Third molar surgery outcomes: a comparison between intravenous sedation and general anaesthesia

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Abstract

**Objective.** To compare intravenous (IV) sedation and general anaesthesia (GA) for third molar surgery in terms of patient anxiety, satisfaction, choice and, oral-health-related quality-of-life (OHRQoL).

**Study Design.** A quasi-experimental design was used, with a clinical convenience sample of patients requiring the removal of two mandibular third molar teeth. Each participant was consulted by an oral and maxillofacial surgeon or one of their surgical trainees, and they were given a free choice between IV sedation and GA for their operation. Participants completed a questionnaire before surgery and again 10-14 days afterwards. Data collected before surgery included baseline sociodemographic characteristics, OHRQoL, anxiety, aspects of personality (positive and negative emotionality) and history of pain. Data collected after surgery included the severity of pain, time taken for recovery, OHRQoL, anxiety, and satisfaction with the surgery.

**Results.** Of the 142 patients, 73 (51.4%) chose to have the operation under IV sedation and 69 (49.4%) underwent GA. Patients opting for GA scored more highly at baseline on negative affectivity and dental anxiety. After surgery, they reported taking more days off before returning to normal activities, as well as a higher incidence of sore throat and nausea.

**Conclusion.** Patients with negative affectivity and higher anxiety opt for their operation to be carried out under GA but this results in more post-operative side-effects and days off.
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<td>alveolar osteitis</td>
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<tr>
<td>ASA</td>
<td>American Society of Anaesthesiology</td>
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<td>CSC</td>
<td>community services card</td>
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<td>GA</td>
<td>general anaesthesia</td>
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<td>IV</td>
<td>intravenous</td>
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<td>LA</td>
<td>local anaesthesia</td>
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<tr>
<td>LMA</td>
<td>laryngeal mask airway</td>
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<td>MID</td>
<td>minimum important difference</td>
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<tr>
<td>MPQ</td>
<td>Multidimensional Personality Questionnaire</td>
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<tr>
<td>NA</td>
<td>negative affect</td>
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<tr>
<td>NOCS</td>
<td>nitrous oxide conscious sedation</td>
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<tr>
<td>NSAID</td>
<td>non-steroidal anti-inflammatory drug</td>
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<tr>
<td>OHIP</td>
<td>oral health impact profile</td>
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<tr>
<td>OHRQoL</td>
<td>oral-health-related quality-of-life</td>
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<tr>
<td>PA</td>
<td>positive affect</td>
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<td>PANAS</td>
<td>Positive and Negative Affect Schedule</td>
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<tr>
<td>PONV</td>
<td>post-operative nausea and vomiting</td>
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<tr>
<td>RCT</td>
<td>randomised control trial</td>
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<tr>
<td>TMJ</td>
<td>temporomandibular joint</td>
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<tr>
<td>VRS</td>
<td>Verbal rating scale</td>
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Chapter 1: Introduction and Literature review

1.1 Introduction

The surgical extraction of third molar teeth (wisdom teeth) is one of the most common surgical procedures carried out in dentistry (Dodson and Susarla, 2010). The indications for the extraction of these impacted teeth include: repeated bouts of pericoronitis; damage to the adjacent teeth; associated pathology; and non-restorable carious lesions and/or pulpal pathology (Kandasamy and Rinchuse, 2009). Third molar surgery may be undertaken under local anaesthesia alone, but more complex impactions may require general anaesthesia (GA). Other considerations—such as age, anxiety, general health, pathology associated with the third molar, technical difficulty and cost—will also determine the type of anaesthesia. The popular perception of third molar surgery being more invasive and traumatic than other forms of oral surgery means that it is common for patients to request a GA for their operation. GA is not without its own risks and complications, and other options should be offered and considered (Brann et al., 1999). For example, intravenous (IV) sedation may be used with local anaesthesia (LA) as an alternative. This method has been shown to be safe and reliable for the surgical removal of third molars (Garip et al., 2007). To date, comparisons of these anaesthesia methods are scarce, and so, surgeons’ recommendations must rely on factors such as the available facilities, cost, and their own preferences.

