Influence of Flap Type on Early Outcomes of Dental Implants

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Abstract

Aim: Alternative approaches compared to the traditional flap surgery have been suggested to enhance the postoperative morbidity and outcome of dental implants. The aim of this study is to compare the early outcomes of dental implant insertion using three different approaches; Full Flap (FF), Crestal Flap (CF), and Flapless (FL).

Subjects and methods: A total of 214 patients (671 implants) took part in this study. The FF method was used in 376 implants (122 patients), the CF was used in 137 implants (49 patients), and the FL was used in 158 implants (43 patients). Cases were performed by single operator, non-randomly allocated to the three groups according to pre-operative and operative findings. The main outcomes were postoperative pain and early implant failure. Chi-square test and ANOVA test were used to examine the differences between the target groups.

Results: Implant failure rate was highest when the FL method was used (7.2%) compared to the CF group (3.6%), and the FF group (3.2%) ($p = 0.042$, X^2 test). Significant differences were also found in the degree of postoperative pain; the average pain scale was 1.4 ± 2.5 in the FL, 0.6 ± 0.98 in the CF, and 1.9 ± 2.2 in the FF group ($p= 0.012$, ANOVA test).

Conclusions: More implant failure was encountered using the free handed FL implant surgery. FL implant surgery needs more careful case selection and advanced treatment planning in order to gain the advantages of the procedure without compromising the results.

Keywords: early outcome , failure, flap , implant, osseointegration

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Introduction

Dental implant placement traditionally involved creating a mucoperiosteal flap exposing the alveolar bone for the preparation of implant bed. The aim of the flap was to get a better visualization of the surgical field during the surgery and a better implant positioning. Furthermore, it may reduce the risk of occurrence of bone fenestrations and dehiscence [1]. However, flap elevation is associated with higher morbidity and discomfort for the patient. In addition, raising the periosteum is

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associated with crestal bone resorption as a result of disrupting the supra-periosteal blood supply [2, 3]. This approach is also associated with gingival recession and the loss of interdental papillae, especially in single implant cases, leading to unaesthetic results [4,5]. For these reasons, alternative methods have been introduced in order to address these concerns. One of these methods is the flapless implant placement, involving a one-stage approach, requiring minimal removal of soft tissues, and is thought to decrease surgical time and produce less morbidity for the patient [1, 6]. Another alternative is the crestal incision approach, namely, by only exposing the crestal part of the alveolar bone, less damage to the blood circulation is expected and therefore better healing occurs.

Few studies have examined the influence of flap design on the outcomes of dental implants, including implant failure, postoperative pain, infection, gingival recession, and esthetic satisfaction; these studies reported variable results [8-13]. The aim of this study was to examine the influence of three different flap designs (flapless (FL), full flap (FF), and crestal flap (CF)) on postoperative pain and early implant failure.

Methods

From November 2004 until September 2010, prospective data was collected from patients referred to the oral surgery clinic to have dental implants. Preoperative personal, implant, and operational variables were collected from patients on a specially-designed form by the operating consultant. All patients were examined to determine if they met the inclusion criteria. Inclusion criteria were: patients above 16 years old with missing tooth or teeth and those indicated for implant placement following thorough clinical and radiographic evaluation. Exclusion criteria were patients who had received radiotherapy in the head and neck region, or presented with chronic or acute infections in the vicinity of the planned implant site, treated or under treatment with intravenous bisphosphonates and pregnant or lactating.

Consent for this study was sought from patients and ethical approval for the study was obtained from the Jordan University Hospital Ethical Committee. A baseline panoramic radiograph was taken in all cases to evaluate the bone height and the presence of any bone pathology. In case of immediate implant insertion, the extraction socket was examined intra-operatively by checking for the presence of bony defects via direct visual examination and probing of the socket walls. Cases with no bone defects and those having minimal alveolar bone width of 6mm were performed with the flapless technique (FL). In case of post-immediate and delayed implant insertion, cases with minimal 2mm width of keratinized gingival crest, minimal 6mm of alveolar bone width at the intended implant site (ridge mapping performed in thin ridge cases), and those who showed no bone defects on the radiographs were considered suitable for flapless (FL) surgery. Cases not indicated for FL surgery according to the above mentioned criteria, were performed by reflecting a flap. Two types of flaps were used, either FF or CF suspected; if bone undercuts were not suspected preoperatively and not encountered operatively, CF approach was used. If bone undercuts were suspected pre-operatively or encountered operatively (during CF approach), the FF approach was used.

