

## Introduction

What are Stem Cells?

- Stem cells have been around for over 150 years. They were first discovered in bone marrow, and have since been found all over the body (Mosaddad et al., 2022, p. 1).
- Stem cells are undifferentiated cells that can change to all different types of cells throughout the body (Mosaddad et al., 2022, p. 2).
- Dental specific stem cells include the following: dental pulp pluripotent-like stem cells, dental epithelial cells, and periodontal ligament stem cells (Souidi et al., 2021, p. 455).

## Why are Stem Cells Used in Dentistry

- Tissue can be lost in the craniofacial region that affects either the function or aesthetic of the area, which can lead to physiological issues (Mosaddad et al., 2022 p. 3).
  - Stem cells can regenerate the lost tissue restoring function and aesthetic of the area (Mosaddad et al., 2022, p. 3).
- The loss of alveolar bone can also cause complications with restorations due to the lack of supporting structure (Costela-Ruiz et al., 2021, p. 5).
  - Using stem cells with restorations can add stability and ensure the restorations do not shed from the oral cavity.
- Bone tissue loss in the craniofacial area is often due to periodontal disease, congenital abnormalities, tumors, traumatic injuries and resorption following tooth loss (Mosaddad et al., 2022, p. 2).
  - Without stem cells, tissue regeneration after tissue loss due to the reasons above would be inadequate, affecting the function of the oral cavity (Mosaddad et al., 2022, p. 2).

## The Use of Stem Cells in Dentistry

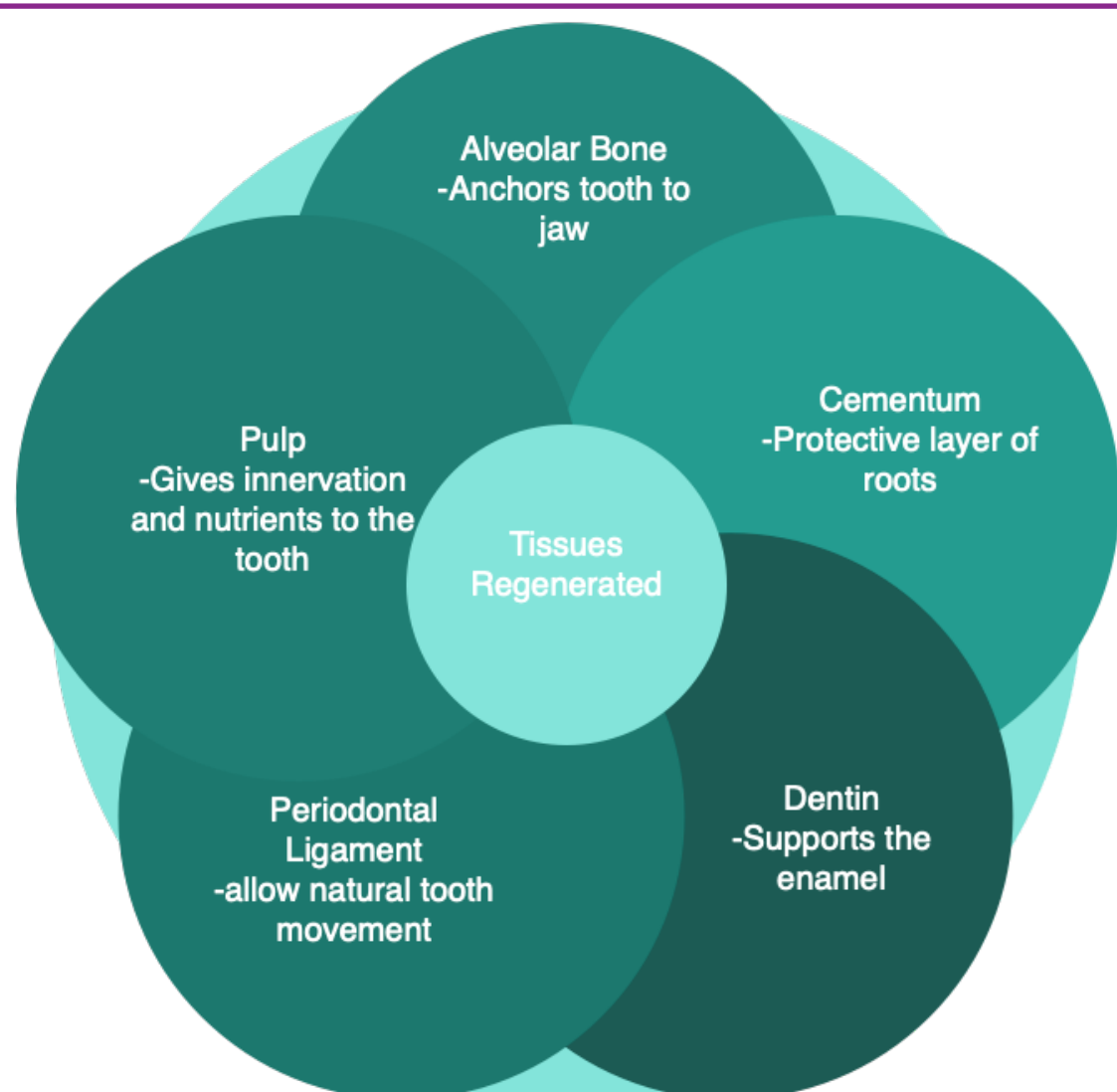
Stem cells can be extracted from the dental pulp extracellular matrix to aid in regeneration. Once extracted, they are cultured in a growth medium depending on their use (Yuan et al., p. 441).

