Review Article

Stem Cell Regeneration – Implications for Medicine

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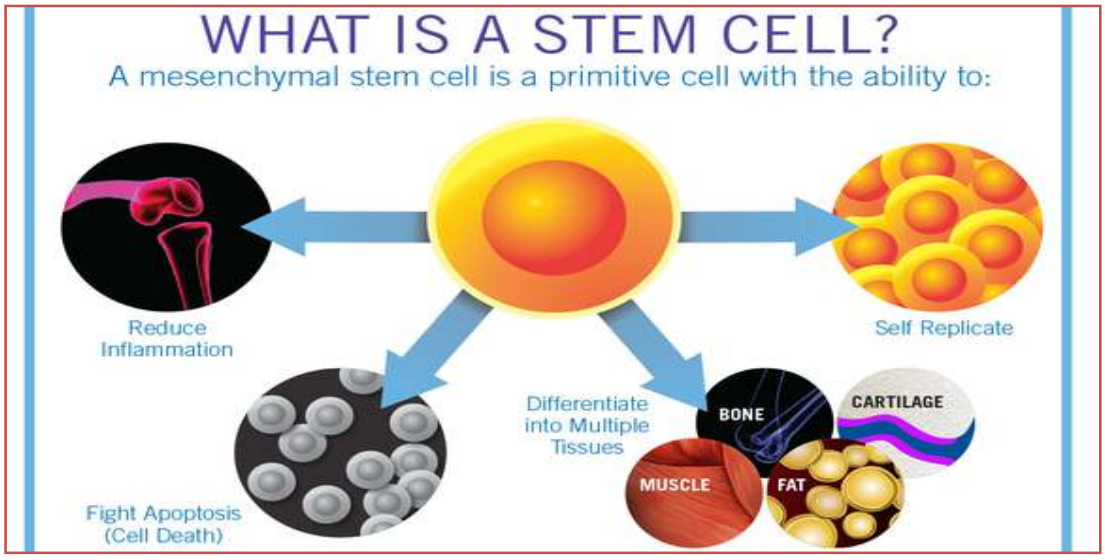
ABSTRACT
Stem cell culturing is a major practice in recent years in medical field. Stem cell regeneration is done in almost all hospitals due to its importance in medicine. A stem cell can be modified and regenerate into all most all cells in human body. Due its vast benefits it is necessary to preserve stem cell. Several experiments are conducted to prove this. In this paper a careful biological model is made to achieve the requirement.
KEYWORDS: Stem cell, biological model, science.

