شبكة المعلومات الجامعية

التوثيق الإلكتروني والميكروفيلم

بسم الله الرحمن الرحيم

HANAA ALY

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جامعة عين شمس

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Influence of The Use of Scaffold on The Regeneration Potential of Necrotic Immature Human Permanent Anterior Teeth: Clinical Study

Thesis

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Ahmed Mohamed Khalil

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List of Abbreviations

ALP	Alkaline Phosphatase
BMPs	Bone Morphogenic proteins
BPC	Bismuth Oxide Containing Portland Cement
$Ca(OH)_2$	Calcium Hydroxide
CBCT	Cone Beam Computerized Tomogram
CEJ	Cementoenamel Junction
CHX	Chlorhexidine
DAP	Double Antibiotic Paste
EDTA	Ethylenediaminetetraacetic acid
EMD	Enamel Matrix Derivative
EMP	Enamel Matrix Proteins
HDPCs	Human Dental Pulp Cells
IL	Interleukin
MTA	Mineral Trioxide Aggregate
NaOCl	Sodium Hypochlorite
PDL	Periodontal Ligament
PRF	Platelet Rich Fibrin
PRP	Platelet Rich Plasma
RET	Regenerative Endodontic Treatment
TAP	Triple Antibiotic Paste
TGF	Transforming Growth Factor

Introduction

1. Introduction

Necrotic immature permanent teeth present a problem in dentistry as no further root completion occurs, leaving open apecies that make cleaning and shaping of wide blunderbuss roots and creating an apical stop or having an apical seal in endodontic treatment difficult. Having incomplete dentin deposition, the root is more prone to fracture during mechanical filing or lateral condensation due to thin dentinal walls. Also increased tooth mobility is expected with the periodontal breakdown resulting from the poor crown-to-root ratio. Endodontic surgery and retrograde filling were used for treating such cases, but this approach is invasive and has its disadvantages as surgical complications and the already fragile root.

Apexification is a technique that was firstly introduced by **Kaiser, 1964** using calcium hydroxide (Ca (OH)2) and later by **Torabinejad and Chivian, 1999** using mineral trioxide aggregate (MTA). It entails creating an apical stop or stimulating its formation using one of the mentioned materials.

Regeneration is a technique that is more superior to apexification as it results into normal maturation of the root entirely achieving increase in root length preventing tooth mobility and increase in radicular dentinal wall thickness leading to increased root resistance to fracture **(Cehreli et al., 2012)**.

The current idea of pulp tissue regeneration incorporates two potential methodologies. The first is revascularization, where another pulp tissue is required to develop into the root canals from the excess tissues that exist apically in the root canal. The second incorporates the replacement of the infected pulp with a healthy tissue that can revive the tooth and reestablish dentin formation. Stem cell therapy, gene therapy, three-dimensional (3D) cell printing, scaffold implantation, and pulp implantation are suggested for this methodology.

The idea of revascularization was presented by **Ostby, 1961**. The revascularization procedure relies upon the acceptance of seeping through the

open apical foramen intra the chemically cleaned canal. The canal dentin and the blood clot give scaffolds in the root channel revascularization **(Banchs and Trope, 2004)**. More as of late, platelet-rich plasma (PRP) and platelet-rich fibrin (PRF) are recommended as additional potential scaffolds **(Torabinejad and Turman, 2011)**.

In the last few years, enamel matrix derivative (EMD) has also been used as a scaffold in regenerative endodontics and it carries great hopes for continuation of root development in immature necrotic permanent teeth.

A trial was made by **Scarparo et al., 2012** where he evaluated the enamel matrix derivative (EMD) biomaterial in nonvital immature teeth of rats. They concluded that EMD can be considered an option in the treatment of nonvital immature teeth. The ingrowth of cementum-like tissues into canal spaces supported dental wall thickness and may add to tooth resistance and backing.

Another examination was directed by **Matsumoto et al., 2014** to research the impacts of Emdogain gel (EMD) on the damaged open apex within periapical lesions which were initiated in rats. They discovered convincingly that EMD doesn't aggravate harmed periapical tissue and may establish a great climate that advances the healing of injured periapical tissues.

Therefore, the purpose of this study was to investigate the use of scaffolded revascularization using EMD with MTA in comparison to conventional MTA revascularization in human permanent anterior teeth.

Review of Literature

2. Review of Literature

Lately, regenerative endodontic strategies have arisen as a promising option in contrast to apexification, due specifically to points of interest like root improvement and fortification which forestall root breaks by increasing root length and thickening the dentin divider **(Narang et al., 2004)**. The regenerative endodontic treatment of nonvital tainted teeth may happen two ways: (1) utilizing tissue engineering technology, which is portrayed by the dynamic recovery of the dentin-pulp complex to embed or regenerate the pulp **(Bansal and Bansal, 2011)**; and (2) pulp revascularization, a methodology wherein another tissue is relied upon to be formed from the tissue present in the teeth, taking into account the continuation of the improvement of the root **(Bansal and Bansal, 2011)**.

2.1 Revascularization Modalities:

Claus et al., 2004 performed a study to learn more about the pulpal changes in auto-transplanted immature teeth whose pulp tissue was taken out before transplantation. The exploratory material comprised of 16 single-established teeth with open apices, from a beagle dog (3 months old enough). On day 0, 4 teeth were extracted, the pulpal tissues were eliminated, and the teeth were then relocated to their contralateral side. A similar strategy was done on days 9, 16, and 23, each time for 4 single-rooted teeth. Longitudinal paraffin segments were made for histologic examination. The outcomes demonstrated that, following 7 days, 2 of the 4 teeth had an ingrowth of new tissue more than one fourth of their length. Following 14 days, every one of the 4 teeth had ingrowth (≥ one fourth of the pulp chamber). At the 21-day perception, the greater part of the pulp chamber of all teeth were filled, and, following 30 days, there was all out ingrowth in 3 of the 4 teeth. This new tissue consisted of well-organized and well-vascularized connective tissue.