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Investigation of factors that influence pain experienced and the use of pain medication following periodontal surgery

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Abstract

Aims: To determine the relationship between anticipated pain and actual pain experienced following soft tissue grafting or implant surgery; to identify the factors that predict actual pain experienced and the use of pain medication following soft tissue grafting or implant surgery.

Materials and Methods: Prior to dental implant placement (n = 98) or soft tissue grafting (n = 115) and for seven days following the procedure, patients completed a visual analog scale indicating anticipated or experienced pain, respectively. The use of pain medication and alcohol, and smoking were measured.

Results: Actual pain experienced on day 1 was lower ($p < .01$) than anticipated pain and continued to decrease ($p \leq .01$) for each of the 7 consecutive days. Anticipated and actual pain were positively correlated. Increasing age ($p < .05$), having sedation during the surgery ($p < .05$), and lower use of pain pills ($p < .01$) predicted lower pain experienced. Actual pain experienced was a predictor of pain pill use ($p < .01$). Greater nervousness ($p < .01$) prior to surgery was a predictor of greater anticipated pain.

Conclusions: Patients anticipated more pain than they actually experienced. Sedation, age and number of pain pills used predicted pain experienced. This trial was registered with clinicaltrials.gov as NCT03064178.

KEYWORDS

actual pain, anticipated pain, anxiety, implant surgery, sedation, soft tissue graft, visual analog scale

1 | INTRODUCTION

Fear or anxiety is known to prevent an individual from seeking dental treatment, and periodontal surgery may be particularly disconcerting (Armfield & Ketting, 2015; Chanpong, Haas, & Locker, 2005; Quteish Taani, 2002). Moreover, patients with higher anxiety pre-surgery have reported experiencing more pain following their surgery (Eli, Schwartz-Arad, Baht, & Ben-Tuvim, 2003; Fardal & McCulloch, 2012). Given that much of the pain associated with periodontal procedures would be expected to subside during the first week post-surgery, daily assessment of pain may more fully quantify the actual pain experienced and thereby better inform prospective patients regarding pain experience. Moreover, having a patient record pain experienced on a daily basis, rather than have the patient recall when they experienced their worst pain over a time period of a week or more, reduces the risk of recall bias.

A previous study identified factors associated with higher pain perception following periodontal or implant surgery. These factors were the following: the complexity of the surgery, the experience of the surgeon, the duration of the surgery, the extension of the

surgical site, the type of pain medication used following surgery, the amount of anaesthesia used, and having periosteal fenestration/dissection (Mei, Lee, & Yeh, 2016). However, it is important to note that not all factors that influence pain perception are intrinsic to the surgical process itself. Anxiety towards dental treatment is also reported to influence the amount of pain patients experience (Eli et al., 2003). Another study investigated patient perceptions of periodontal treatment and compared surgical and non-surgical procedures (Matthews & McCulloch, 1993). It was found that patients who underwent periodontal surgery, such as soft tissue grafts, experienced more pain and swelling post-surgery than those who underwent a non-surgical procedure such as scaling and root planing (Matthews & McCulloch, 1993).

The aforementioned studies highlight the importance of having evidence-based data regarding the amount of pain experienced following periodontal surgery, and to potentially ease pre-treatment anxiety. Based on existing literature, this study was designed to determine how actual pain experienced is influenced by the following factors: anticipated pain, nervousness, type of surgery, sedation, pain pill usage, sex, age and smoking. While higher levels of anticipated pain and nervousness are known to result in higher levels of experienced pain (Eli et al., 2003), the influence of other factors is less consistent and thus was included in our regression analyses. Type of surgery may influence pain experienced due to invasiveness and surgical time. Patients reported experiencing more pain, swelling and bruising when their surgery duration was 60 min or longer (Tan, Krishnaswamy, Ong, & Lang, 2014). For this reason, soft tissue grafts were compared with implant placement as a longer surgical time is required. Sedation use was included because there is evidence that sedation affects pain recall when measured one month post-operatively (Wilson, McNeil, Kyle, Weaver, & Graves, 2014) and has also been shown to decrease pre-operative anxiety, which in turn could affect pain outcome (Wilson et al., 2014). Sex and age were also included as both are known to potentially influence pain perception. There is still no consensus regarding sex differences related to pain perception. There is some evidence that a difference does exist. Men have been found to anticipate more pain, but recall less pain as a result of periodontal surgery (Eli, Baht, Kozlovsky, & Simon, 2000). Others have found that females report more anxiety than males but not more pain (Fardal & McCulloch, 2012). Age was a factor of interest because in other disciplines such as emergency medicine, age-related differences have been found, but there is little evidence available to determine the role of age-related pain differences among periodontal patients (Daoust et al., 2016). When assessing pain following periodontal treatment of chronic periodontitis, it was found that patients aged 18 to 44 years reported more pain than older patients (age 45 to 67 years) (Canakci & Canakci, 2007). Smoking may exacerbate pain due to the overwhelming detrimental effect that smoking has on periodontal tissue and healing (Grossi et al., 1997). A prior study reported that smokers experienced greater pain than non-smokers at 24 hr after extraction of the third molar (Larrazabal, Garcia, Penarrocha, & Penarrocha, 2010).

