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Quality of life after microscopic periradicular surgery using two different incision techniques: a randomized clinical study

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Abstract

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Aim To monitor the quality of life of patients after periradicular surgery when two different flap designs were used.

Methodology Forty patients with teeth having a periradicular lesion of endodontic origin were included according to specific selection criteria. Patients were randomly assigned to two groups. In one group a sulcular incision (SI) with complete papilla mobilization was made, and in the other group a papilla-base incision (PBI) was used. Periradicular surgery was performed using a surgical microscope. Parameters related to life quality were recorded daily in the first week post-surgery using a questionnaire. Pain was evaluated with a 0–100 visual analog scale (VAS). Other symptoms (swelling, bleeding and nausea), plus functions (chewing, speaking, sleeping, daily routine and work) were assessed using a five-point scale. Analgesic intake was recorded. Fisher's test and unpaired *t*-test were used to assess the difference between groups.

Results The VAS score for pain, and the scores for swelling, chewing and phonetic impairment, peaked on days 1 and 2 postoperatively. A significant difference in favour of the PBI group was found for chewing and swelling in the first 4 days. Starting from day 3 post-surgery, the PBI group reported a significantly more rapid decrease in pain levels and analgesics use than the SI group ($P < 0.05$). The other parameters were similar in the two groups.

Conclusions The papilla-base incision technique may be preferred as reduction of pain levels, swelling and drug intake were more rapid in the first week postoperatively compared with cases in which a sulcular incision was used.

Keywords: flap design, periradicular surgery, quality of life.

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Introduction

After the introduction of microsurgical techniques in endodontics, there has been an increased interest in developing protocols for improving the root-end management of teeth (Kim 2002). Conversely, less attention has been paid to the surgical management of soft tissues and to patient-related outcomes in the early post-operative phase (Velvart 2002, Velvart *et al.* 2003, 2004a,b, Velvart & Peters 2005, von Arx *et al.* 2007). Post-operative quality of life of patients is dependent on the degree of pain, tissue swelling, chewing ability, phonetics, and can be of importance for the overall assessment of the treatment success as well as to its acceptance. Pain and swelling are secondary effects that may occur in the immediate post-surgical period (Gutmann & Harrison 1991). About two thirds of the patients treated by the traditional technique without using magnification devices require analgesics during the early

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post-operative phase (Seymour *et al.* 1986, Meechan & Blair 1993).

Recently the goal of endodontic surgery has shifted from the mere reduction or elimination of existing pathosis to the achievement of successful outcomes regarding function and aesthetics as well as to periodontal tissue preservation (Carr & Bentkover 1998, Kim 2004). The introduction of microscopic techniques in periradicular surgery allows the surgeon to control both components with a high level of precision.

Peri-operative pain management is fundamental in any surgical procedure for preserving the patient's psychological welfare. Reducing pain-related discomfort in the immediate postoperative period may enhance the quality of life of the patient (Iqbal *et al.* 2007).

Few studies have examined postoperative discomfort after endodontic surgery, reporting that the use of microsurgical technique is associated with less postoperative pain compared with the traditional technique (Pecora & Andreana 1993, Tsesis *et al.* 2003, 2005). It may be hypothesized that proper soft tissue management also could be of importance in the control of post-surgical discomfort.

The aim of the present study was to assess and compare patient quality of life after microscopic periradicular surgery when two different flap designs were used.

Material and methods

This randomized study was conducted according to the principles embodied in the World Medical Association Helsinki Declaration of 1975 for biomedical research involving human subjects, as revised in 2000 (World Medical Association Declaration of Helsinki 2000). Ethical approval was obtained from the Institutional Review Board of Milan University. All patients were informed of the nature of the study and gave their written consent. Patients requiring endodontic surgical treatment were recruited during a period of 24 months (from December 2004 to December 2006) in a University clinic and in a private practice setting. A single experienced surgeon performed all surgeries.

Patient selection

The following criteria were adopted for case selection: the patients had no general medical contra-indications for oral surgical procedures (they were ASA-1 or ASA-2); the patients had only one tooth that required periradicular surgery; the tooth treated surgically had a periradicular lesion of strictly endodontic origin (chronic apical periodontitis) of size not exceeding 10 mm; the nonsurgical re-treatment was judged unfeasible or had previously failed; the tooth had an adequate final restoration with no clinical evidence of coronal leakage; the apical root canal was devoid of the presence of a post for at least 6 mm; no acute symptoms were present. Both single-rooted and multi-rooted teeth, located in the aesthetic regions (maxillary anterior and pre-molar teeth), were included.

