

# ROLE OF STEM CELLS IN DENTAL MEDICINE.

## STEM CELLS.

Stem cells are unique, undifferentiated cells capable of dividing and developing into specialized cell types in the body. They serve as the foundation for growth, development, and tissue repair. Stem cells are classified based on their source and potential to differentiate:

### Functions of Stem Cells

**Tissue Repair and Regeneration:** Replace damaged or lost cells, aiding in healing and recovery.

**Development:** Responsible for forming all tissues and organs during early development.

**Research and Therapy:** Serve as tools for studying diseases, drug testing, and developing regenerative treatments.

In dental medicine, stem cells play a pivotal role in regenerating tissues such as dentin, pulp, and periodontal ligaments, making them vital for advancing regenerative therapies.

**STEM CELLS PLAY A SIGNIFICANT ROLE IN DENTAL MEDICINE DUE TO THEIR POTENTIAL TO REGENERATE DAMAGED TISSUES AND ENHANCE ORAL HEALTH. HERE'S AN OVERVIEW OF THEIR ROLES:**

## **1. DENTAL TISSUE REGENERATION**

**PULP REGENERATION: STEM CELLS, PARTICULARLY DENTAL PULP STEM CELLS (DPSCS), ARE USED TO REGENERATE DAMAGED OR NECROTIC PULP TISSUE, OFFERING AN ALTERNATIVE TO ROOT CANAL THERAPY.**

**DENTIN REPAIR: DPSCS AND STEM CELLS FROM APICAL PAPILLA (SCAP) CAN DIFFERENTIATE INTO ODONTOBLAST-LIKE CELLS, CONTRIBUTING TO DENTIN FORMATION AND REPAIR.**

**PERIODONTAL REGENERATION: STEM CELLS FROM THE PERIODONTAL LIGAMENT (PDLSCS) CAN REGENERATE PERIODONTAL TISSUES, INCLUDING ALVEOLAR BONE, CEMENTUM, AND LIGAMENT, WHICH ARE DAMAGED IN PERIODONTAL DISEASES.**

## **2. TOOTH DEVELOPMENT AND REPLACEMENT**

**BIOENGINEERED TEETH (TOOTH GERMS): STEM CELLS CAN BE USED TO CREATE BIOENGINEERED TOOTH STRUCTURES, PROVIDING A SOLUTION FOR TOOTH LOSS. THIS INVOLVES GROWING A TOOTH GERM IN VITRO AND IMPLANTING IT INTO THE JAWBONE.**

**ENAMEL REGENERATION: ALTHOUGH CHALLENGING DUE TO THE LACK OF NATURAL ENAMEL-PRODUCING CELLS (AMELOBLASTS) IN ADULTS, STEM CELLS ARE BEING EXPLORED TO CREATE ENAMEL-LIKE MATERIALS.**