Stem cell uses in dentistry:

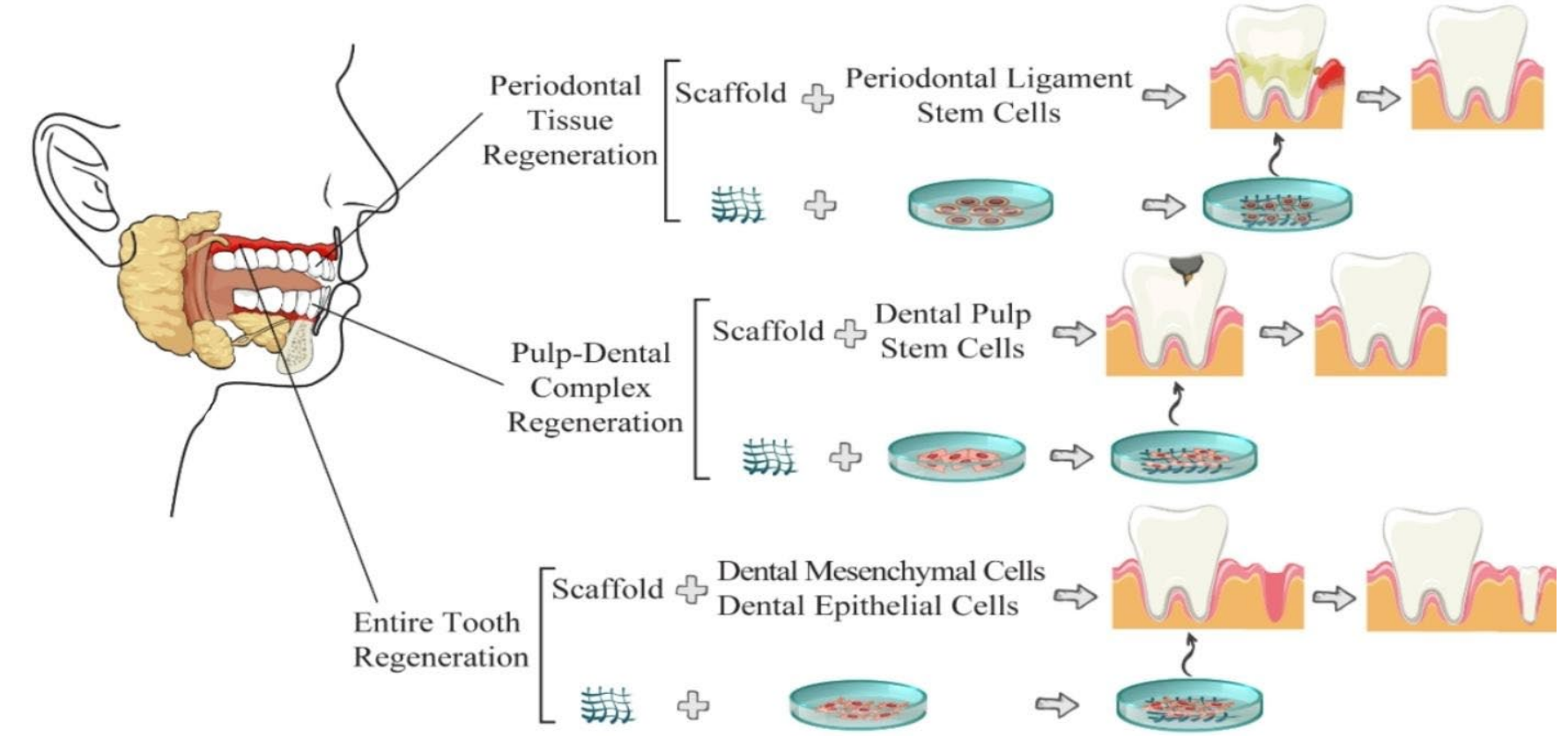
- Artificial bone construction
- Aid in mineralization using proteins extracted from extracellular matrix
- Generation of artificial soft tissues

