greatest untapped resources currently available for the prevention and treatment of many diseases. Hence, a common man can be educated and motivated to store their stem cell without any second thought.

4. CONCLUSION

The results of this study demonstrated a satisfactory level of awareness among the general public regarding stem cells and its applications. Males were found to be more aware about stem cells and its various applications and the age group between 21-40 years were more

aware when compared to the other age groups. A positive attitude towards updating the knowledge regarding Dental Stem Cells has been displayed by the subjects.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

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CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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