The FL is defined in this study as the insertion of dental implant without reflecting any tissues using the trans-mucosal punch technique. The CF approach was performed by making an incision at the crest of the ridge, slightly palatally or lingually when possible, without exposing the buccal and the lingual or palatal surfaces. The FF approach was conducted by making an incision at the crest of the ridge combined with one or two releasing incisions exposing the buccal and when needed the lingual or palatal surfaces.

All patients were prescribed antibiotics, chlorohexidine 0.2% mouth wash one week before surgical appointment and continued for one week post-surgery. In addition, ibuprofen 400mgs was prescribed to be taken three times daily or paracetamol 500 mgs four times daily if ibuprofen was contraindicated or not tolerated.

Patients were treated by a single consultant following the standard procedures of sterilization and cross infection control (use of sterile gloves, surgical face masks, sterile drapes around the patient's mouth, head, and over the supine body of the patient). Four types of endosseous dental implants were used in the study, all with sand-blasted acid-etched surface (Certain® Prevail® Biomet 3i USA, Purtex® Oral Tronics Bremen Germany, Xive® Dentsply Friadent Mannheim Germany, and Kentron® Nuova GEASS Udine Italy) and implants were inserted according to manufacturer instructions.

The patients were followed postoperatively at one week, one month and at the beginning of the prosthetic stage (3 month in lower jaw and 4 month in upper jaw). The immediate outcome at the first postoperative visit measured was pain measured using a verbal analogue scale (VAS). Patients were asked to describe the amount of pain they felt by giving a number from 0 to 10, where 0 represent not feeling any sort of pain and 10 represent the maximum pain they can imagine. At the pre-prosthetic stage, patients were examined for success or failure of the implant. Failure was defined as the removal of an implant because of either signs of progressive infection or non-osseointegration, successful osseointegration was defined by lack of mobility in the implant before or at the time of pre-prosthetic stage.

Statistical analysis was performed using SPSS for Windows release 16.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics were generated. Chi-square test and ANOVA test were used to examine the differences between the target groups. Results were considered significant if p-values were less than 0.05.

Results

A total of 214 patients requiring 671 implants (mean 3.1 implant/patients) participated in this study. The mean patient age was 46.9 ± 13.9 years (range, 17–75 years). There were 117 (54.7%) females and 97 (45.3%) males. The FL method was used in 376 (56%) implant cases in 122 patients, the CF was used in 137 (20.4%) implant cases in 49 patients, and the FF was applied to 158 (23.5%) implant cases in 43 patients.

Patients in the three groups were comparable regarding age, gender, smoking history, and systemic health (Table 1).

Table 1: Comparison of patients (n=214) demographic variables in the three study groups.

Variable	Flapless (n= 122)	Crestal flap (n= 49)	Full flap (n= 43)	P value
Gender (male/female)	65/57	29/20	23/20	0.77[a]
Age (mean ± SD years)	48.4 ± 13.5	43.5 ± 14.5	46.2 ± 13.8	0.12[b]
Smoking (no/yes)	94/28	38/11	26/17	0.08[a]
Chronic disease (no/yes)	85/37	40/9	32/11	0.27[a]

n: number of patients. [a] P value of Chi-square test. SD: standard deviation. [b] P value of ANOVA test.

No statistically significant differences were also detected in terms of implant site and need for bone augmentation (Table 2).

Table 2: Comparison of anatomical and operational factors among the three study groups

Variable		Flapless (total= 376),n (%)	Crestal flap (total= 137), n (%)	Full flap (total= 158), n (%)	P value [a]
Type of surgery	Immediate	44 (11.7)	12 (8.8)	6 (3.8)	0.000
	Post-immediate	7 (1.9)	8 (5.8)	31 (19.6)	
	Delayed	325 (86.4)	117 (85.4)	121 (76.6)	
Site of implant	Upper anterior	64 (17.0)	17 (12.4)	22 (13.9)	0.10
	Upper posterior	149 (39.6)	47 (34.3)	62 (39.2)	
	Lower anterior	43 (11.4)	10 (7.3)	21 (13.3)	
	Lower posterior	120 (31.9)	63 (46.0)	53 (33.5)	
Indication for implantation	Single crown	21 (5.6)	21 (15.3)	6 (3.8)	0.000
	Fixed partial prosthesis	236 (62.8)	107 (78.1)	81 (51.3)	
	Full prosthesis	119 (31.6)	9 (6.6)	71 (44.9)	
Bone augmentation	Yes	8 (2.1)	4 (2.9)	6 (3.8)	0.54
Type of implant	Oral T	43 (11.4)	33 (24.1)	27 (17.1)	0.000
	Kent	306 (81.4)	24 (17.5)	90 (57)	
	3i	0 (0)	28 (20.4)	18 (11.4)	
	Xive	27 (7.2)	52 (38.0)	23 (14.6)	

n: number. %: column percentage. P value [a]: Chi-square test.

