

UNIVERSITI TEKNOLOGI MARA

**RADIOGRAPHICAL DIMENSION
CHANGES AND WOUND HEALING
EVALUATION OF AUTOLOGOUS
DENTINE PARTICLES IN
COMBINATION WITH PLATELET-
RICH FIBRIN (PRF) AND
COLLAGEN PLUG- IN HUMAN
ALVEOLAR RIDGE
PRESERVATION: A RANDOMISED
CONTROLLED TRIAL**

FAZLIEHA BINTI KAMARUDDIN

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ABSTRACT

Alveolar ridge preservation (ARP) procedures effectively reduce physiological bone resorption and accelerate bone regeneration, which may lead to better prosthetic and aesthetic outcomes for patients. Numerous grafting materials have been utilised for this procedure, including autogenous bone, xenografts, or allografts. However, these materials possess several drawbacks such as excessive harvesting methods of autogenous bone which may increase the patient's morbidity. Meanwhile, there is a risk of contamination, rejection, and infection, as well as a high cost for xenografts and alloplastic bone grafts. Dentine particles (DP) derived from the extracted tooth are an alternative grafting material mainly consisting of type I collagen and various growth factors such as bone morphogenic proteins, which can stimulate the cellular response of osteogenic lineages, enhancing the potential for bone regeneration. Platelet-rich fibrin (PRF) is a natural fibrin-based biomaterial that aids in micro-vascularisation and wound healing. Collagen plug (CP) also contains collagen type I, which may accelerate the osteogenesis, apart from stabilizing the grafting materials. Thus, combining these three has been proposed as an alternative option for ARP.

This research aims to provide an overview of the usage and explore the potential of DP, PRF, and CP in bone regeneration to improve ARP treatment outcomes, which is one of the alternative options in ARP. In this study, thirty-three mandibular extraction sockets were randomised into three groups, where the first test group (A) was filled with DP, PRF, and CP, the second positive control group (B) was filled with PRF and CP only, while the third negative control (C) was left empty. Early wound healing was assessed through the Early Healing Score (EHS) at 10 ± 4 days post-ARP, evaluating three key parameters which are clinical signs of re-epithelialization (CSR), hemostasis (CSH), and inflammation (CSI). Three-dimensional radiographic evaluation was performed to measure the changes in ridge width (RW), buccal ridge height (BH), lingual ridge height (LH) and buccal bone thickness (BBT) after 6 months of ARP.

The study found comparable early wound healing outcomes among all groups, with no significant differences in EHS scores for re-epithelialization (Group A: 2.1 ± 0.3 , Group B: 2.0 ± 0.4 , Group C: 1.9 ± 0.5), hemostasis (Group A: 1.8 ± 0.4 , Group B: 1.7 ± 0.5 , Group C: 1.6 ± 0.6), and inflammation scores (Group A: 1.5 ± 0.5 , Group B: 1.6 ± 0.6 , Group C: 1.7 ± 0.7). In terms of RW, group A demonstrated the smallest reduction (0.43

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CHAPTER 1

INTRODUCTION

1.1 Research Background

Dental extraction is the last resort regarding the tooth's fate, with periodontal disease and dental caries being the most common cause (Passarelli et al., 2020). After tooth extraction, the alveolar process resorbs, affecting the replacement of missing teeth with dental implants and prostheses. Physiological ridge resorption is a common effect of dental extraction. An alveolar ridge's dimensional changes after extraction are relatively inevitable over time (Kim et al., 2014).

When a tooth is extracted, a blood clot initially forms in the socket, and polymorphonucleocytes migrate to the area as part of the body's defence against infection (Gomes et al., 2019). This is followed by coagulative necrosis, forming a provisional matrix that includes new blood vessels and immature collagen fibres (Diller & Tabor, 2022). By day seven, the bundle bone starts to undergo resorption, with osteoclastic activity creating small voids in the bone (Siddiqui & Partridge, 2016). Angiogenesis facilitates the entry of new blood vessels into the socket, and woven bone forms around them (Hankenson et al., 2011). Between days 7 and 14, the lining of the bundle bone is removed, and by day 14, bone development progresses further (Udeabor et al., 2023). The resorption of the bundle bone impacts implant stability, as the loss of the bundle bone results in a reduction of both the height and width of the buccal bone (Fee, 2017). During the healing of the alveolar socket, the periodontal ligament is lost, directly impacting the preservation of the bundle bone (Araújo & Lindhe, 2005a). The wall of the dental alveolus is primarily composed of a thin layer of cortical bone, often referred to as bundle bone, alveolar bone proper, lamina dura, or cribriform plate (Hubar, 1993). This layer typically has a thickness ranging from 0.22 to 0.54 mm (Hubar, 1993). Bundle bone is a specialized structure where the fibres of the periodontal ligament attach (Jiang et al., 2016). Once a tooth is extracted, the periodontal ligament disappears, leading to the loss of the bundle bone (Hansson & Halldin, 2012). The surrounding alveolar bone resorbs as the bundle bone deteriorates, particularly in individuals with a thin periodontal phenotype (Chappuis et al., 2013).