Clinical Relevance

Scientific rationale for the study: Fear of pain associated with periodontal surgery can be a deterrent for seeking treatment. Avoidance of such procedures can lead to further health complications and higher risk of chronic disease that may be related to poor nutritional status.

Principal findings: Patients, who anticipate less pain, have sedation and are older experience less pain. Thus, attenuating the anxiety of a patient pre-surgery and using sedation can be part of a strategy to improve the post-surgery experience of a patient.

Practical implications: Providing evidence-based information regarding actual pain experienced may prevent patient avoidance of periodontal procedures that promote wellness.

To more accurately inform patients about how much pain they will experience because of their periodontal surgery, the objectives of this study were to determine the relationship between anticipated pain and actual pain experienced following soft tissue grafting or implant surgery and to identify the factors that predict actual pain experienced and the use of pain medication following soft tissue grafting or implant surgery.

2 | MATERIALS AND METHODS

2.1 | Subjects

A total of 213 patients were recruited from a periodontal clinic in Southern Ontario. The required sample size was calculated to be 114, but a larger sample size was used to further substantiate significant findings. Using the equation of Tabachnick and Fidell (2007), $n = 50 + 8k$ was used to calculate the required sample size for the regression analysis in which at least 50 cases are included in addition to eight times the number of independent predictor variables. Our regression analysis included eight independent predictor variables (sex, type of surgery, nervousness, anticipated pain, sedation use, age, smoking and pain pill use (Model 1 only) or pain experienced (Model 2 only). Patients requiring dental implant surgery or soft tissue graft surgery were eligible to participate. Patients were not eligible to participate if they regularly took pain medication for pre-existing health conditions or if they previously had implant or soft tissue graft surgery because they had prior knowledge of how much pain to expect. Patients were also required to be 19 years of age or older. If eligible, a patient was presented with a letter of invitation by a dental assistant during their consultation prior to surgery. Informed written consent was obtained from all patients who elected to participate. Demographic information for the

patients such as sex, age and smoking history was collected from patients' records. Nervousness towards dental treatment was measured using a scale of 1 through 5 (1 being not nervous and 5 being very nervous). The nervousness scale was filled out by patients upon their first visit to the clinic and was retained in their file. The periodontist therefore had access to the nervousness rating prior to the procedure. Patients were instructed on how to complete the 7-day diary before surgery. The study design is shown in Figure 1. The study protocol was approved by the Research Ethics Board at Brock University.

2.2 | Surgical procedure

All periodontal surgery, either the dental implant placement, connective tissue graft (CTG) or mucogingival graft (MGG)), was performed by the same periodontist (PCF). Patients were instructed to take 600 mg ibuprofen preoperatively at the start of their appointment. They also took four amoxicillin capsules (500 mg each) prior to surgery and had a 30-s antimicrobial rinse (chlorhexidine) immediately prior to surgery. Patients were provided the following post-operative medication and instructions: 600 mg ibuprofen every six hours following surgery as needed for pain; a 7-day course of amoxicillin (tid); a chlorhexidine rinse 24 hr after surgery and thereafter twice daily until sutures are removed 2 weeks later. Patients who received a graft were fitted with a palatal stent before surgery to protect the site post-surgery. Patients had control over when they wore the stent. Local anaesthetic used was lidocaine HCl 2% and epinephrine 1:50,000. Patients who opted to have conscious sedation were administered triazolam (oral), midazolam (IV) and dexamethasone (IV).