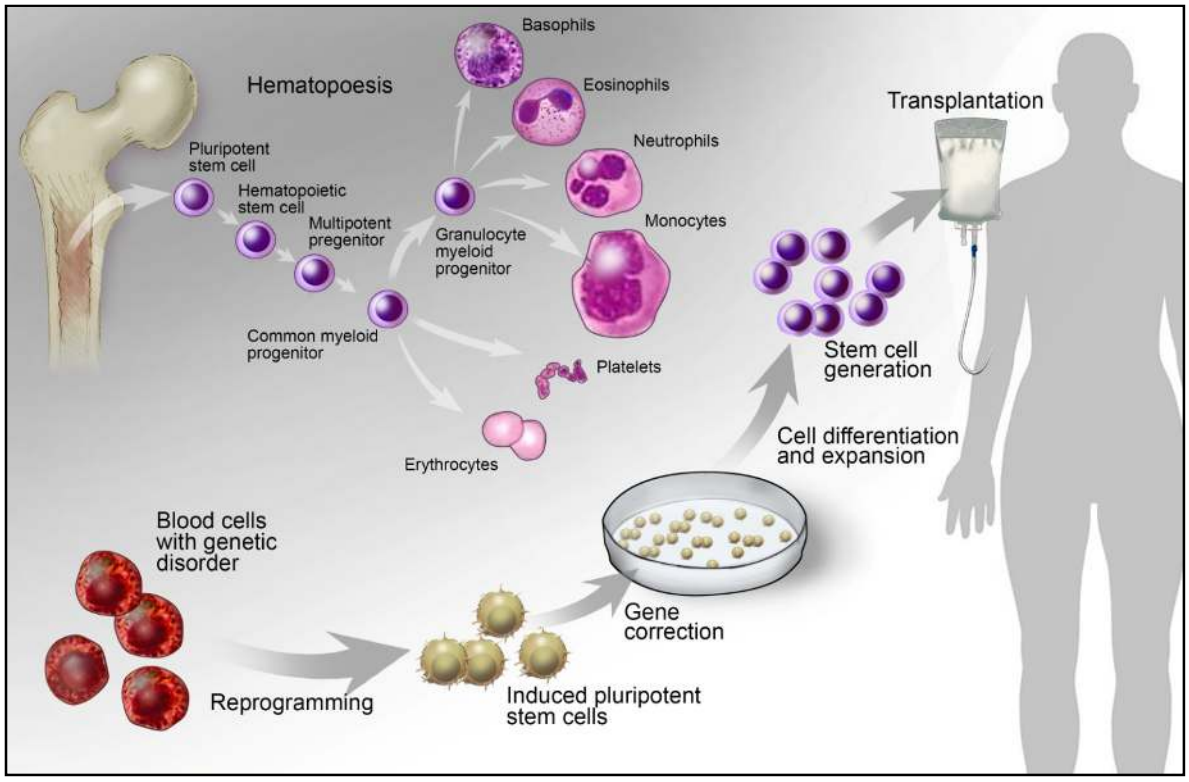
INTRODUCTION

The versatility of stem cells implies that they can transform into any type of body cell (Poulos, 2018). This feature has paved the way for the cells to be used for purposes of repairing or regenerating diseased organs and tissues (Kim, Mehrazarin& Kang, 2012). This paper provides a literature review of some of the past scholarly studies that have focused on the subject of stem cell regeneration. In so doing, the section is projected to give an issue into subjects such as the current trends in stem cell regeneration, some of the merits and demerits of this practice, and future implications. Some studies have focused on the efficacy of stem cell regeneration. In the experiment by Wu, Chiu and Chin et al. (2014), the main aim was to regenerate damaged tissues via the therapeutic use of stem cells. The study employed adult homologous stem cells and strived to determine their efficacy in damaged tissue regeneration. In the findings, the study reported that this therapy, which employs stem cells, is safe. Sudarshan, Annigeri and Vijayabala (2012) concurred that stem cell regeneration as a therapeutic intervention yields significant improvements in pump function and myocardial vascularization. Based on these findings, it can be inferred that the subject of lost tissue regeneration has received in-depth analysis but only recent research has made regenerative dentistry and medicine gain momentum; proving contributory to the subject of molecular biology. In medicine, chronic debilitating diseases have led to the exploration of stem cells and their possible role in repairing, repopulating, replacing, and rewiring organs and tissues (Sankaranarayanan, Kailasam, Elangovan, Ravi &Sarkar, 2013). According to Kim, Mehrazarin and Kang (2012), the increasing attention in stem cell regeneration is informed by overwhelming success with which the therapy has been reported —relative to animal studies. With the animal studies avowing that stem cell regeneration is a promising therapy, several clinical trials have been conducted. In the study by Poulos (2018), the central objective was to find out the role of cell replacement therapy or stem cell regeneration in alleviating symptoms of diseases such as peripheral vascular disease, diabetes, arthritis, and cancer. In a related study, Alpert and Chen (2017) sought to unearth the contribution of stem cell regeneration in addressing heart failure and hematological disease. Findings suggested that stem cell regeneration is a promising therapy due to its promising results. In a related experiment, Nolta (2016) documented that for patients with type-1 diabetes, stem cell regeneration aids in protecting pancreatic islet cells. On the other hand, Horst, Chavez, Jheon, Desai and Klein (2012)

observed that for individuals diagnosed with the chronic obstructive pulmonary disease, the cell therapy procedure aids in repairing the lung tissue. Stem cell regeneration has also gained application in dentistry. For these studies, dental tissues have been used to obtain the stem cells. Some of the areas in which promising results have been reported include the ability to foster whole tooth regeneration, craniofacial defects' bone replacement and repair, and periodontal regeneration (Gasparotto, Landim-Alvarenga and Oliveira et al., 2014). Others include the repair of perforations and regeneration of apical or cervical dentin and resorbed root, as well as regenerations of damaged coronal pulp and dentin