However, significant differences were found in some operational factors, such as type of surgery (immediate, post-immediate, and delayed), indication for implantation, and type of implant system used (Table 2).

Out of a total of 671 placed implants, 37 (5.5%) implants (placed in 31 patients) failed to ossiointegrate at the time of evaluation. Factors that were not comparable in the three study groups, i.e. the particular implant system used (p = 0. 27, X^2 test), the type of surgery (p = 0.89, X^2 test), and the indication for implantation (p = 0. 21, X^2 test), had no statistically significant relationships with implant success rate. A statistically significant difference in terms of early implant failure rate was found between the three flap groups (p = 0.042, X^2 test). Implant failure rate was highest when the flapless method was used (Table 3). Significant differences were also found in the degree of postoperative pain when the three study groups were compared (Table 3).

Table 3: Comparison between the three flap techniques in terms of postoperative pain and implant failure.

Outcome variable	Flapless (total= 376)	Crestal flap (total= 137)	Full flap (total= 158)	P value
Postoperative pain (VAS score) Mean ± SD	1.4 ± 2.5	0.6 ± 0.98	1.9 ± 2.2	0.012*
Failed implants n (%)	27 (7.2)	5 (3.6)	5 (3.2)	0.042**

n: number, SD: standard deviation.* X^2 test, ** ANOVA test.

The average pain scale was lowest in the crestal group (0.6 ± 0.98) and highest in the full flap group (1.9 ± 2.2) (*p*= 0.012, ANOVA test).

Discussion

CES-D is a tool for self-reporting of The rationale for FL implant surgery was to introduce an alternative procedure to the traditional flap surgery, producing a simpler technique with similar or even better outcomes in terms of implant aesthetics, osseointegration, and at the same time reduce the co-morbidities of the implant insertion procedure. Compared to the traditional flap surgery the FL approach

is thought to preserve circulation, hard tissue volume, and soft tissue architecture [6]. Other advantages of the FL approach are decreased surgical time and less morbidity for the patient [1, 6]. However, it has been shown that FL implant placement does not reduce the amount of alveolar bone resorption compared to conventional surgical approach [7]. Moreover, it has been suggested that the FL approach often requires advanced clinical experience and surgical judgment, since it is associated with reduced visualization of the anatomic landmarks and vital structures, and the increased risk of incorrect implant placement [1, 6].

The idea behind the crestal flap approach was to minimize the exposure of the periosteum; thus, maintaining maximal blood supply. Performing the incision, on the other hand, allowed for better visual control of the alveolar ridge, and thus better implant positioning when compared to the FL approach. Several published studies have compared the FL implant surgery with the traditional flap surgery [8-13], and to the best of our knowledge, no other study had discussed the CF separately rather than the FF and compared the results of the three flaps altogether.

In this study, we aimed to assess the morbidity after implant insertion using the three different surgical approaches. Significant differences in postoperative pain between the three groups were noticed, the highest average pain scale was 1.9 ± 2.2 in the FF group, followed by the FL group 1.4 ± 2.5, and the lowest average pain scale was 0.6 ± 0.98 in the CF group. Our results are comparable to the literature on the FL group versus the FF group, where FF surgery has been related to more postoperative pain and discomfort [12, 13], although Lindeboom and Wijk 2010 [9] found that patients in the FL implant group had to endure more than patients in the flap group. The low average pain scale in the CF group in our study was an interesting finding, especially when compared to the FL group. This might be partially attributed to the higher percentage of patients having immediate implant insertion in the FL group than the CF group (Table 2). The added procedure of tooth extraction and immediate insertion of the dental implant might have increased the morbidity of the implant insertion. More implants also failed in the FL group compared to the CF group, and implant

failure has been related to higher pain scores [14].

