Soft and Hard Tissues Remodeling and Alternations after Minimal invasive (Non-traumatic) Extraction of Molar Teeth

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ABSTRACT

Objectives: to evaluate and assess the amount of the soft and hard tissues remodeling and alternations after non-traumatic extraction of molar teeth.

Materials and Methods: Twelve patients were included following the assessment of general health and eligibility criteria. Atraumatic extraction of molar teeth using periotomes was done. Alginate impression was taken, and stent was fabricated on the included teeth. Two holes were made, 5 and 7 mm from the gingival margins for the measurement of horizontal width. After that, a bite index made of putty was taken as a reference guide for radiographs to measure the vertical height. For soft tissue measurement, we used the stent on the cast before extraction and 3 months after the extraction. Horizontal measurement using the caliper and stent in the patient mouth was performed prior to extraction and 3 months later.

Results: There were statistically significant differences in soft tissue changes at 5 and 7 mm. There was statistically significant difference in the amount of bone loss at the level of 5 mm in comparison with 7 mm, which was 7.67 mm loss at 5mm and 4mm loss at the level of 7 mm from the gingival margin. There was a difference in the vertical height from the reference line to the mesial and distal side of the extraction socket in comparison with the pre-extraction records.

Conclusion: There were minimal bleeding and minimal dimensional changes following the atraumatic tooth extraction was found.

KEY WORDS
periodontics, bone remodeling, extraction, minimal invasive dentistry

INTRODUCTION

Wound healing is a complex process that requires spatially and temporally regulated expression as well as coordinated interplay between many different types of tissues and cells response¹.² Bone resorption has been widely described in the literature as mainly occurring during the first 3 months after the extraction³. Therefore, wound healing of extraction sockets results not only in dimensional alterations of the underlying bone but also of the surrounding soft tissue architecture. Pronounced morphologic and dimensional alterations have been described in particular for the facial bone wall in experimental and clinical research⁴,⁵. The bone remodeling in the horizontal dimension can result in the loss of as much as 50% of the buccal wall⁶. In recent systematic reviews⁷, the authors stated that the bone remodeling pattern after tooth extraction in the maxilla displayed a mean bone shrinkage respectively in width and height. Hence, this study aimed to assess the amount of the soft and hard tissues remodeling and alternations after non-traumatic extraction of molar teeth.

MATERIALS AND METHODS

Ethical considerations:
This study was approved by the Dental Ethics Committee and Dental Students Research Facilitation Committee in "Al-Qassim University, College of Dentistry".

Study design and sample:
This study was a prospective clinical trial study. All patients attending the college dental were assessed and examined for eligibility. Inclusion criteria: extraction of an upper or lower first molar due to
are fractured during extraction are excluded from the study. Teeth are missing or designated for extraction, or the socket bony walls diseased (soft or hard tissue loss); have endo-perio lesions; the adjacent other condition affecting bone and soft tissue healing; have periodontal therapy, for prophylactic or other reasons; have malignancies or any form. Patients immunocompromised or diabetic; undergoing antibiotic therapy are invited to participate in the study and enrolled after signing the consent form. Data collection:

The assessment form used in this study, includes social data regarding participants, file number, contact number, date of extraction, tooth number, medical history, and presence of periodontal disease. Alginate impression was taken to enrolled patients, and the constructed cast was used to construct a stent, small holes were created in the stent on the mid buccal and palatal/lingual sides 5 and 7 mm apical to gingival margin for future measurements. Other data was collected on clinical measurements at the extraction visit and at a recall visit 3 months later. Additional measurements were made on radiographs and study casts directly after extraction and 3 months later.

Clinical measurements:

Directly after extraction, a periodontal probe (Michigan O probe with William’s markings) was used to measure the distance from the midpoint of the crest of the facial gingival margin to the midpoint of the crest of the labial alveolar plate. An osteometer (Oraltronics, Sybron Implant Solutions, accuracy ± 0.2 mm) was used to measure the width of the socket using the prefabricated stent at 5 and 7 mm apical to the gingival margin by penetrating the tissues until its two pointed heads reaches the bone. This assessment was repeated 3 months following extraction under local anesthesia using the prefabricated stent holes as reference points.

Tooth extraction:

Minimally traumatic extractions was carried out under local anesthesia (Figure 1A). Firstly, root separation will be completed using high speed hand-piece with fissured diamond bur with high caution not to damage the underlying bone. Secondly, periotomes (Figure 1B) was used to cut the periodontal ligaments around the tooth designated for extraction. Later, rotational movement with surgical forceps was then used to extract the tooth in vertical axis. Elevator was not used on buccal and palatal/lingual surfaces and line angles to ensure minimally traumatic extraction.