2.3 | Pain evaluation

Patients completed a 10-cm visual analog scale (VAS) prior to surgery indicating the amount of pain they anticipated as a result of their surgery. The VAS had anchors at 0 cm indicating "no pain" and 10 cm indicating "worst pain imaginable." There were no other markings along the VAS. This served as the anticipated pain measure, and completed VAS was collected from the patient before their procedure. Patients completed Day 1 of the diary on the same day they had the surgery and each consecutive day following for a total of seven days. Each day, the patients completed the VAS in the diary to indicate the amount of pain they experienced, the number of pain pills they took to manage their pain, and any use of alcohol (number of servings) and tobacco (number and whether it was cigarettes and/or cigars). The amount of pain medication used by the patient served as an alternative way of assessing the amount of pain a patient experienced compared to the VAS. This was collected to gauge how much pain medication the patient felt was necessary to control the pain following surgery. Patients returned their completed 7-day diary at their two-week follow-up visit.

2.4 | Statistical analyses

Statistical analyses were performed using IBM SPSS Statistics version 22. A bivariate correlation was used to test whether there was a significant relationship between the amount of pain anticipated and the amount of actual pain experienced. A repeated measures ANOVA was used to examine how pain changed over time. This informed which day pain was greatest and, therefore, which day to use for pain rating in the regression. The factors that influenced actual pain experienced (Model 1) and amount of pain medication used (Model 2) were examined using linear regression. Predictor variables for the two regression models included the following: sex, type of surgery, nervousness, anticipated pain, sedation use, age and smoking. In Model 1, pain pill use was also included, whereas actual pain experienced was included in Model 2.

Model 1: Pain$_i$ = $\beta 0_i + \beta 1\ \text{sex}_i + \beta 2\ \text{surgery}_i + \beta 3\ \text{nervousness}_i + \beta 4$ anticipated pain$_i$ + $\beta 5$ sedation$_i$ + $\beta 6\ \text{age}_i + \beta 7\ \text{smoking}_i$ + $\beta 8\ \text{pain pills}_i + \varepsilon_i$

Model 2: Pills$_i$ = $\beta 0_i + \beta 1\ \text{sex}_i + \beta 2\ \text{surgery}_i + \beta 3\ \text{nervousness}_i + \beta 4$ anticipated pain$_i$ + $\beta 5$ sedation$_i$ + $\beta 6\ \text{age}_i + \beta 7\ \text{smoking}_i$ + $\beta 8\ \text{pain}_i + \varepsilon_i$

Statistical significance was defined as $p < .05$.

3 | RESULTS

3.1 | Patient demographics

Of the 256 patients recruited, 213 had complete anticipated pain scale ratings and 7-day pain diaries and were therefore included in the final analysis. This was a completion rate of 83%. The average age of the patients was 51 ± 15 years with an age range of 19–80 years. Females accounted for 62.4% of the sample. Among the types of surgeries, 54% had soft tissue grafts, which could be further divided into 42.2% CTG, 10.8% MGG and 1% had both CTG and MGG surgeries. The remaining 46% of surgeries were implanted placements. Patient characteristics of the final sample are summarized in Table 1.

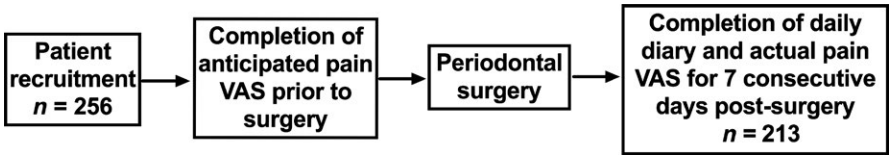

FIGURE 1 Study design. After recruitment, patients completed the anticipated pain VAS prior to surgery. They were instructed to complete the first day of their diary in the evening of the same day of their surgery and each consecutive day following for a total of 7 days

TABLE 1 Descriptive statistics of patients electing for preventative or rehabilitative periodontal surgery

Age (years)	51 ± 15 (range: 19–80)
Gender [*n* (%)]	
Male	80 (37.6)
Female	133 (62.4)
Type of surgery [*n* (%)]	
Graft	115 (54)
CTG	90 (78)
MGG	23 (20)
CTG + MGG	2 (2)
Implant	98 (46)
Sedation [*n* (%)]	
IV	49 (23)
Nitrous	3 (1.4)
None	161 (75.6)
Smoking status [*n* (%)]	
Never	147 (69)
Former	54 (25.4)
Current	12 (5.6)
Nervousness [mean ± *SD*]	2.5 ± 1.3
1 [*n* (%)]	64 (30.6)
2	45 (21.5)
2.5	1 (0.5)
3	52 (24.9)
3.5	2 (1.0)
4	24 (11.5)
4.5	1 (0.5)
5	20 (9.6)
Expected pain [mean ± *SD*]	4.46 ± 2.37 (range: 0–9.4)

CTG, connective tissue graft; MGG, mucogingival graft.