1.2 Literature review

1.2.1 Third molar surgery outcomes

In this section, an overview of the surgical outcomes from third molar surgery will be discussed. After a brief introduction, common complications such as pain, swelling, trismus and alveolar osteitis will be reviewed.
1.2.1.1 Introduction

Third molar teeth are commonly the last teeth to erupt into the oral cavity, and their impactions are extremely common. A Swedish paper reported more than 72% of people aged between 20 and 30 years have at least one lower impacted third molar (Hugoson and Kugelberg, 1988). However, a recent meta-analysis of the worldwide prevalence of third molar impaction was found to be 24.4% (Carter and Worthington, 2015). The sequelae of impacted third molar teeth can result in pain, swelling, repeated bouts of pericoronitis, cyst formation, damage to the adjacent teeth and pulpal pathology (Kandasamy and Rinchuse, 2009). Due to the rise in surgical complications as we age, the removal of third molars are often carried out in the patient's 20s or 30s (Renton et al., 2001; Gbotolorun et al., 2007). As a result, their removal—whether prophylactic or curative—is one of the top ten in-patient and day-case procedures, and therefore makes up a large proportion of the oral and maxillofacial surgery hospital waiting list (Shepherd and Brickley, 1994; Worrall et al., 1998).

This operation is not without complications, with the most common being pain, swelling, trismus and alveolar osteitis (dry socket) (Nageshwar, 2002). The sections to follow will review the current understanding of each, in terms of its definition, aetiology, treatment and prevention.

1.2.1.2 Pain

Pain is defined as an unpleasant sensory and/or emotional experience that can be associated with the presence or absence of tissue damage (Bonica, 1979). Pain after surgery is a normal physiologic response. However, there are certain factors that can contribute to an increased pain experience.

Patient age and gender have been associated with pain. Patients in the older age range, >30 years old, and females have a higher risk of experiencing more pain after surgery (Benediktsdottir et al., 2004). Patients with a less than desirable oral hygiene regime also have more post-operative pain (Larrazábal et al., 2010).

Different mucoperiosteal flap designs have been studied in association with post-operative pain (Jakse et al., 2002; Kirk et al., 2007; Goldsmith et al., 2012; Dolanmaz et al., 2013). These studies all concluded that there is little difference in pain experience from different flap designs.
Kim et al carried out a prospective study where extraction of mandibular third molars were carried out without raising a full thickness mucoperiosteal flap (Kim and Choi, 2011). They found this technique to significantly reduce post-operative pain. However, the criteria for its use were heavily restricted and unlikely to be applicable in more severe impaction cases.

Medication use has a direct impact on patients’ pain experience post-surgery. Antibiotics have been well researched in third molar surgery, and various studies have compared their use pre-operatively and post-operatively (Arteagoitia et al., 2005; Lacasa et al., 2007; Monaco et al., 2009; López-Cedrún et al., 2011). A review of randomised control trials by Oomens and Forouzanfar concluded that there is limited evidence to support the use of routine antibiotics (Oomens and Forouzanfar, 2012). A systematic review published by Marcussen et al concluded that a single oral dose of 2g of amoxicillin before third molar surgery significantly decreases the incidence of infection and pain (Marcussen et al., 2015). Additionally, Susarla et al commented that level 1 evidence suggests that patients undergoing multiple third molar extractions will benefit from a single dose of systemic antibiotic administered pre-operatively (Susarla et al., 2011).

The analgesic medication regime is an important aspect of pain control during third molar surgery. Ibuprofen is an effective non-steroidal anti-inflammatory drug (NSAID) for pain management (Seymour et al., 1998), while other NSAID,—such as diclofenac (Collins et al., 1998; Shah et al., 2012), other COX-2 inhibitors (Haglund and Bu, 2006; Levrini et al., 2008; Tiigimae-Saar et al., 2010; Jacob Liporaci Junior, 2012), tramadol and mecloxicam (Isiordia-Espinoza et al., 2012)—have all been shown to be effective in pain management. The addition of opiates (such as codeine) to a NSAID is also common practice; however, a recent double-blinded randomised control trial showed no difference (Best et al., 2017). Perhaps more importantly, the timing of medication—such as the administration of pre-emptive analgesia—is critical in reducing post-operative pain (Yamaguchi and Sano, 2013). At the time of writing, there were no studies that show one analgesic to be superior to another; thus, their choice is largely based upon the treating clinician and patient preferences.

