



*Faculty of Dentistry*

# **Proliferation Capacity and Osteogenic Potential of Human Dental Pulp Stem Cells from Permanent and Exfoliated Deciduous Teeth**

**Thesis**

Submitted to Faculty of Dentistry Ain Shams University in partial fulfillment of the requirement for Doctoral Degree in Oral Biology

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# *Dedication*

*To my Family*

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## List of Abbreviations

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|               |                                           |
|---------------|-------------------------------------------|
| <b>BMMSC</b>  | : Bone Marrow Mesenchymal Stem Cells      |
| <b>BMP</b>    | : Bone Morphogenetic Protein              |
| <b>BSP II</b> | : Bone Sialoprotein II                    |
| <b>CD</b>     | : Cluster of Differentiation              |
| <b>CFU-F</b>  | : Colony Forming Unit- Fibroblast         |
| <b>DEX</b>    | : Dexamethasone                           |
| <b>DFSC</b>   | : Dental Follicle Stem Cells              |
| <b>DMEM</b>   | : Dulbecco Modified Eagle Medium          |
| <b>DPSC</b>   | : Dental Pulp Stem Cells                  |
| <b>EBM</b>    | : Eagle Basal Medium                      |
| <b>ED</b>     | : Enzyme Digestion                        |
| <b>EDTA</b>   | : Ethylene Diamine Triacetic Acid         |
| <b>ESC</b>    | : Embryonic Stem Cells                    |
| <b>FBS</b>    | : Fetal Bovine Serum                      |
| <b>FGF</b>    | : Fibroblast Growth Factor                |
| <b>GP</b>     | : Glycerophosphate                        |
| <b>HLA</b>    | : Human Leukocyte Antigen                 |
| <b>hNDP</b>   | : Stem cells from Human Natal Dental Pulp |
| <b>HS</b>     | : Human Serum                             |
| <b>MEM</b>    | : Modified Eagle Medium                   |

|                                |                                              |
|--------------------------------|----------------------------------------------|
| <b>MSC</b>                     | : Mesenchymal Stem Cells                     |
| <b>MTT</b>                     | : Methyl Thyazol Tetrazolium                 |
| <b>OC</b>                      | : Osteocalcin                                |
| <b>ODHPSC</b>                  | : Osteoblast from Human Pulpal Stem Cells    |
| <b>OG</b>                      | : Out Growth                                 |
| <b>PBS</b>                     | : Phosphate Buffer Solution                  |
| <b>PD</b>                      | : Population Doubling                        |
| <b>PDLSC</b>                   | : Periodontal Ligament Stem Cells            |
| <b>RA</b>                      | : Retinoic Acid                              |
| <b>RT-PCR</b>                  | : Reverse Transcriptase- Polymerase Chain    |
| <b>SCAP</b>                    | : Stem Cells from Apical Pappilla            |
| <b>SCID</b>                    | : Severe Combined Immunodeficiency           |
| <b>SHED</b>                    | : Stem Cells from Human Exfoliated Deciduous |
| <b>SMA</b>                     | : Smooth Muscle Actin                        |
| <b>TGF</b>                     | : Transforming Growth Factor                 |
| <b><math>\alpha</math> MEM</b> | : alpha Modified Eagle Medium                |

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# Introduction

In recent years, stem cell researches have grown exponentially owing to the recognition that stem cell-based therapies have the potential to improve the life of patients with conditions that range from Alzheimer's disease to cardiac ischemia and regenerative medicine, like bone or tooth loss. Based on their ability to rescue and/or repair injured tissue and partially restore organ function, multiple types of stem/progenitor cells have been speculated. Growing evidence demonstrates that stem cells are primarily found in niches and that certain tissues contain more stem cells than others. Among these tissues, the dental tissues are considered a rich source of mesenchymal stem cells that are suitable for tissue engineering applications (*Estrela et al., 2011*).

Interestingly, there are several types of dental stem cells that are well characterized and described both in vitro and in vivo. They include dental pulp, periodontal ligament, apical papilla and dental follicle precursor cell. (*Gronthos et al., 2000; Miura et al., 2003; Seo et al., 2004; Morsczech et al.,*