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Original Research

Assessment of Wound Healing Following Surgical Extractions of mandibular third molar teeth Using the Inflammatory Proliferative Remodelling Scale

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ABSTRACT:

Introduction: monitoring and assessment of wound healing after oral surgical procedures is an important concern in dentistry. **Objective:** To monitor wound healing following surgical extraction of mandibular third molar using the Inflammatory Proliferative Remodelling (IPR) Scale. **Methods:** 200 otherwise healthy adult patients undergoing surgical extraction of mandibular 3rd molar were evaluated. The IPR Scale was completed, corresponding to the three phases of wound healing. Mean subscale and total scores were calculated. Patients graded their preoperative anxiety, intraoperative pain, and pain during follow-up on a 10 cm visual scale, and the findings were correlated with the IPR Scale scores. **Results:** Mean IPR total score (range 0–16) was excellent (14.43 ± 1.45). Mean scores by healing phase were as follows: inflammatory 6.35 (range 0–8); proliferation, 4.56 (range 0–5); remodeling, 2.83 (range 0–3). There was a positive correlation between mean preoperative anxiety level and intraoperative pain perception and a negative correlation between mean preoperative anxiety level and IPR Scale scores for each healing phase. Two cases were complicated by abscesses which resolved with treatment. **Conclusion:** The IPR Scale is a promising tool for the effective evaluation of the wound healing process following wisdom tooth extractions. Relaxation methods and behavioural adaptation might help to lower patient anxiety and thereby improve oral wound healing.

Keywords -Hypothalamic-pituitary-adrenal, Sympathetic-adrenal-medullary axes

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INTRODUCTION

monitoring and assessment of wound healing after oral surgical procedures is an important concern in dentistry. It has been extensively studied in the past, both in animals and in humans, and several studies have recently been carried out to review all knowledge about clinical and histological features of uncomplicated oral wound healing. Natural healing response is an essential phylogenetically primitive defence mechanism. Injuries of any kind initiate a complex series of cascade and often overlapping biological events toward restoring tissue integrity.¹ Any tissues follow an essentially identical pattern consisting of three main phases: inflammatory, proliferation, and remodelling. Oral surgical procedure like removal of impacted third molar teeth

frequently require incision and removal of alveolar bone. Hence it is of utmost importance to identify early signs and symptoms of complications in the tissue healing or healing socket. Assessment may allow us to perform timely interventions to ensure a good outcome and favourable progression of wound repair. Therefore, clinically wound healing scales may be useful to assess whether the healing is going towards satisfactory way in specific time interval.² Recently developed Inflammatory Proliferative Remodelling (IPR) Wound Healing Scale may assist surgeons in monitoring postoperative oral mucosal wound healing. The scale is divided into three subscales corresponding to the three phases of wound healing, and each is rated at the appropriate time point during follow-up period, yielding three

subscale scores and a total score. The outcome parameters of the subscales depend on the biological events that occur during that specific phase of wound healing.³ Hence, the aim of this present study was to evaluate the healing process following extraction of impacted mandibular third molar tooth procedures using novel IPR scale.

MATERIAL AND METHODS

The present in-vivo, prospective clinical study was performed in the Department of Oral and Maxillofacial Surgery on sub-urban and rural population with a sample size of 200 cases. Study participants included otherwise systemically healthy consecutive patients aged between 18-60 years who were diagnosed with a partially bony impacted mandibular third molar tooth based on panoramic radiographs (OPG) requiring surgical extraction. Exclusion criteria were pregnant or lactating mothers, diabetes mellitus, smoking habit (cigarettes or other tobacco materials), steroid intake and individual allergic to penicillin medication. All eligible patients who meet the inclusion criteria and agreed to participate in the study willingly were signed an informed consent form. The study protocol and consent form were approved by the institutional ethical board after thorough follow-up.