The administration of corticosteroids (such as intravenous dexamethasone) pre-operatively can reduce post-operative pain (Baxendale et al., 1993; Buyukkurt et al., 2006; Mehra et al., 2013). The use of orally administered corticosteroids such as betamethasone does not seem to provide the same reduction in pain relief, but 30mg of oral prednisolone given to patients immediately after surgery can be of benefit (Tiigimae-Saar et al., 2010; Marques et al., 2014). Even though
there seems to be conflicting evidence, the use of short-term corticosteroids is beneficial in managing post-operative discomfort, with minimal side-effects (Ngeow and Lim, 2016).

A longer operation time has been shown to increase post-operative pain (Benediktsdottir et al., 2004). This may be directly related to the surgeon’s experience, since less experienced surgeons have a higher incidence of complications (Sisk et al., 1966; Capuzzi et al., 1994).

The use of hilotherapy, an alternative to cryotherapy, has been trialled in recent times to manage post-operative pain. It utilises a contoured facemask and delivers cooled water (15 °C) that runs adjacent to the skin, avoiding iatrogenic cold injury (from ice packs) and poor compliance (Bates and Kneipil, 2016). This therapy is encouraging, with recent studies in maxillofacial trauma and orthognathic surgery showing dramatic improvement in patient-reported pain (Modabber et al., 2013; Bates and Kneipil, 2016; Glass et al., 2016; Veitz-Keenan, 2016).

In summary, pain after third molar surgery is to be expected, and a multitude of different strategies have been suggested and used to manage this common post-operative complication. The subjective nature of pain means that it can be difficult to ascertain the ideal strategy for any given situation, and so it must be evaluated individually.

1.2.1.3 Swelling

Swelling is defined as a “transient abnormal enlargement of a body part or area not due to cell proliferation” (Dorland’s Medical Dictionary). Swelling after third molar surgery is a common complication, and its severity varies among patients. Different strategies have been suggested for its management, and they are reviewed in this section.

The use of corticosteroids in surgery has been well documented and widely used (Baxendale et al., 1993; Buyukkurt et al., 2006; Graziani et al., 2006; Tiigimae-Saar et al., 2010; Alcântara et al., 2014). A recent systematic review by Herrera-Briones and co-workers on the use of corticosteroids in third molar surgery concluded that their administration significantly improves post-operative swelling, especially if it is used pre-operatively and administered parenterally (Herrera-Briones et al., 2013).

The use of hilotherapy—as previously mentioned—not only aids in pain, it dramatically reduces post-operative swelling, especially in the first 3 days after surgery (Modabber et al.,
Although those results are encouraging, Bates and Knepil did mention that the available studies in their meta-analysis were limited with low numbers, and a large variability in study design and analysis. Further well-designed trials are required to confirm its efficacy.

Numerous studies have investigated flap designs and their influence on post-operative swelling (Jakse et al., 2002; Kirk et al., 2007; Goldsmith et al., 2012; Dolanmaz et al., 2013). These studies all consistently showed that different flap designs do not significantly influence post-operative swelling. However, the closure of surgical flaps does influence post-operative swelling, with primary closure resulting in significantly greater post-operative swelling (Pasqualini et al., 2005; Danda et al., 2010).

Other medications that have been trialled to investigate their effects on swelling are antibiotics and analgesics (Bjørnsson et al., 2003; Lacasa et al., 2007; Kaczmarzyk et al., 2007; Monaco et al., 2009). These studies did not conclude whether the use of these medications was effective in reducing the severity of post-operative swelling after surgery, however.

Patient characteristics (such as age and gender) has been related to more post-operative swelling after third molar surgery (Yuasa and Sugiura, 2004; Kim et al., 2006). These studies concluded that males and patients over the age of 30 developed more post-operative swelling.

In summary, different therapies have been trialled for the management of post-operative swelling. The use of corticosteroids has been well-documented and shown to be effective for reducing its severity. Newer therapies such as hilo therapy are encouraging, while there is no evidence that either surgical flap design or the use of antibiotics has any benefit.

**1.2.1.4 Trismus**

Trismus is defined as a "motor disturbance of the trigeminal nerve, especially spasm of the masticatory muscles, with difficulty in opening the mouth (lockjaw), a characteristic early symptom of tetanus" (Dorland's Medical Dictionary).

There are several factors that can cause a patient to develop trismus. Infection, trauma, temporomandibular joint disorders, radiotherapy, chemotherapy, and congenital defects can all cause the normal range of mouth opening of 40-60mm to decrease (Dhanrajani and Jonaidel,
2002). For the purpose of this literature review, studies will be limited to trismus arising from third molar surgery.