3.2 | Pain analysis

The mean anticipated pain rating taken immediately prior to surgery was 4.46 ± 2.37. Actual pain on day 1 was significantly lower than anticipated pain ($p < .01$). Actual pain decreased continuously each day post-surgery ($p \leq .01$) (Figure 2).

3.3 | Relationship between anticipated and actual pain

The mean for actual pain experienced on day 1 was 3.20 ± 2.47. Actual pain on day 1 was used for comparison because that was when patients experienced the greatest amount of pain and therefore was deemed to be most clinically relevant. The Pearson correlation coefficient (R) was .274, and the R^2 value was .075. This correlation between anticipated pain and actual pain was statistically significant ($p = .01$, two-tailed test) (Figure 3). This indicated that a patient who anticipated a higher amount of pain was more likely to actually experience a higher level of pain.

3.4 | Predictors of actual pain

With respect to the regression analysis for actual pain experienced on Day 1 post-surgery, patients who deviated from the prescribed pain medication of 600 mg ibuprofen were excluded (21 patients). Data for age, nervousness and sedation were missing for 1, 4 and 3 patients, respectively. The final sample was therefore 184 patients. The model had an R of .474 and R^2 of .224. The adjusted R^2 was .184. The Durbin–Watson value was 2.112. Anticipated pain was a significant predictor variable of actual pain ($p < .01$). Patients who were older were likely to experience less pain ($p < .05$). Patients who had sedation during their procedure were likely to experience less pain than those who had local anaesthesia alone ($p < .05$). Pain pill use

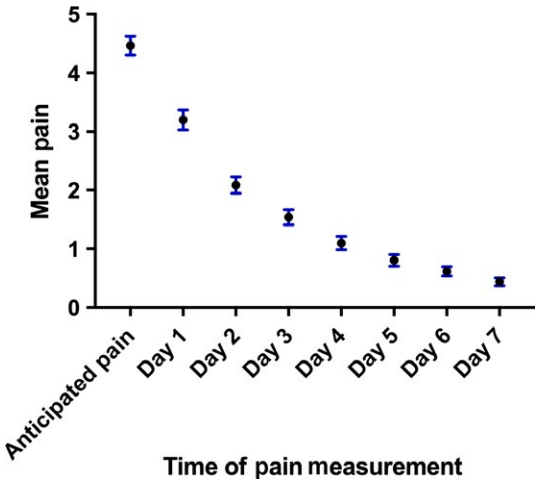

FIGURE 2 Mean pain rating recorded by patients on VAS. Anticipated pain was measured prior to surgery. Day 1 through day 7 indicates the actual pain experienced post-surgery. The same day of surgery was considered Day 1

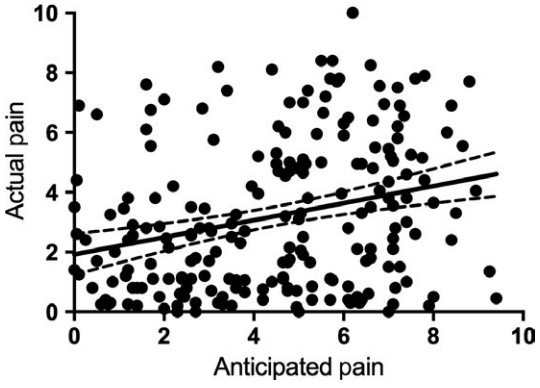

FIGURE 3 Bivariate correlation between anticipated pain and actual pain (on Day 1 post-surgery)

was also a predictor of actual pain experienced ($p < .01$). The regression analysis is summarized in Table 2.