Clinical studies evaluating success rates of implants placed using the flapped and FL approach had shown high rates of success and survival with both approaches. In a review of the literature, Brodala 2009 [1] showed that over a mean observation period of 19 months, FL implant placement is associated with high survival rates of 95.9% for retrospective studies and 98.6% for prospective cohort studies. Campelo and Camara 2002 [15] had shown a cumulative success rate of 91% over a 10-year observation period for implants placed using the flapless approach. Rousseau 2010 [8] showed, in a retrospective analysis of 174 implants placed using the FL approach, 98.3% success rate after 2 years of follow up.

In our study, more implant failures were noticed in the FL group (7.2%) than in the CF and the FF groups (3.6% and 3.2%). The use of 3D CT guided implant insertion has been used in some of the studies that showed comparable success rates [12, 13, 16]. This might have reduced the chances of dehiscence and perforations and allowed better positioning of implants, which might have influenced the results. Nevertheless, the use of 3D CT guided implant insertion does not explain the different results we had from the literature, as comparable results to traditional flap surgery has also been reported in free handed FL surgery [8, 15]. Therefore, and because we had more implant failure in the flapless group than the flap groups, we agree with the opinion suggested by other clinicians, namely, that successful FL implant insertion is dependent on advanced imaging, clinical training, and surgical judgment [1, 6, 15]. Although the FF approach was associated with more postoperative pain in this study, it might be a more predictable procedure when compared to the CF and especially the FF approach.

Conclusion

In this prospective study, the free handed FL dental implant insertion technique was compared with the traditional FF and the CF techniques. Despite the weakness in the study design of not randomizing cases, all were performed by one operator. FL implant surgery was associated with higher risk of early implant failure when compared to the FF and CF surgeries, although patients had more pain after the FF surgery. Therefore, it is recommend that FL dental implant surgery should be preserved for dentists experienced in dental implantology, as it requires careful case selection and advanced treatment planning in order to gain the advantages of the procedure without compromising the results.

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تأثير نوع الشريحة على المُخرَجات المبكره للزرعات السنيه

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الملخص

الهدف : تم إقتراح عده بدائل مقاربات بدلا من جراحة الشريحة التقليدية وذلك لتحسين مَرَضِيَّه ما بعد الجراحه وكذلك مُخرجات الزرعات السنيه. هدفت هذه الدراسة إلى مُقارنه المخرجات المبكره لاستعمال الزرعات السنيه باستخدام ثلاثه طرق مختلفه وهي الجراحة بدون شريحة وجراحة الشريحة الهلالية وجراحة الشريحة الكاملة.

العينة والمنهجية:تم إدخال 671 زرعة في 214 مريضا في هذه الدراسه. تم استخدام 376 زرعه ل 122 مريضا باتباع جراحة بدون شريحة ، كما تم استخدام 137 زرعه ل 137 مريضا بإتباع جراحه الشريحه الهلاليه كما تم إستخدام 158 زرعه ل 43 مريضا بإتباع جراحه الشريحه الكامله . وقد تم أداء كل الحالات من قبل جراح واحد كانت المخرجات الرئيسيه هي الألم والفشل المبكر للزرعه . تم إستخدام اختبار خي مُرَبَّع (Chi – square) وإختبار تحليل التباين (ANOVA) وذلك لفحص الفروقات ما بين المجموعات الثلاث.

النتائج :كان معدل فشل الزرعة (7.2%) أعلى ما يكون في الجراحة بدون شريحة وذلك مقارنة ب (3.6%) لمجموعه الشريحة الهلاليه و (3.2%) لمجموعة الشريحة الكاملة وذلك باستخدام اختبار القيمة الإحتمالية ($P=0.042X^2$) .

وجدنا فروقات مهمه في درجه ألم ما بعد الجراحة، وكان معدل مِقياس الألم 2.5 ± 1.4 في الجراحه بدون شريحه ، 0.98 ± 0.6 في جراحه الشريحه الهلاليه و 2.2 ± 9. في جراحه الشريحه الكامله وذلك بإستخدام إختباريّ تحليل التباين (ANOVA) والقيمه لإحتماليه (P=0.012).

الخُلاصة :تم مواجهة فشل أعلى عند إستخدام الجراحه بدون شريحه ، كان ألم ما بعد الجراحه أعلى عند إستخدام الشريحه الكامله عنه في حالات إستخدام كل من جراحه اللا شريحه وجراحه الشريحه الهلاليه.

الكلمات الدالة : زرعة ، فشل ، المخرجات المبكرة ، شريحة ، الاندخال العظميّ.