The following exclusion criteria were applied: presence of any kind of pathosis associated with vertical root fracture; perforation of the furcation area or lateral canal walls; presence of traumatic injuries; periodontal bone loss, detected with a periodontal probe (>4 mm probing depth); bone defects involving both the buccal and lingual cortical bone; presence of a thin gingival biotype.

Based on sample size calculation it was planned to enrol at least 16 patients for each treatment group, in order to detect a between-group 10% difference in postoperative pain (that was considered the most important symptom affecting quality of life), with a power of 0.8 and a significance level equal to 0.05.

According to the above criteria 40 teeth in 40 consecutive patients (23 women and 17 men), were included in the study. Each patient was given written information about the surgical procedure and the necessary follow-up care. They were also given the opportunity to withdraw from the study at any time. A consent form was signed if they agreed. Each patient received one session of professional oral hygiene on the day before surgery.

Allocation to groups

The choice of using one or the other kind of surgical flap for each patient was made by a computer-generated randomized table. A closed opaque envelope containing the indication of which surgical flap had to be used was opened before the start of each surgical operation. Twenty patients (20 teeth) were allocated to the group using a sulcular incision (SI group) with a complete mobilization of the entire papilla and 20 patients (20 teeth) to the group using a papilla-base incision (PBI group).

Surgical procedure

Preoperatively, the patient rinsed with an antiseptic mouthwash containing 0.2% chlorhexidine

digluconate (Curasept®, Curaden Healthcare s.r.l., Saronno, Milan, Italy) to reduce the risk of contamination of the surgical field. Treatment was provided under local anaesthesia with lidocaine 2% and epinephrine 1 : 1 00 000.

Soft and hard tissue management

The flaps were rectangular and consisted of two releasing vertical incisions and a horizontal incision. The vertical incisions were placed in at least one tooth both distal and mesial to the tooth being treated. The initial portion of the vertical incision was placed perpendicular to the marginal course of the gingiva toward the mid section of the papilla and gradually turning the incision parallel to the tooth axis. Subsequently it ran vertical, parallel to the tooth axis and to supraperiosteal blood vessels in the mucosa and gingiva with paramedian releasing incision (Fig. 1).

In the SI group, the two releasing incisions were connected by a sulcular horizontal incision involving interproximal spaces to free the buccal from the palatal papilla with a complete mobilization of the buccal papilla (Fig. 2).

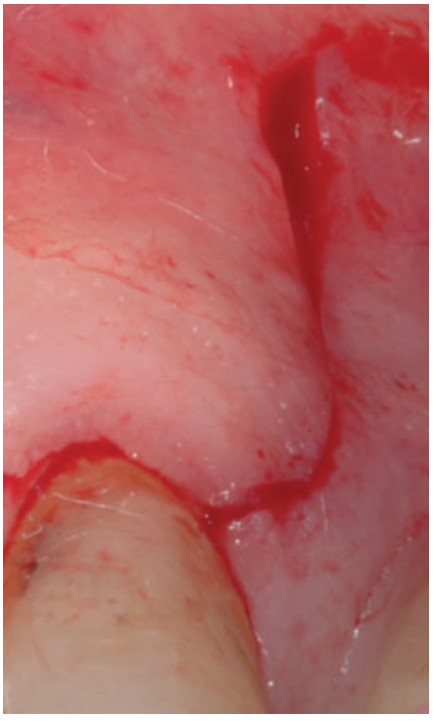

Figure 1 An example of the distal releasing vertical incision, common to both groups.

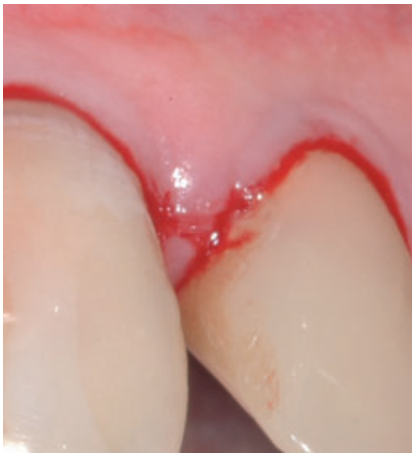

Figure 2 An example of the incision performed in the sulcular incision (SI) group, with complete mobilization of the papilla.

In the PBI group, two different incisions were performed at the base of papilla resulting in a split-thickness flap, as described by Velvart (2002). Buccally, over the tooth, the interproximal spaces were joined by an intrasulcular incision in a curvilinear fashion (Fig. 3). The sulcular incision reached from the releasing incisions to the start of the nearest PBI.