(Souidi et al., 2021, p. 469, 478, 480)

## Benefits of Using Stem Cells in Dentistry



## Various Stem-Cell Based Strategies Used in Dentistry



Source: Souidi, A., Yazdani, M., Ranjbar, R., Tebyanian, H., Yazdani, A., Tahmasebi, E., Keshvad, A., Seifalian, A. (February, 2021) *Role and Application of Stem Cells In Dental Regeneration: A Comprehensive Overview*. EXCLI Journal 2021; 20:454-489, 1611-2156

## Dental Mesenchymal Stem Cells Used in Neuro-Regeneration

Dental Follicle Stem Cells (DFSCs)			Dental Pulp (DPSCs & SHED)		
Stem Cell Markers	Cell Surface Markers	Neural Markers	Stem Cell Markers	Cell Surface Markers	Neural Markers
OCT4	CD44/CD90	Nestin	OCT3/4	CD133	Nestin
SOX2	HLA-ABC	β-III-tubulin	NANOG	CD29	β-III-tubulin
	Stro-1	p75	SSEA4	CD44	Synaptophysin
		GFAP		CD146	S100
				TNF receptor superfamily	GFAP
				IL-receptors	

Periodontal Ligament Stem cells (PDLSCs)			Stem Cells from Apical Papilla (SCAP)		
Stem Cell Markers	Cell Surface Markers	Neural Markers	Stem Cell Markers	Cell Surface Markers	Neural Markers
OCT3/4	CD105	NG2	OCT3/4	Stro-1	Nestin
NANOG	CD90		NANOG	CD146	GFAP

Source: Bonaventura, G., Imcontro, S., Lemmo, R., La Cognata, V., Barboglio, I., Costanzo, E., Barcellona, M. L., Pelliceri, R., & Cavallaro, S. (2020). Dental mesenchymal stem cells and neuro-regeneration: a focus on spinal cord injury. *Cell and tissue research*, 379(3), 421-428. <https://doi.org/10.1007/s00441-019-03109-4>

## How Do Stem Cells Advance Dentistry

- Stem cells are a constant advancing technology because of their self renewable nature they are constantly finding new advantages. Present day studies have demonstrated their many uses such as:
  - aid in mineralization
  - artificial bone tissue construction
  - oral maxillofacial periodontal tissue engineering (Mosaddad et al., 2022, p. 14)
- Regeneration of periodontal tissue was once a dream of the future but because of studies conducted there has been many advancements. One study found the addition of the Platelet Rich Plasma aided the extracellular matrix regeneration and osteogenic differentiation of PDL stem cells which was found to improve the placed sheets' regenerative abilities of the periodontal tissue. (Mosaddad et al., 2022, p. 17)
- There is no limit to their use in the future and advancements as they have renewable properties. A possible advancement is the dental stem cells use in the regeneration of dental enamel which, as of current day medicine, is not possible (Mosaddad et al., 2022, p. 14).

## Role of the Dental Hygienist

For dental hygienists the role of education is important in the topic of stem cell regeneration. Practicing clinicians can be educated on the benefits of dental tissue cell regeneration with the use of various stem cell types. With this, patients who are in need of these practices and procedures can be properly informed about the options and opportunities available with the new and evolving studies. This is important due to the fact that patients are most likely unaware of these advances.