Radiographic measurements:

Standardized digital radiographs using paralleling technique was taken immediately and 3 months following extraction. A bite index (Figure 1C) made with putty material was used to standardize the radiographs for each participant. Using the digital radiographs and KODAK Dental Imaging Software (accuracy ± 0.03 mm), bone levels at the mesial aspect of the tooth distal to the extraction site and at the distal aspect of the tooth mesial to the extraction site was determined by measuring the distance from a reference line connecting the cemento-enamel junction points on surfaces of the adjacent teeth to the bone levels at these sites. Bone levels at the distal and mesial aspects of the socket of the extracted tooth was determined by measuring the distance from a reference line connecting the cemento-enamel junction points of the adjacent teeth to the bone levels at these sites. Differences between the measurements from the radiograph taken at the time of extraction and 3 months...
months later was used to determine changes in bony contour (Figure 2).

Measurements from study models:

Alginate impressions will be taken prior to extraction and 3 months later. The constructed casts and a caliper will be used to assess the changes in the dimensions of the alveolar ridge at the extraction site (accuracy ± 0.03 mm). The stent already fabricated on the cast and used for measurement as reference points will be used on these two casts to mark the 5 and 7 mm points apical to the gingival margins prior to extraction. These points will then be used to measure the differences in width of alveolar ridge for the soft tissue prior to extraction and 3-months follow-up period.

Statistical analyses

Data were analyzed using SPSS Software (IBM). The data presented in the tables and texts are expressed as mean. Differences between pre- and post-extraction in hard and soft tissues means at 5 and 7 mm in horizontal dimension, and for vertical dimension, we used the cemento-enamel junction of the mesial and distal teeth to the bone crest and the differences from the reference line to the extraction socket for both mesial and distal tooth were tested using paired sample t-test.

RESULTS

A total of 12 patients with mean of age 31, (5 upper and 7 lower) were included in the study.

Table 1 show, statistically significant differences in soft tissue changes at 5 and 7 mm. The amount of soft tissue collapse at 5 mm was 4.17 mm and at 7 mm was 3.04 mm. There were statistically significant differences in hard tissue at the midpoint buccal and lingual bone in the level of 5 and 7 mm from the gingival margin.

The amount of bone loss at the level of 5 mm in compare to 7 mm was different, which was 7.67 mm loss at 5 mm and 4 mm loss at the level of 7 mm from the gingival margin.

Table 2 show, statistically significant differences in the vertical height from the reference line to the mesial and distal side of the extraction socket in compare to the pre-extraction records. The amount of hard tissue loss mesially to the extraction socket in 3 months was 1.034 mm and distally was 0.9 mm with no statistical difference (Table 1).

DISCUSSION

Understanding the healing process and the dimensional changes that occur in the alveolar bone and the soft tissue after extraction of the teeth is important to predict the final contour of the ridge and to know the factors that may affect the prosthetic efficiency and options. As previously mentioned a sample size of 12 subjects was included in this study and followed three months to measure the changes in the clinical records after the Atraumatic Extraction.

There was a highly statistically significant different in soft tissue changes between 5 and 7 mm. The amount of soft tissue collapse at 5 mm was a mean of 4.17 mm and at 7 mm was 3.04 mm (p < 0.001). This can be explained as, the collapse is a result of the socket healing and the soft tissue was supported by the bone how is already supported by the tooth before the extraction. Also, the healing process usually create a tension that will squeeze the socket that and produces pressure on the bone leading to further resorption. In addition, the thickness of the buccal and lingual plates of bone is thinner at 5 mm in compare to 7 mm.

In this study, there was statistically significant difference in hard tissue loss at the med point buccal and lingual bone in the level of 5 in compare to 7 mm from the gingival margin. In contrast, other study on premolars showed that there was no statistically significant difference between thick and thin gingival biotypes at both 5 and 7 mm from the gingival margins three months after the extraction1). Per mesial and distal side from the extraction socket, there was statistically significant difference in the vertical height from the reference line to the mesial and distal side of the extraction socket in compare to the pre-extraction records. The amount of hard tissue loss mesially to the extraction socket in 3 months was a mean of 1.034 mm and distally was 0.9 mm. This is not in agreement with Schropp et al2), where only 0.1 mm of bone loss was seen at the tooth surface mesial as well as distal to the extraction site. This disagreement might be explained by the use of subtraction radiography in the Schropp et al study. The amount of alveolar bone reduction after tooth extraction may affect or limit the prosthetic treatment options or influence the success rate of the implant supported fixed or removable partial dentures. Atraumatic extraction will not be the optimal measure to maintain the alveolar bone height and width but, it will be minimized the tissue laceration and provide good hemostasis and smooth healing. Socket preservation is advisable to prevent farther bone loss and provides good condition for future implant placement. Some authors reported conflicting results regarding this matter3-10). It should be considered that the study is underpowered due to the insufficient number of published studies that evaluate this matter in molar teeth.

CONCLUSION

In conclusion, there was a minimal dimensional change following atraumatic tooth extraction. Greater amount of soft tissue collapse was seen in 5 mm compared to 7 mm. Also, more bone loss at the level of 5 mm was noticed compared to the level of 7 mm. About 1 mm of bone loss in vertical height was seen in both mesial and distal aspect of extraction socket. There was a minimal bleeding after the atraumatic extraction. The horizontal dimension was intact after the atraumatic extraction. Soft tissue profile immediate after extraction was good.

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REFERENCES