A periosteal release incision was made for releasing residual muscle tension and facilitates the passive coronal displacement of the flap. In the SI group a 15c surgical blade (Kai Europe, GmbH, Solingen, Germany) was used for the incision, whilst a CK-2 microsurgical scalpel (Analytic, Glendora, CA, USA) was used in the PBI group. In both groups surgical loupes were used as a magnification device for flap elevation procedure. The full mucoperiosteal flap was mobilized, reflected and carefully retracted during the

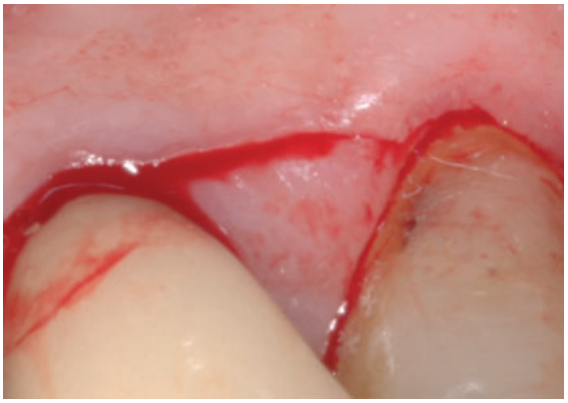

Figure 3 An example of the papilla-base incision (PBI group).

root-end management. After flap reflection, a retractor was positioned on the exposed cortical bone with light but firm pressure acting as a passive mechanical barrier to the reflected tissues. The flap was frequently irrigated with sterile saline to prevent dehydration of the periosteal surface. Surgical access to the root was then made through the cortical bone using a round bur. Shaving of the bone was performed with a brush stroke approach, low rotary speed and constant sterile water irrigation. The periradicular lesion was removed with sharp bone curettes and angled periodontal curettes. The curetted tissue was placed in 10% formalin solution for pathological diagnosis.

Management of the resected root end

After exposure of the root end, a straight fissure bur in a hand-piece was positioned perpendicular to the long axis of the root and then beginning from the apex, cutting coronally, 2.5–3 mm of the root-end was removed. Prior to root-end preparation, local haemostasis was achieved using bone wax. The root-end cavities were prepared using zirconium nitride retro-tips (Dentsply Maillefer Instruments, Ballaigues, Switzerland) driven by an ultrasonic device unit (Piezon Master 600, EMS, Nyon, Switzerland). All root-end cavities were created with the setting of the ultrasonic device unit at no more then half power, under constant copious sterile water irrigation to avoid over-heating. The retro-tips allowed a well-defined parallel preparation of 2.5 to 3 mm deep. Root-end cavities were then dried using paper points. Finally a zinc oxide EBA-reinforced cement (Super Seal, Ogna Pharmaceuticals, Milan, Italy) was used as the root-end filling material.

For performing root-end management procedures an operating microscope was used as the magnification device in both groups.

The reflected tissues were re-approximated to their original position, compressed and stabilized, and sutured with polyamide 6-0 (Ethicon Inc., Johnson & Johnson, Piscataway, NJ, USA). The flap closure was initiated from the releasing incisions and in the papilla-base incision two interrupted sutures were used.

The time needed to complete each surgical procedure was recorded, starting from the first incision to finishing the last suture.

Postoperative instructions

The patients were advised to avoid mouth rinsing, hard and hot food, hot drinks, heavy physical work and tooth brushing during the day of surgery (Gutmann & Harrison 1985). Ice packs were provided after surgery. The patients were instructed to rinse their mouth twice daily with chlorhexidine digluconate 0.2% (Curasept ®, Curaden Healthcare s.r.l.) for plaque control, up to 10 days after surgery. All patients were prescribed nonsteroidal analgesics after the surgical procedure for pain relief and/or swelling control if needed. No antibiotic therapy was prescribed. Sutures were removed 5 days after surgery.

Evaluation parameters

A questionnaire similar to that used in previous studies (Shugars *et al.* 1996, Tsesis *et al.* 2005) was used to evaluate postoperative limitations in function (chewing, talking, sleeping, daily routine and work), as well as pain and the presence of other symptoms (swelling, bleeding, nausea, bad taste/breath). For pain assessment a visual analog scale (VAS) was adopted, where 0 = no pain, and 100 = unbearable pain. For other symptoms and functional activities the answers were based on a 5-point Likert-type scale, ranging from 1 ('none') to 5 ('very much'). Finally, patients were asked whether they had taken any analgesics on each postoperative day. Patients received the questionnaire to fill out on each day starting on the day of surgery, for 7 days. Questionnaires were returned postage-paid.