3.5 | Factors affecting pain pill use

The sample size for the pain pill use regression was 184 patients. The R for the model was .413. It had an R^2 of .170, the adjusted R^2 was .128. The Durbin-Watson value was 1.965. The only factor that was a predictor of pain pill use was actual pain ($p < .01$). The regression analysis is summarized in Table 3.

3.6 | Factors affecting anticipated pain

Without having pain pills in the regression for predictors of anticipated pain, the sample size was larger with 205 patients with complete data sets. The R for the regression model analysing anticipated pain was .394. The R^2 was .155, and the adjusted R^2 was .125. The Durbin-Watson value was 1.837. Nervousness towards dental treatment was a predictor of anticipated pain ($p < .01$). The regression results are summarized in Table 4.

4 | DISCUSSION

A key finding was that patients anticipate that a periodontal surgery will be more painful than the pain they actually experience. Additionally, those who anticipate higher amounts of pain are likely to experience more pain than those who anticipate lower amounts of pain. Actual pain was found to be highest on day 1; the end of the day on the same day of surgery. Factors that predicted the amount of pain experienced included the patient's anticipated pain, their age, whether or not they had sedation, and how many pain pills they used. Specifically, patients experienced less pain if they had anticipated less pain, were older, had sedation and used less pain medication. In contrast, type of surgery, sex, nervousness and smoking status were not predictors of actual pain experienced.

Finding that anticipated pain and actual pain are positively correlated and that individuals who anticipate more pain tend to experience more pain highlights the psychological component of pain. Several studies that have examined the psychological component of acute pain have used the Pain Catastrophizing Scale (PCS) to measure an individual's affect towards their pain (Lin, Niddam, Hsu, & Hsieh, 2013; Pallegama, Ariyasinghe, Perera, & Treede, 2017; Quartana, Campbell, & Edwards, 2009). Pain catastrophizing is measured based on three main pillars: rumination, magnification and helplessness; these pillars evaluate the degree to which patients dwell on the pain they are experiencing or are about to experience, think that the pain will get worse, and how they feel like they can cope with the pain (Quartana et al., 2009). In a setting where pain intensity was unpredictable, PCS score was correlated with pain rating, but not when pain intensity was predictable (Lin et al., 2013). Therefore, the unpredictability of the pain and not the pain intensity itself was what caused the difference in pain rating between the two conditions; supporting the assertion that pain rating is not merely physiological, but that there is a psychological component as well.

Older individuals reported experiencing significantly less pain. There is clinical evidence to support the finding that pain perception

TABLE 2 Regression results of actual pain experienced on Day 1 post-surgery

	B ± *SE*	β	*t*	*p* value
Sex	−0.191 ± 0.359	−0.039	−0.533	.595
Surgery	−0.379 ± 0.368	−0.079	−1.029	.305
Nervousness	0.115 ± 0.142	0.062	0.809	.420
Anticipated Pain	0.230 ± 0.074	0.224	3.103	**.002**
Sedation	−0.983 ± 0.420	−0.174	−2.339	**.020**
Age	−0.030 ± 0.013	−0.185	−2.421	**.017**
Smoking	0.257 ± 0.281	0.064	0.916	.361
Pain Pills	0.575 ± 0.139	0.288	4.125	**.000**

Bolded numbers denote statistical significant findings.

TABLE 3 Regression of number of pain pills used on Day 1 post-surgery

	B ± *SE*	β	*t*	*p* value
Sex	0.341 ± 0.186	0.137	1.827	.069
Surgery	−0.058 ± 0.195	−0.024	−0.300	.764
Nervousness	−0.061 ± 0.074	−0.067	−0.830	.408
Anticipated pain	−0.010 ± 0.040	−0.019	−0.243	.809
Sedation	0.065 ± 0.207	0.025	0.315	.753
Age	−0.013 ± 0.007	−0.155	−1.958	.052
Smoking	−0.012 ± 0.148	−0.006	−0.079	.937
Pain	0.143 ± 0.037	0.290	3.883	**.000**

Bolded numbers denote statistical significant findings.

