Effects of Different Angulation Placement of Mini-Implant in Orthodontic

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Abstract. Orthodontic is one of the treatments in dentistry field which concerned on malocclusion treatments such as improper bites, tooth irregularity and disproportionate jaw relationships. The mini-implant (OMI) is one of the components used in the orthodontic treatment, besides braces and spring. The application of OMI has been well accepted in orthodontic treatment. However, one of the main factors of OMI failures is the implant insertion procedure in which the clinician find it difficult to obtain the best angle to insert the OMI. Therefore, this study aims to evaluate stress in an OMI and bones using the finite element analysis (FEA) with variations of insertion angles and to identify their optimal angle for the implant placement. The three dimensional (3D) model of a left maxillary posterior bone section was constructed based on CT image dataset. That 3D model consists of cortical bone, cancellous bone, second premolar, first molar and second molar teeth. The 3D model of OMI was placed between root of second premolar and first molar teeth. The OMI was simulated with seven different angles of insertions: 30°, 40°, 50°, 60°, 70°, 80° and 90°. Within the seven different insertion angles, the results showed that the increase of insertion angle reduced the maximum equivalent von Mises stress in cortical bone, cancellous bone and OMI. Based on this FEA study, the optimal angle placement of OMI is when the implant positioned at vertical angle (90°) to the bone surface.

Introduction

Very few people have perfect teeth alignment; most of them have abnormal problem of teeth alignment or abnormal problem of face appearance. This situation usually will result in difficulties or discomfort when biting or chewing, problem in speech, improper in tooth cleaning, increased the risk of tooth decay and periodontal (gum) diseases. Due to the difficulty in biting or chewing, patients may not eat certain foods that provide good nutrition for their body [1, 2]. The problems of teeth configuration cause many difficulties to the patients and therefore, the best solution to overcome the problems is by undergoing orthodontic treatment. This is the most appropriate treatment to improve oral health which focused on the diagnosis and treatment of dental and facial irregularities such as crowded, protruding teeth and crooked.

The orthodontic mini-implant is one of the components in the treatment besides braces and spring. A lot of factors contribute to the success of treatment such as selection of mini-implant dimension and implant placement site as well as the surgical procedures to insert the implant. All