(Kim, Mehrazarin& Kang, 2012). In relation to the regeneration of damaged coronal pulp and dentin, stem cell regeneration has been found to facilitate the deposition of physiologic dentin (Wu, Chiu and Chin et al., 2014). According to Sudarshan, AnnigeriandVijayabala (2012), this facilitation has been contributory to medicine and dentistry whereby it has minimized micro-leakage and interfacial failure —while ensuring that the structural integrity of the tooth is restored. In the study by Sankaranarayanan, Kailasam, Elangovan, Ravi and Sarkar (2013), it was acknowledged that in situations, where apexification or apexogenesis is required for young permanent teeth, stem cell regeneration leads to pulp regeneration. As such, it was observed that stem cell regeneration is important because its associated ability to promote pulp regeneration paves the way for the completion of development of lateral and vertical roots. In so doing, Poulos (2018) indicated that long-term prognosis is improved. As mentioned earlier, stem cell regeneration has also been used in periodontal regeneration. According to Alpert and Chen (2017), some of the techniques that have been embraced to foster the regeneration of the periodontium include the use of alloplastic materials, allografts, and autologous bone grafts. Whereas the techniques have been used widely, Kim, Mehrazarin and Kang (2012) cautioned that the structure of the periodontium, which constitutes soft and hard tissues, has proved complex and too challenging for these methods. As such, cell-mediated regeneration has been employed to counter the limitations with which the techniques highlighted above are associated. In one of such studies, Nolta (2016) indicated that when expanded autologous marrow stromal stem cells (MSCs) are transplanted *ex vivo*, this process leads to the regeneration of new periodontal ligaments, alveolar bone, and cementum. Particularly, the experiment was conducted with dogs experiencing class III periodontal defects. In situations, where *in vitro* cultures of periodontal ligament cells are established, Horst, Chavez, Jheon, Desai and Klein (2012) asserted that the results demonstrate re-implanting into periodontal defects; upon which periodontal regeneration is promoted. Given the degree of concurrence among the scholarly studies and results documented above, it can be inferred that stem cell regeneration is highly contributory to medicine and dentistry because it fosters tissue regeneration in very complex tissues; including the periodontium.





Stem cell regeneration has also gained application in the orofacial region. According to Gasparotto, Landim-Alvarenga and Oliveira et al. (2014), mesenchymal stem cells, which are obtained from dental and non-dental sources, aid in the regeneration of maxillofacial regions. Some of these regions include craniofacial regeneration, the repair of the palate and cleft lip, regeneration of salivary gland, and the production of dentin and enamel (Wu, Chiu and Chin et al., 2014). In experiments where the mesenchymal stem or stromal cells have been used, prophylactic treatment has been achieved in relation to atrophy or vocal fold scar (Sudarshan, Annigeri and Vijayabala, 2012). For the mesenchymal stems cells that have been transplanted into vocal folds (pre-clinically *in vivo* and *in vitro*), no adverse risks have been reported (Kim, Mehrazarin& Kang, 2012). In studies where focus has been on oral submucosal fibrosis (which is a chronic condition that restricts mouth opening and affects the underlying muscles of mastication, esophagus, pharynx, lips, cheeks, fauces, palate, and the sub-mucosal layer of the pharynx), stem-based therapy has been embraced (Sankaranarayanan, Kailasam, Elangovan, Ravi &Sarkar, 2013). As affirmed by Poulos (2018), the main of stem cell therapy has been to steer neoangiogenesis via the release of growth factors and cytokines. In the findings, stem cell regeneration studies focusing on oral sub-mucosal fibrosis avow that the practice yields promising results (Alpert and Chen, 2017). Particularly, neoangiogenesis, a product of stem cell therapy, has been found to aid in reversing hypoxia and increasing the supply of additional scavenging defenses in diseased issues, upon which the removal of senescent cells has been facilitated (Nolta, 2016). Also, stem cell therapy stimulates resident tissue stem cells, upon which the latter cells are transformed into new fibroblasts. According to Horst, Chavez, Jheon, Desai and Klein (2012), the eventual role of the new fibroblasts lies in the removal of morphologically altered and biochemically disintegrated collagen fibers. Indeed, most of the current literature suggests that stem cell therapy plays a contributory role in regenerative medicine. This procedure entails the use of undifferentiated cells for purposes of curing diseases. Some of the diseases that have been targeted include autoimmune disease, cardiovascular disease, diabetes, liver disease, and Parkinson's disease; which are neurodegenerative conditions.The selected studies highlight further that one of the specific zones to which the stem cell regeneration procedure has been applied entails the orofacial region. In particular, stem cell therapy has been employed in this region for purposes of

alveolar bone regeneration, temporomandibular joint reconstruction, and periodontal and tooth regeneration. From the scholarly affirmations, it is evident that stem cell therapy's curing ability is promising; with the dental pulp and other craniofacial stem cells forming sources from which the required cells have been obtained. In conclusion, stem cell therapy has unlimited dental and medical applications. The evolution of the stem cell regeneration concept reflects a shift from the surgical care model to a medical model that has, in turn, paved the way for a biological model of care (through stem cell therapy). However, most of the selected articles affirm that the success of this practice and the ability to achieve the desired goals of stem cell therapy depend on the degree of collaboration and expertise among practicing dental surgeons, matrix biologists, cell biologists, biomaterial scientists, immunologists, and molecular biologists.

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Appendices

Appendix A: Highlights of stem cell regeneration