TABLE 4 Regression results for predictors of anticipated pain

	B ± *SE*	β	*t*	*p* value
Sex	0.233 ± 0.359	0.048	0.649	.517
Surgery	−0.622 ± 0.370	−0.132	−1.680	.095
Nervousness	0.459 ± 0.138	0.257	3.328	**.001**
Sedation	0.798 ± 0.392	0.156	2.036	.043
Age	0.005 ± 0.012	0.030	0.385	.701
Smoking	0.238 ± 0.283	0.061	0.841	.401

Bolded numbers denote statistical significant findings.

decreases with age. A clinical investigation investigating how pain perception differs with age used an 11-point numerical rating scale for patients who presented with conditions that are often associated with acute pain during an emergency department visit (Daoust et al., 2016). Six common diagnoses that are considered painful were the focus of the study: renal colic, pancreatitis, appendicitis, headache/migraine, dislocation or extremity fracture. It was found that pain decreased linearly with age for renal colic, pancreatitis, appendicitis and headache/migraine, but there were no age differences found for dislocation or extremity fractures (Daoust et al., 2016). The inflammatory response is responsible for the pain reported following surgery. Topical capsaicin can be used to experimentally induce a neurogenic flare response, which is a way of measuring stimulation of axon reflexes to mimic the inflammatory response (Helme, Littlejohn, & Weinstein, 1987). It was established that the flare response to capsaicin decreased as age increased indicating that the pain response could be diminished among older adults due to a decreased inflammatory response (Helme et al., 1987).

With regard to sedation in dentistry, it has previously been reported that there is a high demand with 68.2% of adults preferring to have conscious sedation or general anaesthesia during periodontal surgery than to go without sedation (Chanpong et al., 2005). This was higher than the preference for sedation for endodontics or extraction, suggesting that patients view periodontal surgery as the most painful dental surgery to endure without sedation (Chanpong et al., 2005). The current study found that patients who had sedation experienced less pain on day 1 than those who did not opt for sedation. This could be due to the dexamethasone adjuvant administered to those who had IV sedation. Dexamethasone helps decrease the acute pain a patient experiences because of its anti-inflammatory properties. A meta-analysis showed that individuals who were administered dexamethasone pre- or intra-operatively had lower VAS pain ratings at two and 24 hr post-operatively (Waldron, Jones, Gan, Allen, & Habib, 2013). It was also found that the 24-hr pain reduction was greater when dexamethasone was given pre-surgery compared with during surgery. Also, patients who were administered dexamethasone had lower opioid use to manage pain at 2 and 24 hr post-operatively. They required less "rescue analgesia" to manage intolerable pain, and they had a longer time to their first dose of analgesic (Waldron et al., 2013). Thus, the decreased pain experienced by the patients receiving IV sedation may be due to dexamethasone administered.

There is also evidence that conscious sedation affects a patient's recall of the surgery and the pain experienced (Wilson et al., 2014). To look at the effects of moderate sedation on recall of pain and anxiety, patients were analysed based on whether they had conscious sedation plus local anaesthesia during tooth extraction surgery or local anaesthesia alone (Wilson et al., 2014). Pain and anxiety were measured for three time points: state or current, predicted and recalled at 1 month post-surgery. It was found that there was a significant interaction between group and time with regard to the pain ratings. Those who underwent conscious sedation reported less pain in their state than before surgery (Wilson et al., 2014). The conscious sedation group also recalled less pain than the local anaesthesia only group (Wilson et al., 2014). The predicted pain levels were similar between two groups, but the conscious sedation group predicted that they would experience more pain than their state or recalled pain while the local anaesthesia alone group predicted less pain than their current state (Wilson et al., 2014). These results suggest that conscious sedation favourably affected the recall of pain related to oral surgery. Because those patients who had sedation recalled less pain following surgery, they might be more apt to seek oral care in the future.

Pain medication use was also a predictor variable for amount of pain experienced post-surgery. Specifically, patients who reported experiencing more pain also reported using more pain pills. This finding is in agreement with previous findings showing a correlation between analgesic consumption and the perception and duration of pain after periodontal surgery (Matthews & McCulloch, 1993; Mei et al., 2016). Moreover, a Cochrane systematic review examining the effects of oral ibuprofen for post-operative pain management compared with placebo found that ibuprofen is an effective method for providing post-operative analgesia (Derry, Derry, Moore, & McQuay, 2009). Of the 72 studies included in the review, 57 were related to dental pain (Derry et al., 2009). The primary outcome was a 50% reduction in pain over 4 to 6 hr (Derry et al., 2009). An effective dose of ibuprofen for pain relief was examined specifically in the dental studies: a 400 mg dose was significantly better at achieving 50% pain relief than 200 mg, and 600 or 800 mg was significantly better at achieving 50% pain relief than 400 mg (Derry et al., 2009). This is an important clinical finding for the current study because 600 mg ibuprofen, the same dose prescribed to the patients, was found to be most efficacious for pain relief.