## **3. TREATMENT OF ORAL DISEASES**

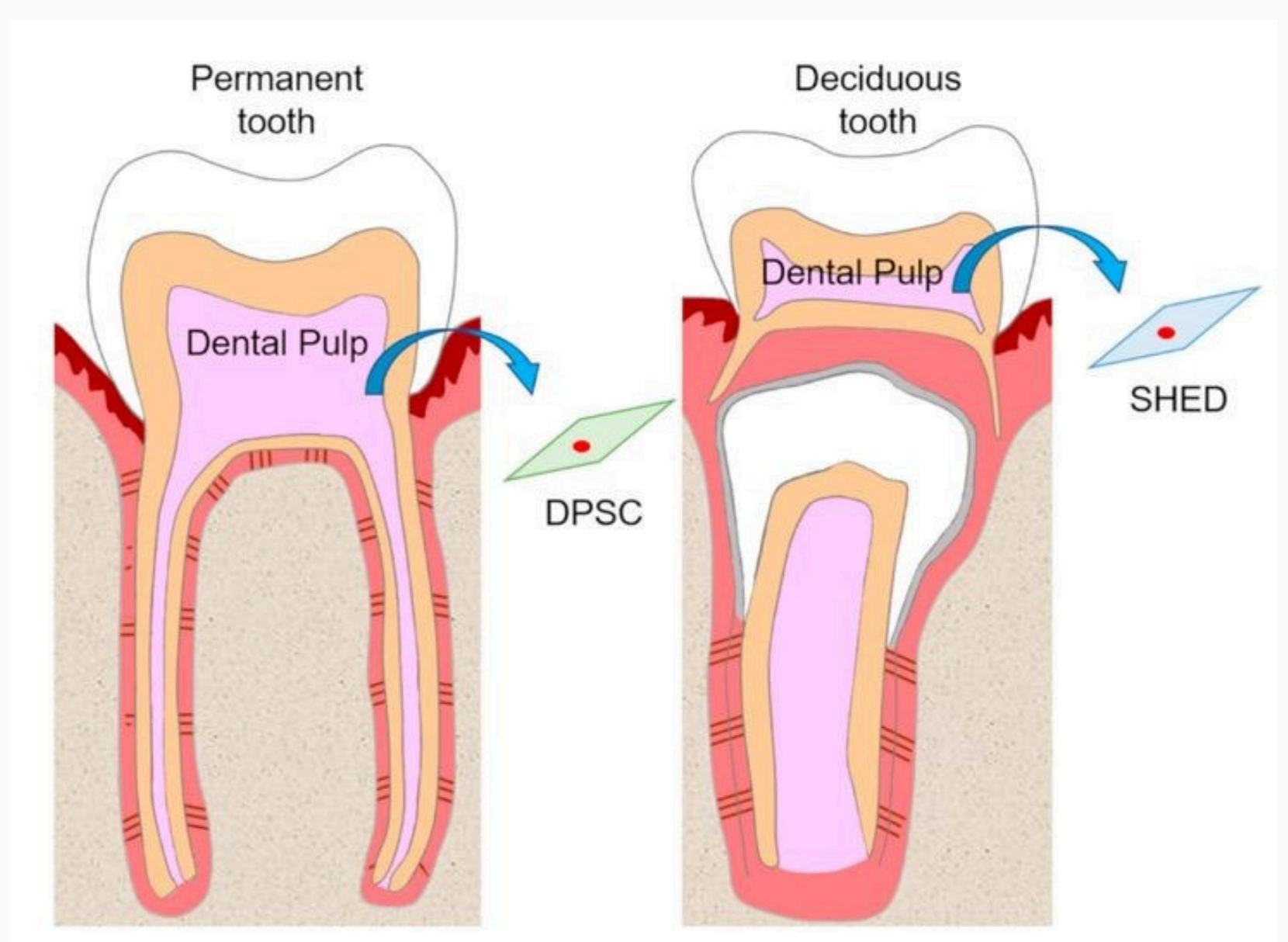
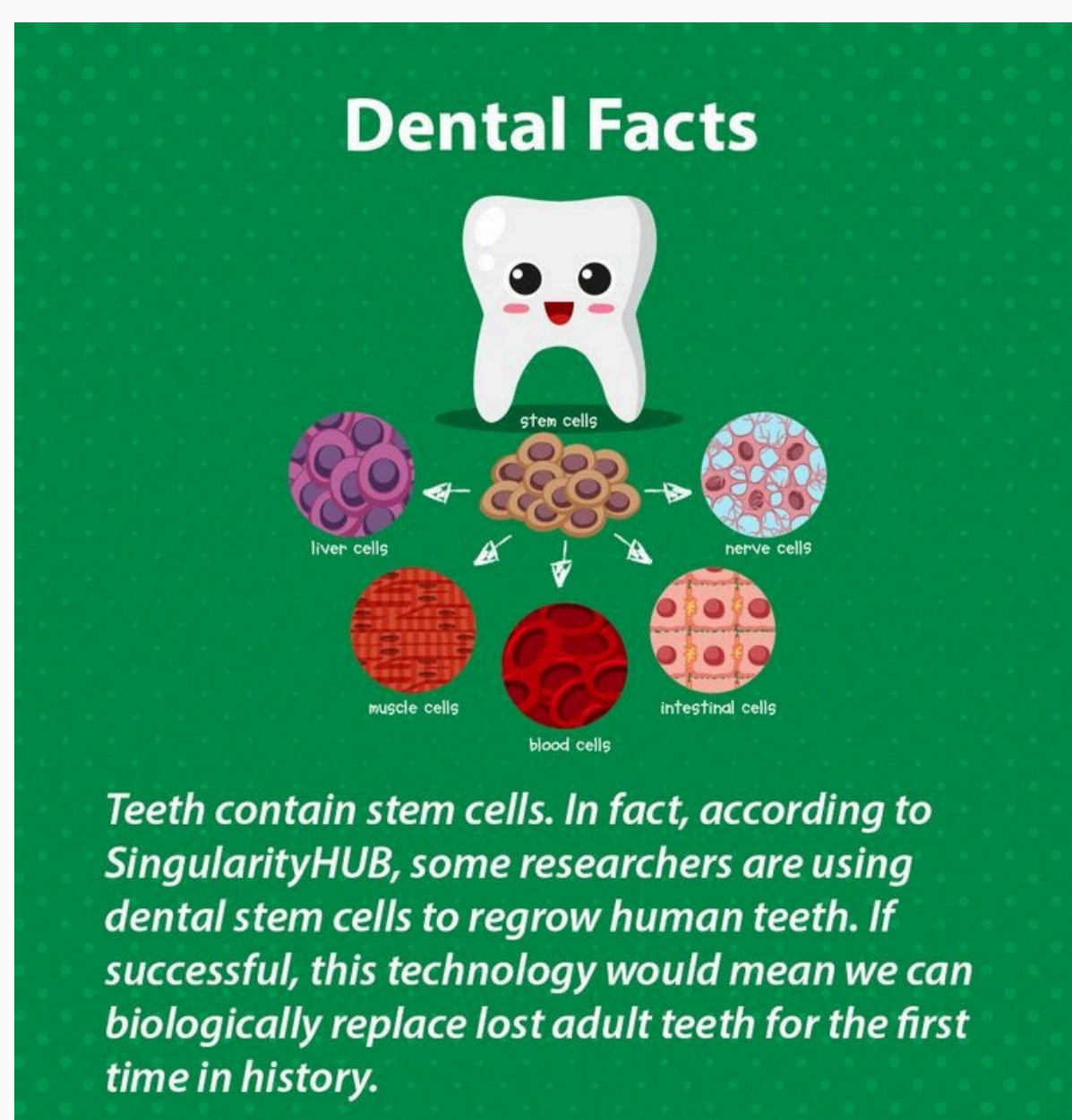
**CRANIOFACIAL DEFECTS: STEM CELLS AID IN REPAIRING CONGENITAL OR ACQUIRED DEFECTS, SUCH AS CLEFT PALATE OR JAWBONE DEFECTS.**