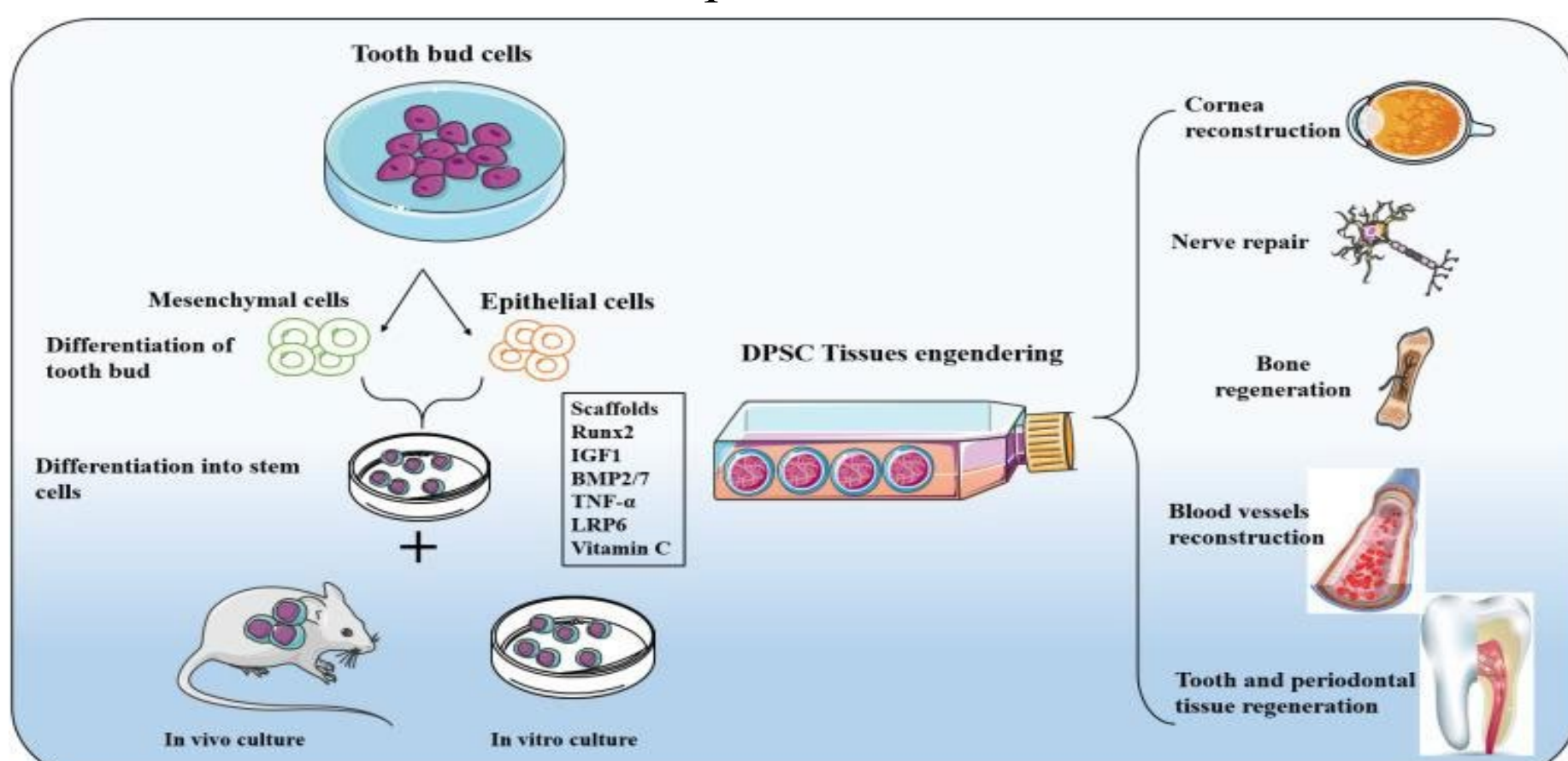
## Conclusion

- Using stem cells for regenerative purposes in dentistry is becoming more popular due to recent studies.
- Stem cells are being harvested to store and use for future treatments due to their predictive results. Practitioners are able to use the stem cells to replace lost or damaged tissues from different areas of the mouth that would not naturally regenerate (Yuan et al., 2022, p. 440).
- This form of regenerative dentistry is becoming more known due to dental tissues being stronger than implants or dentures (Souidi et al., 2021, p. 456).

