



# Exosome Light in Regenerative Dentistry



Aylin Islam<sup>1\*</sup> and Serap Çetiner<sup>2</sup>

<sup>1</sup>Paediatric Dentistry Department, Near East University, Cyprus

<sup>2</sup>Paediatric Dentistry Department, Kyrenia University, Cyprus

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**\*Corresponding author:** Aylin Islam, Department of Pediatrics Dentistry, Near East University, Cyprus, Tel: +90(392)6802030; Fax: +90-3926802025; Email: serap.cetiner@neu.edu.tr

## Abstract

Among children and adults, the prevalence of dental caries is one of the most common health problems that is experienced by approximately 90% of the global population and is characterized by infected and necrotic pulp. The current clinical treatment of choice in the case of latter stage - necrotic dental pulp (DP) infections is traditional root canal therapy. Besides this traditional technique, 'revascularization' biological procedure used as the current regenerative protocol to control the root canal infection and regenerate a pulp tissue through the endodontic space for immature necrotic permanent teeth. In this review, the pulp vitality maintenance, stem cell-free therapies and the benefits of stem cell-derived exosomes advantages for regenerative dentistry and regenerative medicine fields are tried to summarize.

**Keywords:** Exosomes; Regenerative dentistry; Dental pulp

**Abbreviations:** DP: Dental Pulp; RCT: Root Canal Therapy; DPSCS: Dental Pulp Stem Cells; MSCS: Mesenchymal Stem Cells; MVBS: Multi-Vesicular Bodies

## Introduction

Among children and adults, the prevalence of dental caries is one of the most common health problems that is experienced by approximately 90% of the global population and is characterized by infected and necrotic pulp. Poor oral hygiene is accepted as the primary etiologic agent of dental caries. When these dental caries expand, they can cause irreversible degeneration in the mineralized and soft tissues of the teeth. In advanced stages, the situation deteriorates, reaches the Dental Pulp (DP) and subsequently causes bacterial infected DP that leads to necrosis of the vital pulp tissue. In such cases, the treatment option is usually a pulpectomy [1-3].

The current clinical treatment of choice in the case of latter stage - necrotic DP infections is traditional Root Canal Therapy (RCT). Unfortunately, in this therapy the living tissue is removed and replaced with a foreign filling material. Consequently, the tooth loses its vitality, sensitivity, becomes exposed to secondary infections, post-operative pain and periapical lesions originating from coronal micro leakage may occur after endodontic therapy [4,5-8]. The current regenerative protocol used to control the root canal infection and regenerate a pulp tissue through the endodontic space for immature necrotic permanent teeth is the 'revascularization' biological procedure [3,9,10].

Although the DP revascularization procedure has been adapted to clinics and is recommended as an effective treatment

option for immature necrotic teeth by the American Association of Endodontics, difficulties still remain in terms of pure pulpal regeneration due to the impossibility of a naturally well-organized odontoblastic layer through the dentinal walls [11-13]. In this review, the pulp vitality maintenance, stem cell-free therapies and the benefits of stem cell-derived exosomes advantages for regenerative dentistry and regenerative medicine fields are tried to summarize.

## Discussion

When the multiple stem cell profile of DP tissue (from the pulpal tissues of exfoliated primary teeth, permanent teeth, wisdom teeth and supernumerary teeth) has been identified, the stem cell sources of Dental Pulp-Dental Pulp Stem Cells (DPSCS) have been started to use as a potential stem cell-based therapy tool for regeneration of the dentin-pulp complex in regenerative dentistry [14-17]. However, the slow proliferation and differentiation of DPSCS in vivo and the severe decline of stem/progenitor cell numbers in the DP with the ageing process create challenges related to stem cell-based therapies [16,18].

## New Hope: 'Stem Cell Derived Exosomes'

Exosomes are extracellular nanosized membrane vesicles produced during the invagination process of the endosomal membrane of specialized intracellular Multi-Vesicular Bodies

(MVBS) [19-21]. The mesenchymal origin of DPSCs, the therapeutic application of exosomes, particularly Mesenchymal Stem Cells (MSCS)-derived exosomes, has extra significance for the field of regenerative dentistry. MSCS derived exosomes have been reported to play an important role in wound healing (angiogenesis in vitro for vascular regeneration), the specific lineage differentiation of MSCS, anti-inflammatory features against acute inflammation, biomimetic tools for dental pulp-like regeneration and odontogenic differentiation applications, bone regeneration by osteoinductivity and osteogenesis activity [3,22-26].

### Conclusion

It is obvious that exosome-based therapies can be a good alternative choice against to the disadvantages stem cell-based therapies.

As a result, the future of regenerative dentistry field could be formed around dental derived exosome therapies with exosomes' anti-inflammatory, immunomodulatory and osteo/odonto inductive roles, particularly for desired pure dentin-pulp complex regeneration.

### Conflict of Interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this paper.

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