**TMJ DISORDERS: MESENCHYMAL STEM CELLS (MSCS) CAN REGENERATE CARTILAGE IN TEMPOROMANDIBULAR JOINT (TMJ) DISORDERS.**

**ORAL CANCER THERAPY: STEM CELLS ARE STUDIED FOR DELIVERING TARGETED THERAPIES OR ENHANCING THE EFFICACY OF TREATMENTS LIKE RADIOTHERAPY AND CHEMOTHERAPY.**

## **4. IMPLANTOLOGY AND BONE REGENERATION**

**STEM CELLS ARE USED TO REGENERATE ALVEOLAR BONE, IMPROVING THE SUCCESS OF DENTAL IMPLANTS. BONE MARROW STEM CELLS (BMSCS) AND ADIPOSE-DERIVED STEM CELLS (ASCs) ARE COMMONLY APPLIED FOR THESE PURPOSES.**





## 5. SALIVARY GLAND REPAIR

STEM CELLS CAN REGENERATE SALIVARY GLAND TISSUE DAMAGED BY RADIATION THERAPY, ALLEVIATING ISSUES LIKE XEROSTOMIA (DRY MOUTH).

## 6. REGENERATIVE ENDODONTICS

STEM CELLS CAN RESTORE THE VITALITY OF TEETH BY REGENERATING THE PULP-DENTIN COMPLEX IN IMMATURE TEETH WITH NECROTIC PULPS.

## 7. ORTHODONTICS

STEM CELLS ARE BEING EXPLORED TO ENHANCE ORTHODONTIC TOOTH MOVEMENT AND REPAIR ROOT RESORPTION CAUSED BY ORTHODONTIC TREATMENTS.