A recent study evaluated pain perception following ten types of periodontal and implant surgeries (Mei et al., 2016). When analysed based on complexity of surgery; simple surgery, complex surgery, or periodontal plastic surgery, logistic regression analysis showed complex surgery and periodontal plastic surgery to be predictive of moderate-to-severe pain (Mei et al., 2016). When the surgery types were divided into periodontal surgeries and implant-related surgeries, there was no difference in numerical rating pain score (Mei et al., 2016). This is consistent with the findings of this study, which found no difference in the pain experienced between implant surgeries and soft tissue graft surgeries. This study also showed that the experience of the surgeon was significantly different between those

who experienced mild pain post-surgery and those who experienced moderate-to-severe pain post-surgery (Mei et al., 2016). The current study eliminated that variable by having all surgeries performed by one periodontist.

In addition to the type of surgery; sex, nervousness towards dental treatment and smoking status were not found to be significant predictors of actual pain. Some of these factors were hypothesized to influence pain experienced because previous studies had found a relationship such as that between nervousness and pain experienced (Eli et al., 2003). It was hypothesized that due to the reported sex differences in dental fear, this would result in sex differences in pain experience, but this was not the case. A possible explanation for the insignificant findings could be that the anchors on the VAS are open to individual interpretation, so "worst pain imaginable" might mean something different to males and females. This is not the only study to find no sex differences in pain perception between males and females (Mei et al., 2016). Interestingly, nervousness towards dental treatment was not a predictor of actual pain. This insignificant finding is perhaps attributable to the way nervousness was measured. The nervousness rating was obtained on the patient's first visit to the clinic, not the day of their surgery. This measure captured their overall attitude and sense of nervousness towards dental treatment instead of their state nervousness on the day of surgery. Smoking status was considered as a potentially influential factor because it is a known predictor of periodontitis and it delays the healing process, it was hypothesized that smokers would experience more pain as a result of surgery than non-smokers, but no difference was found between smokers and non-smokers. This insignificant relationship might be attributable to the small number of smokers included in the sample. It has been shown that recalled pain is greater than pain reported immediately after surgery (Kyle, McNeil, Weaver, & Wilson, 2016). For example, one month following extraction surgery, patients recalled more pain than they reported during experiencing the most painful part of their surgery immediately after the surgery (Kyle et al., 2016). In the current study, anticipated pain was recorded prior to surgery and actual pain in their diary each day for a 7-day period so that they did not have to recall the pain they experienced at any time point. This means that the present study may have more accurately measured actual pain experience than studies requiring patient recall.

5 | CONCLUSION

Patients tend to anticipate more pain than they actually experience after implant or soft tissue graft surgery. As anticipated pain is correlated with actual pain, a patient who anticipates a greater amount of pain will likely also experience a greater amount of pain. The greatest amount of pain experienced by patients occurs on the same day of surgery with a significant decrease in pain each day following surgery. In addition to anticipated pain being a predictor of actual pain, other factors that predicted lower actual pain experienced included use of sedation, older age and lower number of pain pills used. The amount of pain the patient was experiencing was the only predictor of pain pill use.

5.1 | Implications

Enhancing our understanding of a patients' pain experience can help direct the conversation regarding how much pain a patient should anticipate and what factors can be modulated to reduce pain. This has important clinical implications because the fear of pain resulting from oral surgery can be a deterrent for seeking treatment (Armfield & Ketting, 2015; Chanpong et al., 2005). Dental avoidance can then lead to further health complications that may be related to poor nutritional status and thus higher risk of chronic disease (Beaudette, Fritz, Sullivan, & Ward, 2017). Thus, providing patients with evidence-based guidance regarding realistic expectations of pain following surgery might reduce dental avoidance (Beaudette et al., 2017). Findings from this study can be shared with future patients; showing that the actual amount of pain experienced by these patients was less than they anticipated. For clinicians to be able to inform their patients of this, it might ease their anxiety towards treatment, which might ultimately result in less pain experienced and better overall health.

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CONFLICT OF INTEREST

The authors declare that there are no conflict of interests in this study.

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