Statistical analysis

Fisher's exact test was used to assess statistically the difference between groups for analgesics and for any variable related to function and symptoms on each postoperative day. For simplicity, the responses corresponding to 1 (none) and 2 (little) were combined in a single category. The patient's experience of pain was evaluated using analysis of variance (ANOVA) for repeated measures. The difference between the two groups for pain on each postoperative day was assessed using an unpaired *t*-test. The patient was considered as the unit of analysis. A probability $P = 0.05$ was considered as the level of significance. The software STATISTICA® (StatSoft, Inc., Tulsa, OK, USA) version 5.0 was used for statistical analysis.

Results

Forty patients were initially treated with periradicular surgery. One patient (belonging to the SI group) failed to fill out the questionnaire completely and another one

Table 1 Distribution of the surgically treated teeth in the two study groups

Tooth location	RF group	PBI group	Total
Anterior	15 (1)[a]	16 (1)[a]	31 (2)[a]
Pre-molar	5	4	9
Total	20 (1)	20 (1)	40 (2)

[a]The number of teeth excluded from the analysis is indicated between parentheses

(belonging to the PBI group) failed to return the questionnaire; both were excluded from the analysis. Thus, a final of 38 patients (22 women and 16 men) were evaluated. Fifteen of them were smokers (six in the SI group and nine in the PBI group) with an average daily consumption of 7.2 cigarettes.

Nineteen patients were evaluated in the SI group (10 women and nine men, ranging in age from 22 to 59 years, average 36.4 years), and 19 were evaluated in the PBI group (12 women and seven men, ranging in age from 29 to 56 years, average 33.7 years). Teeth consisted of maxillary anterior and pre-molar teeth (Table 1). The average size of the periradicular lesion was 6 mm (range 4–9 mm).

No statistically significant difference was found in the distribution of patients according to age, gender, smoking habits and lesion size between the two groups.

The average time needed to complete the surgical procedure was 42 min (range 35–58 min) for the PBI group, and 35 min (range 28–41 min) in the SI group; the difference was significant ($P = 0.01$).

Tables 2 and 3 report the results of the evaluation for symptoms and functional activities, respectively. Figure 4 reports the levels of pain reported for 7 days post-surgery. Figure 5 reveals the percentage of patients taking analgesics during the postoperative period.

All patients reported some degree of discomfort because of pain, swelling, chewing impairment and difficulties in phonetics on days 1 and 2 postoperatively.

In the PBI group, a more rapid decrease in pain levels (Fig. 4) and analgesics taken (Fig. 5) was observed compared with the SI group starting from day 3 ($P < 0.05$). Such difference became negligible after 5–6 days.

In the SI group, swelling was significantly higher than in the PBI group from days 1 to 4 (Table 2). Chewing impairment also was significantly greater in the SI group as compared with the PBI group from days 2 to 4 (Table 3). No significant difference was found at any time between smokers and non smokers for pain levels and tissue swelling.

Bleeding, nausea and bad taste/breath were occasionally reported in the first 2 days and were negligible

Table 2 Occurrence of symptoms in the first week postoperatively

	day 1 (%)		day 2 (%)		day 3 (%)		day 4 (%)		day 5 (%)		day 6 (%)		day 7 (%)	
Symptom	SI	PBI	SI	PBI	SI	PBI	SI	PBI	SI	PBI	SI	PBI	SI	PBI
Swelling														
Very much	15.8	–	42.1	5.3	10.5	–	–	–	–	–	–	–	–	–
Quite a bit	47.4	47.4	31.6	47.4	42.1	–	21.1	–	–	–	–	–	–	–
Some	36.8	52.6	21.1	42.1	42.1	47.4	52.6	31.6	15.8	–	–	–	–	–
Little/none	–	–	5.3	5.3	5.3	52.6	26.3	68.4	84.2	100	100	100	100	100
Bleeding														
Very much	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Quite a bit	5.3	5.3	–	–	–	–	–	–	–	–	–	–	–	–
Some	47.4	47.4	5.3	10.5	–	–	–	–	–	–	–	–	–	–
Little/none	47.4	47.4	94.7	89.5	100	100	100	100	100	100	100	100	100	100
Nausea														
Very much	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Quite a bit	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Some	15.8	–	–	–	–	–	–	–	–	–	–	–	–	–
Little/none	84.2	100	100	100	100	100	100	100	100	100	100	100	100	100
Bad taste/breath														
Very much	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Quite a bit	21.1	10.5	–	–	–	–	–	–	–	–	–	–	–	–
Some	42.1	57.9	47.4	42.1	21.1	10.5	5.3	5.3	–	–	–	–	–	–
Little/none	36.8	31.6	52.6	57.9	78.9	89.5	94.7	94.7	100	100	100	100	100	100