## COMMON SOURCES OF DENTAL STEM CELLS:

**DENTAL PULP STEM CELLS (DPSCS):** FOUND IN THE PULP TISSUE OF PERMANENT TEETH.

**STEM CELLS FROM HUMAN EXFOLIATED DECIDUOUS TEETH (SHED):** DERIVED FROM BABY TEETH.

**PERIODONTAL LIGAMENT STEM CELLS (PDLSCS):** LOCATED IN THE PERIODONTAL LIGAMENT.

**STEM CELLS FROM APICAL PAPILLA (SCAP):** FOUND AT THE ROOT TIPS OF DEVELOPING TEETH.

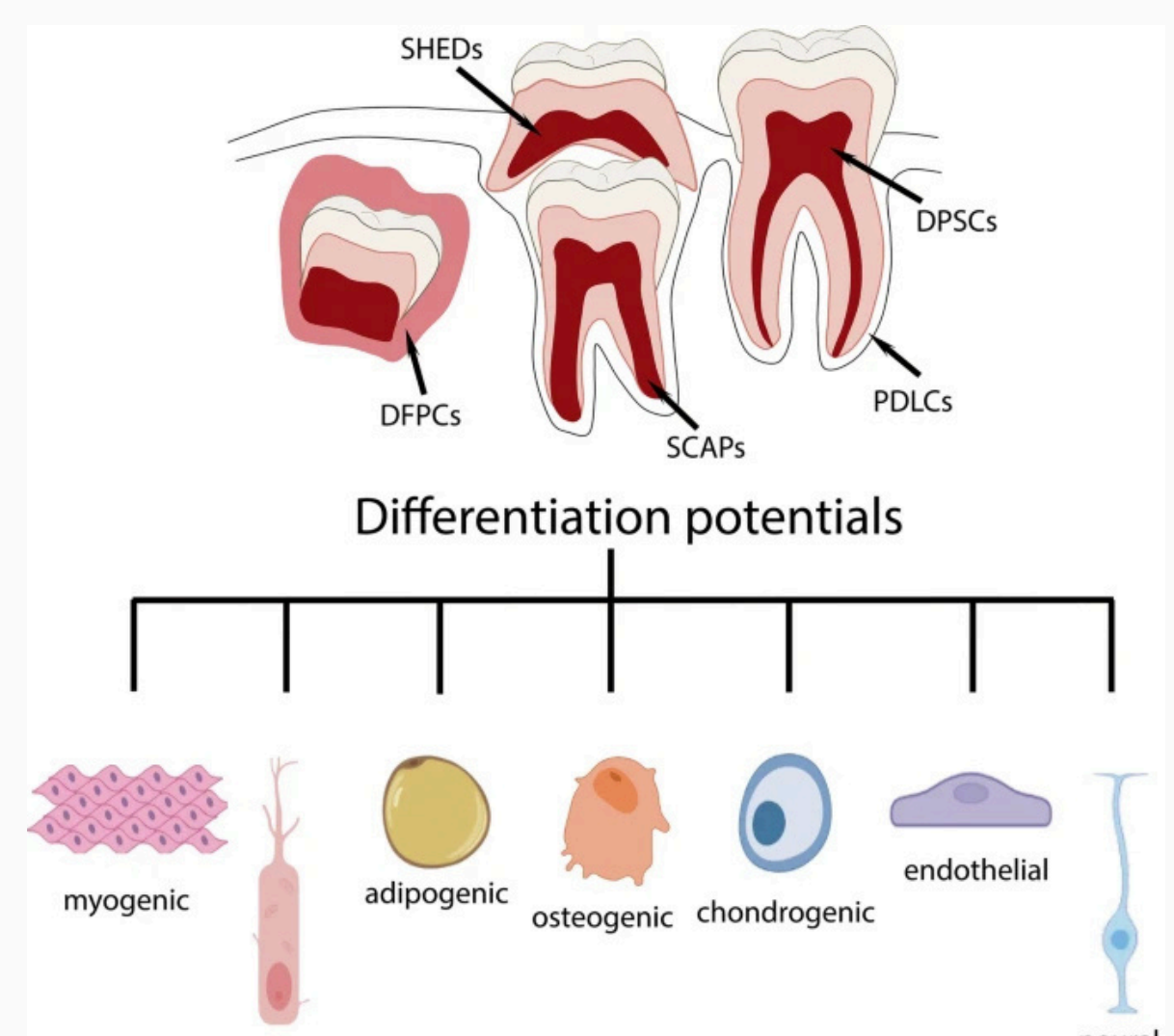
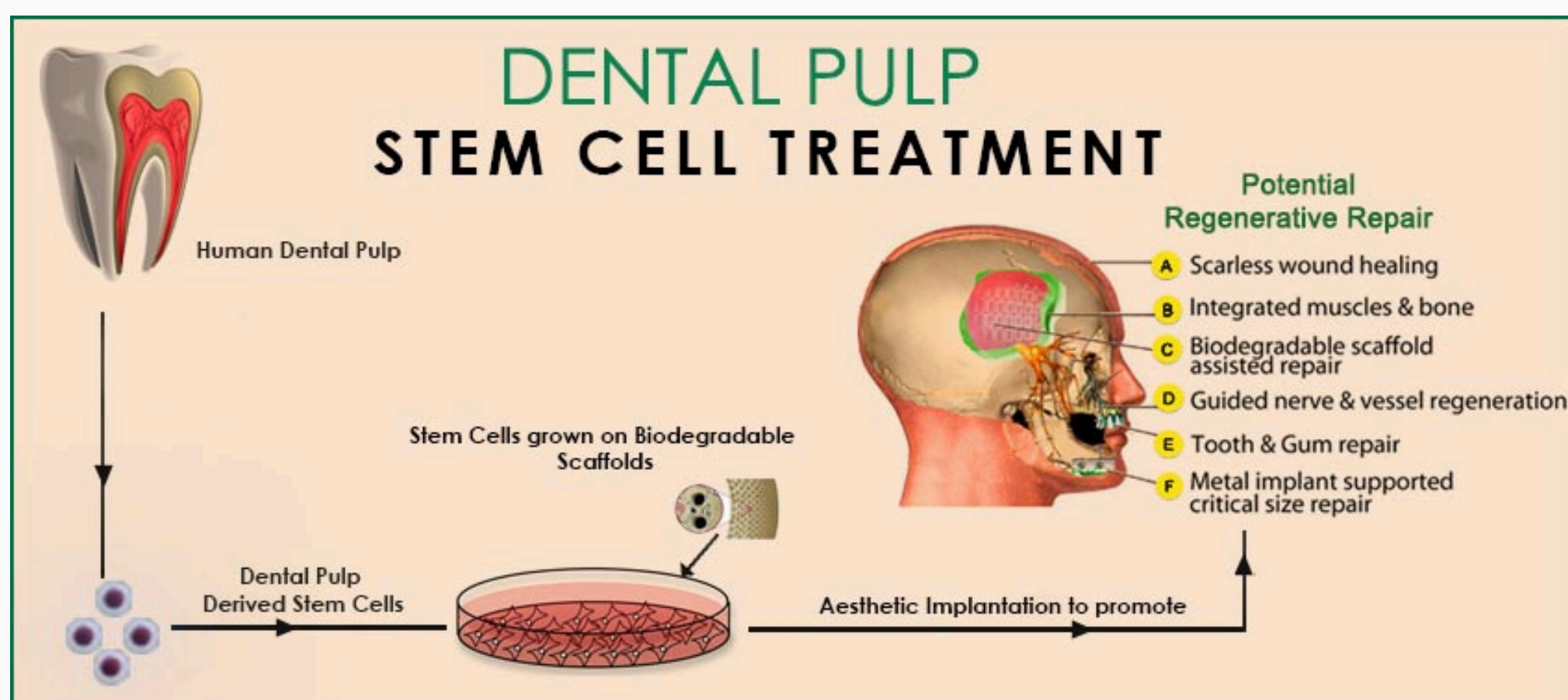
**DENTAL FOLLICLE PROGENITOR CELLS (DFPCS):** PRESENT IN THE DENTAL FOLLICLE OF DEVELOPING TEETH.