## References

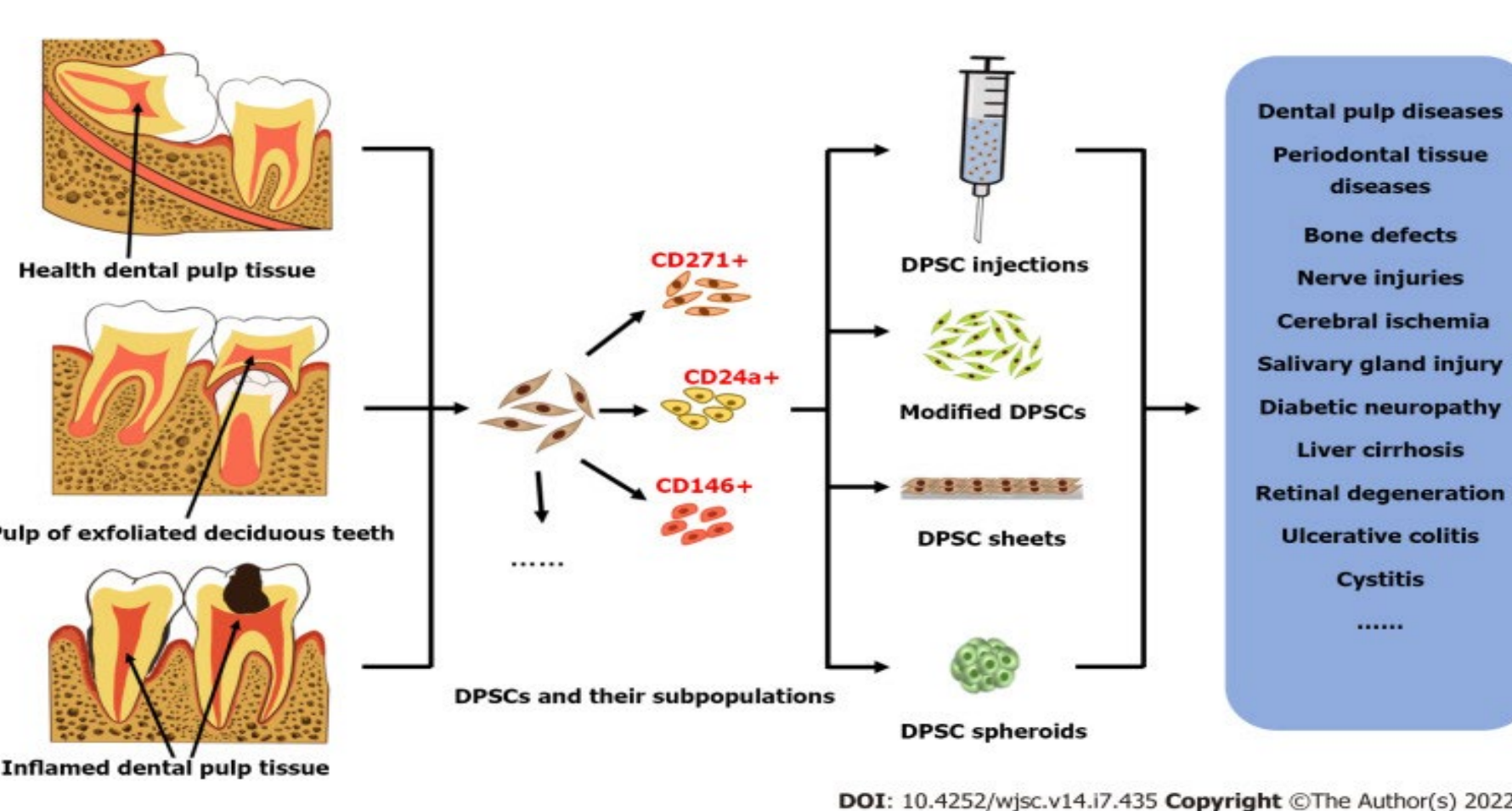
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## Differentiation of Dental Pulp Stem Cells



Source: Liu, P., Zhang, Y., Ma, Y., Tan, S., Ren, B., Liu, S., Dai, H. Y., & Xu, Z. (2022, January 11). Application of dental pulp stem cells in oral maxillofacial tissue engineering. *International journal of medical sciences*. Retrieved April 30, 2023, from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8795794/>

## Sources of Stem Cells and Their Application in Regenerative Medicine



Source: Yuan, S.-M., Yang, X.-T., Zhang, S.-Y., Tian, W.-D., & Yang, B. (2022, July 26). Therapeutic potential of dental pulp stem cells and their derivatives: Insights from basic research toward clinical applications. *World journal of stem cells*. Retrieved April 30, 2023, from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9350620/>