The gray area indicates significant differences between groups

Table 3 Impairment of common activities in the first week postoperatively

	day 1 (%)		day 2 (%)		day 3 (%)		day 4 (%)		day 5 (%)		day 6 (%)		day 7 (%)	
Activity	SI	PBI	SI	PBI	SI	PBI	SI	PBI	SI	PBI	SI	PBI	SI	PBI
Sleeping														
Very much	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Quite a bit	5.3	15.8	–	5.3	–	–	–	–	–	–	–	–	–	–
Some	42.1	36.8	15.8	21.1	10.5	10.5	5.3	10.5	5.3	10.5	–	–	–	–
Little/none	52.6	47.4	84.2	73.7	89.5	89.5	94.7	89.5	94.7	89.5	100	100	100	100
Chewing														
Very much	42.1	26.3	15.8	–	10.5	–	–	–	–	–	–	–	–	–
Quite a bit	26.3	36.8	36.8	42.1	31.6	–	5.3	–	–	–	–	–	–	–
Some	26.3	36.8	47.4	52.6	47.4	47.4	42.1	5.3	15.8	–	–	–	–	–
Little/none	5.3	–	–	5.3	10.5	52.6	52.6	94.7	84.2	100	100	100	100	100
Phonetics														
Very much	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Quite a bit	21.1	15.8	–	–	–	–	–	–	–	–	–	–	–	–
Some	42.1	57.9	47.4	21.1	10.5	–	–	–	–	–	–	–	–	–
Little/none	36.8	26.3	52.6	78.9	89.5	100	100	100	100	100	100	100	100	100
Daily routine														
Very much	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Quite a bit	36.8	10.5	10.5	–	–	–	–	–	–	–	–	–	–	–
Some	47.4	63.2	36.8	42.1	36.8	26.3	21.1	15.8	–	–	–	–	–	–
Little/none	15.8	26.3	52.6	57.9	63.2	73.7	78.9	84.2	100	100	100	100	100	100
Missed work														
Very much	5.3	–	–	–	–	–	–	–	–	–	–	–	–	–
Quite a bit	36.8	21.1	10.5	–	–	–	–	–	–	–	–	–	–	–
Some	42.1	63.2	42.1	52.6	36.8	26.3	–	–	–	–	–	–	–	–
Little/none	15.8	15.8	47.4	47.4	63.2	73.7	100	100	100	100	100	100	100	100

The gray areas indicate significant differences between groups

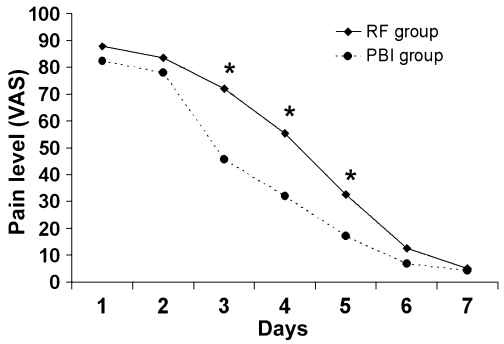

Figure 4 Diagram showing the trend of pain levels in the two groups, assessed by means of a visual analog scale (VAS). Asterisks indicate significant difference between groups.

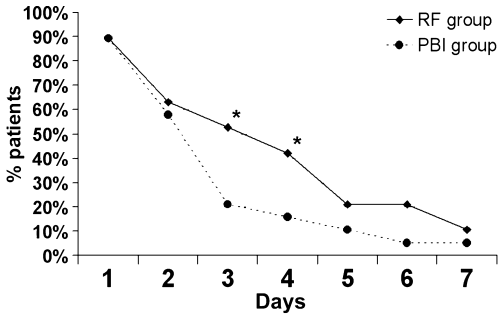

Figure 5 Diagram showing the trend of the percentage of patients using analgesics in the two groups. Asterisks indicate significant difference between groups.

thereafter. No significant difference between the two groups was found for these symptoms.

The recovery of normal speech and sleeping was similar in the two groups. No patient reported the maximum score for these two activities.