## FUTURE DIRECTIONS:

**PERSONALIZED REGENERATIVE THERAPIES USING PATIENT-SPECIFIC STEM CELLS.**

**COMBINING STEM CELL THERAPY WITH 3D BIOPRINTING TO CREATE CUSTOMIZED DENTAL TISSUES AND STRUCTURES.**

**STEM CELL-BASED THERAPIES HOLD IMMENSE PROMISE FOR TRANSFORMING DENTAL MEDICINE, SHIFTING THE FOCUS FROM TRADITIONAL TREATMENTS TO BIOLOGICALLY-DRIVEN REGENERATIVE SOLUTIONS.**



# Stem Cells & Dental Stem Cells



## WORLD'S BIGGEST DENTAL STEMCELL BANK

### Stem Cells

Stem cells are the master cells of our body. Stem cells are characterized dependent on two major characteristics, long time self-renewal capacity even after inactive for a longer period and differentiation ability (one or more different specialized cell types).

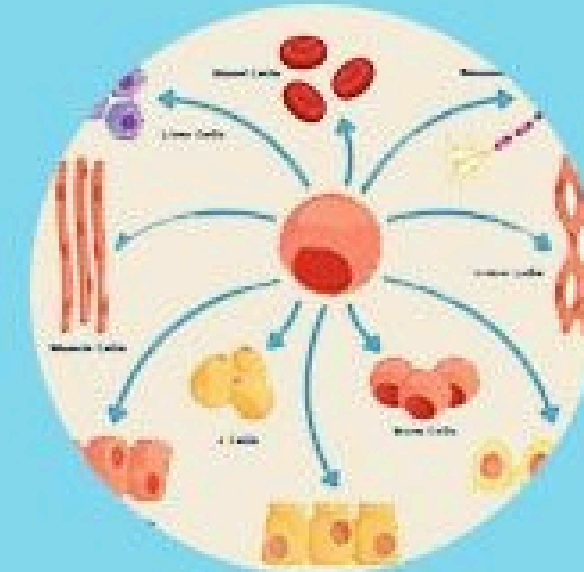
Adult stem cell showed plasticity towards some specific lineage

Stem cells have 3 different types.

Embryonic Stem Cells

Induced Pluripotent Stem Cells

Adult Stem cell



### Adult Stem cells

Adult Stem cells are unique human cells that can form into various cell types, from muscle cells to nerves. Now and again, they have the ability to repair damaged tissues. Stem cells can generate cells to replace those that are lost through normal repair, disease, or injury.

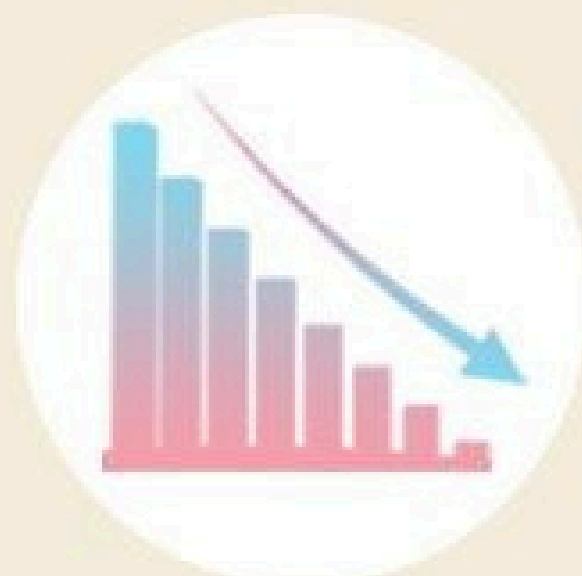
Adult stem cells are categorized into two types.

Hematopoietic Stem Cells (Blood Stem Cells)

Mesenchymal Stem Cells (Tissue Stem cells).

### Dental Stem cells

Stem cells found in the tooth pulp are called dental stem cells. The dental pulp stem cells are found within the child's milk teeth and healthy adult teeth. These cells have remarkable regenerative potential and can convert into different types of cells. Tooth derived cells are considered to be naive cells which allow these cells to adapt and repair cells like muscles, nerves, joints and even a damaged heart. The tooth pulp is an extremely good source for the mesenchymal stem cells. Mesenchymal stem cells have the ability to eventually form dentin, enamel, nerves tissues, blood vessels, and dental pulp.



### Mesenchymal stem cells decline with age

Traditionally bone marrow is a very rich source for hematopoietic stem cells whereas it's not that great source for mesenchymal stem cells. MSCs availability drastically reduces in the bone marrow when the age of an individual increase. Researchers state mesenchymal stem cells decline with age. As illustrated in the below graph, per marrow we can found ONE mesenchymal stem cell in every 10,000 cells when the child is under 11 years. When the child's age becomes 18 plus years, the availability of mesenchymal stem cells goes down 10 times and we can only found 1 mesenchymal stem cell in every 1,00,000 cells and so on..

### Reasons to store your child's dental pulp stem cells today

Banking stem cells at the age of 5-11 years means they are available anytime throughout your children's lifespan. Whenever they need it in the future, there is no need to identify a suitable match and no necessity or hassle to search. They can directly use them from the bank.

Younger the stem cells the more the effectiveness. Before they can deteriorate with age, store your child's tooth stem cells today.