Tooth extractions were performed by an experienced oral surgeon. Extra oral area was cleaned with betadine solution. Pre-operative mouth rinse was performed with 0.2% chlorhexidine to reduce the bacterial load. Local anaesthesia was performed using 2% lignocaine with 1:100000 adrenaline (inferior alveolar nerve block, buccal and lingual block). A second examiner thorough with IPR scale ratings³ evaluated patient pain perception prior to the start of the procedure by tapping the tongue, lower lip, chin, and gums around the relevant tooth. A full thickness flap was raised to gain access to the tooth. Bone removal was done with rotary micromotor bur with copious saline solution. Tooth was removed either in-toto or in section as per situations. Socket was curetted, flushed with plenty on saline solution and suturing was performed with 3-0 silk sutures. After the extraction, all the patients were prescribed amoxicillin 500 mg three times/day for 7 days. Patients were instructed to rinse with chlorhexidine 0.2% mouth rinse two times per day for 10 days. Analgesics (diclofenac Na+paracetamol) were prescribed in case of pain.

Wound healing evaluation: At the time of the surgical procedure, an examine who is thorough with IPR scale asked each patient to describe their pre-operative anxiety level (registered before anaesthesia was induced) and intraoperative pain level (registered after anaesthesia was induced) by marking the appropriate place along a 10 cm line drawn on a A4 size paper. During follow-up, the IPR Scale was used to monitor the wound healing process. Patients were

requested to present at the department at 3-5 days, 14 days, and 6 weeks after the day of extraction. This roughly corresponding to the three phases of wound healing (inflammatory, proliferative, and remodelling phase) respectively. At each visit, the same examiner used the appropriate subscale to evaluate the wound. Each clinical manifestation was scored 0 or 1, yielding three subscale scores ranging from 0-8, 0-5, and 0-3, accordingly. The examiner also took a clinical photograph of the wound with a digital camera and submitted it for evaluation by another experts in oral and maxillofacial surgery to avoid bias. During the visits, patients again rated their pain level on the VAS. At the end of follow-up, the total score of the IPR Scale was calculated (0-16), where 0-4 indicated poor healing, 5-10 acceptable healing, and 11-16 excellent healing. The subscale scores were given different weights in the calculation of the total score commensurate with their importance to the healing process. The inflammatory phase was considered the most important because inflammation can endanger the subsequent series of biologic events leading to early wound healing. The remodelling phase carried the least weight because it can continue for several years and basically involves maintenance of stability.

Statistical analysis plan: Statistical analysis was conducted using SPSS software. Continuous variables were presented as means and standard deviations, and categorical variables as numbers and percent. Student t-test was used to compare continuous variables between groups and Fisher exact test or chi-square test, as appropriate, was used for categorical variables. Two-sided P values < 0.05 were considered statistically significant.

RESULTS

The study group included 200 patients (95 male, 105 female) of mean age 30.5±10.6 years. The mean operative time was 35.6±13.4 minutes. All the subjects finished the follow-ups.

The mean VAS score was 5.9±3.6 for preoperative anxiety and 2.4±2.4 for intraoperative pain. There was a positive correlation between preoperative anxiety and intraoperative pain (P value 0.65) (table 1). The mean total wound healing score on the IPR Scale was 14.43±1.45, which is considered excellent. The mean wound healing scores for the three subscales (phases) were as follows: inflammatory phase - 6.35±1.34; proliferative phase - 4.56±0.8; and remodelling phase, 2.83±0.51. There was a negative correlation found between the mean preoperative anxiety score on the VAS and the IPR Scale scores at each healing phase (inflammatory phase: r = 0.12, P = 0.34; proliferative phase: r = 0.02, P = 0.86; remodelling phase: r = 0.13, P = 0.64). The effect of patient sex and age on IPR Scale scores, for both the subscales and the total, and on patient anxiety and pain were additionally investigated. Comparison by sex showed a

significant between-group difference in the inflammatory phase, with female patients having a lower wound healing score than male patients (4.56±0.97 vs. 6.18±1.33, P value 0.003). To evaluate the effect of age, the study group was divided into two groups: 18–30 and 30–60 years. There were no significant between-group differences in any of the

subscale scores or the total score. Three cases were complicated at the first follow-up visit (inflammatory phase) by the formation of an abscess requiring surgical drainage and a second course of antibiotics. Those resolved, and the patients showed proper healing at the subsequent follow-up visit (proliferative phase).