Moderate impairment for routine daily activities, function and loss of work was reported in both groups, especially in the first 3 days (significance was detected only for day 1). A gradual recovery was observed during the first postoperative week for these two parameters.

Discussion

The preservation of soft tissues represents a challenge in any surgical and reconstructive procedure. When the success of a surgical treatment has to be evaluated,

not only healing and function should be assessed. The aesthetic outcome and the patient's subjective symptoms such as post-treatment discomfort should also be taken into account as they may affect their quality of life and acceptance of treatment.

Treatment of the soft tissues with adequate surgical and reconstructive techniques as well as ongoing maintenance is mandatory in modern dentistry, and preservation of the dentition is no longer acceptable without considering the aesthetic consequences (Allen 1988).

The prognosis of endodontic periradicular surgery is dependent on a myriad of factors (Rud *et al.* 1972). According to Friedman (1988), these factors can be divided into preoperative, intra-operative and postoperative. Amongst the latter there is the degree of tissue shrinkage. Some studies showed that a full-thickness marginal flap is related to considerable retraction of the papilla especially during the initial healing phase that may often lead to scar formation (Velvart & Peters 2005). By contrast, the PBI technique allows predictable recession-free healing of the interdental papilla, without scar formation (Velvart & Peters 2005). For these reasons such a technique should be preferred, to avoid opening of the proximal space, when periradicular surgical treatment is necessary.

In the present study, the two types of incisions were compared by examining the patient's quality of life postoperatively, without considering the aesthetic issue. The latter in fact should be evaluated later than 1 week post-surgery, when complete soft tissue healing has occurred. Both SI and PBI groups revealed that age, gender, smoking, site of operation and size of the lesion had no influence on postoperative sequelae. This result is in agreement with other studies (Tsesis *et al.* 2005, Penarrocha *et al.* 2006, Christiansen *et al.* 2008). Another recent study reported conflicting results regarding smoking effects on postoperative pain and swelling (García *et al.* 2007), suggesting that the actual influence of smoking habits on postoperative symptoms, if any exists, is yet to be determined. Amongst the various possible confounding factors, preoperative oral hygiene status was also recently claimed to negatively affect pain and swelling after periapical surgery (García *et al.* 2007). Conversely, another study reported no influence of such factor on the postoperative period (Penarrocha *et al.* 2006). This factor was not considered in the present study because in addition to the presurgical rinse with chlorhexidine, all the patients underwent a session of professional oral hygiene the day before surgery.

All patients of both groups reported in the first 2 days the greatest discomfort with speaking and chewing, whilst sleeping was only moderately affected. The postoperative symptoms were similar to those reported in the study by Tsesis *et al.* (2005).

Some studies have revealed a lower incidence of postoperative pain and swelling following periapical surgery using operating microscopes versus periapical surgery performed using traditional techniques. Pecora & Andreana (1993) hypothesized that the microscope allowed for a better control of soft tissues, minimizing surgical trauma. In the present study, the same anaesthesia and the same microsurgical procedure during the root-end management was used in both groups.

Pain experience peaked in both groups in the first 2 days, but the decrease in pain levels was more rapid and the amount of analgesics taken, as well as tissue swelling, was lower in patients belonging to the PBI group from days 3 to 7.

Using the full thickness flap the papilla is mobilized and becomes part of the flap. The buccal papilla should be dissected from the lingual papilla, but in narrow interproximal space the separation process is technically difficult and damage to the papilla occurs easily due to the elevation process. Residual tissue fragments after the flap elevation process are often too small to survive and may necrotize leading to recession (Gutmann & Harrison 1991, Velvart & Peters 2005). Often there is insufficient adaptation of the papilla to the underlying tissue surface and this might pre-dispose to recession. The dimension of the papilla might also have an effect on the healing pattern after surgery. The PBI technique, which leaves the body of the papilla in place, would eliminate any visible opening of the interproximal space during the healing process. With this technique split flap thickness can be preserved thereby maintaining tissue vitality. Hence, the risk of recession defects and loss of papilla height can be reduced.

The data of the present study showed that a more rapid decrease in pain levels is achieved with the PBI incision. This may affect the quality of life of patients and treatment acceptance. Further prospective studies with larger sample size are needed to confirm the present results.

Conclusions

The type of incision performed influenced pain levels, swelling and drug intake in the first postoperative week. A papilla-base incision technique, when applicable,

may be preferred to other flap designs for the management of soft tissues in periradicular surgery.

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