Table				
Table 1 – Self-reported VAS scores for preoperative anxiety, intraoperative pain and procedure timing in patients undergoing tooth extraction				
Parameter	Mean	SD	Median	Range
Anxiety VAS	5.9	3.6	6	1-10
Pain VAS	2.4	2.4	1	1-10
Timings (minutes)	21.6	13.4	20	10-60

DISCUSSION

Tooth impaction is a pathological situation where a tooth fails to attain its normal functional position. Impacted third molars are most commonly encountered in routine dental practice. The impaction rate is higher for third molars when compared with other teeth. The mandibular third molar impaction is said to be due to the inadequate space between the distal of the second mandibular molar and the anterior border of the ascending ramus of the mandible. Extraction of such impacted third molar frequently require surgical intervention. Fear related to surgical extraction and post-surgical healing are two main concern. Several past studies have used indexes or scales to evaluate the wound healing process after extractions.⁴ Recently developed IPR Scales solves many of the problems of previously used wound healing scales, including the lack of a standardised definition of ideal wound healing, failure to distinguish among the different phases of the wound healing process, and lack of correlation between the wound healing parameters applied and the wound healing phases. The scale is intended to help surgeons decide if and when to intervene in the healing process, according to the specific phase – inflammatory, proliferative, or remodelling.⁵ As part of our evaluation, patients rated their anxiety and pain at different time points. The findings confirmed that oral surgery provokes high levels of anxiety before the procedure and this may affect pain perception during the procedure. Eli et al.⁶ in a study reported similar results with 60 study subjects undergoing dental implant insertion wherein there was a significant relationship between state anxiety and pain perception at all-time points evaluated: immediately before surgery, immediately after surgery, and four weeks postoperatively. In our present study, a negative correlation was found between

hypothalamic-pituitary-adrenal and the sympathetic-adrenal-medullary axes, leading to enhanced glucocorticoid and catecholamine production, which can in turn directly affect several components of the healing process. Significant evidence from animal and human studies indicates that physiological stress responses can specifically impair the inflammatory phase. Greater clinician awareness of the association between psychological factors and wound healing might lead to more patient referrals for instruction in relaxation methods and behavioural adaptation, making the process easier for both patient and surgeon. In our current study we found no effect of patient age on the wound healing process. However, comparison by sex revealed that female patients had significantly lower wound healing scores than male patients. These results are in correlation with the study conducted by Engeland et al.⁷ who evaluated 212 patients 7 days after sustaining a 3.5-mm circular wound on the oral hard palate. They found that the mucosal wound healing process was slower in women than men (P value 0.008) regardless of age, suggesting that sex hormones play a role in oral mucosal wound healing. To our knowledge, there are no studies of tooth extraction in which follow-up was extended to 6 weeks. Future studies are needed to test the IPR Scale for wider applications in oral mucosal surgery so that clinicians will be able to identify wound healing patterns and specific modifiers that may promote or inhibit the healing process following surgical procedures.

CONCLUSION

The IPR Scale is a promising tool for the effective evaluation of the wound healing process following wisdom tooth extractions. Relaxation methods and behavioural adaptation might help to lower patient anxiety and thereby improve oral wound healing.

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VAS anxiety scores and IPR Scale scores, indicating that the more anxious the patient before the extraction, the lower the IPR Scale scores in all three phases. This finding supports the direct influence of anxiety on oral wound healing following extraction. It is well recognised that psychological stress can activate the

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