A 2-year prospective study carried out by Grossi et al, identified various pre-operative factors that were associated with severe trismus after third molar surgery. These were older patients (older than 22 years of age), females, ramus relationship, tobacco use, intra-operative bone removal and deeply impacted molars (Grossi et al., 2007).

The relation of different operative techniques to the severity of post-operative trismus has been studied. The use of different surgical flap designs was investigated because it is relatively easy to learn and modify for research, and it had been hypothesised that modification of the flap design might avoid damaging the surrounding structures (such as the buccinator muscle), thus reducing the degree of trismus (Jakse et al., 2002; Nageshwar, 2002; Kirk et al., 2007; Kim and Choi, 2011; Goldsmith et al., 2012; Dolanmaz et al., 2013). These studies consistently concluded that flap design did not have any influence on post-operative trismus.

The lingual split surgical technique has been shown to result in less trismus (Yates et al., 1979). However, this technique is now less frequently indicated due to the high risk of lingual nerve damage (Mason, 1988; Valmaseda-castellón et al., 2000; Pichler and Beirne, 2001; Renton and McGurk, 2001).

The administration of intravenous corticosteroids (such as dexamethasone) can reduce trismus after third molar extractions (Graziani et al., 2006; Beirne, 2013; Alcântara et al., 2014). However, corticosteroids—such as methylprednisolone (Ustun et al., 2003; Alcântara et al., 2014) or betamethasone (Marques et al., 2014)—do not result in any improvement in the degree of trismus. The use of corticosteroids—as mentioned in the previous section—has a beneficial effect on the severity of post-operatively swelling, which can also have a positive effect on the degree of trismus that patients experience.

Cryotherapy does not appear to benefit the degree of trismus post-operatively, but the use of hilotherapy may be helpful (Laureano Filho et al., 2005; Rana et al., 2011). In the latter study, they compared the use of the Hilotherm cooling device with conventional ice packs, and concluded that the use of the device improved trismus post-operatively and reduced the duration of hospital stay. However, this study utilised the device in patients undergoing orthognathic surgery.
In summary, trismus is a common complication of third molar surgery. The existing literature shows that pre-operative factors such as severity of the impaction are significant predictors for trismus, while operative technique and the use of corticosteroids do not seem to have an effect. Newer technologies such as the Hilotherm cooling device appear to be of benefit, especially in maxillofacial surgery, but this is a costly capital expense for routine third molar surgery.

1.2.1.5 Alveolar osteitis

Alveolar osteitis (AO), commonly known as dry socket, is defined as post-operative pain inside and around the extraction site, which increases in severity at any time between the first and third day after the extraction; it may be accompanied by a partially or totally disintegrated blood clot within the alveolar socket, with or without halitosis, and with pain occasionally radiating up to the ear and temporal region (Kolokythas et al., 2010). It was first described in the literature by Crawford in 1896 as the condition known as dry socket. Since then, many other terms have been used, such as localised osteitis, post-operative alveolitis, alveolalgia, alveolitis sicca dolorosa, septic socket, necrotic socket, localised osteomyelitis and fibrinolytic alveolitis (Birn, 1973; Blum, 2002).

The incidence of AO in the literature is variable. AO can occur after routine dental extractions and is reported to be in the range of 0.9% to 3.2% of cases (Fridrich and Olson, 1990). The incidence after third molar surgery is much higher, with reports ranging up to 45% (Fridrich and Olson, 1990; Larsen, 1991; Larsen, 1992; Blum, 2002; Sweet and Butler, 2011). This variability is partly due to the inconsistencies in the literature’s AO definition and method of assessment (Blum, 2002). Irrespective of its incidence, AO is a painful post-operative complication and the patient may require up to 4 additional visits to manage the condition (Larsen, 1991).

The aetiology of AO is multi-factorial. A case series of over 10,000 extractions found predisposing factors to be female gender, being aged 30-34 years, a smoker, or having traumatic or multiple extractions (MacGregor, 1968). Other considerations—such as inexperienced surgeon, oral contraceptive use, flap design, physical dislodgement of blood clot, pre-existing pericoronitis, fragments remaining in the wound, and excessive irrigation—have all been suggested as contributing factors (Nitzan, 1983; Larsen, 1992; Blum, 2002; Kirk et al., 2007; Kolokythas et al., 2010; Azhar Sheikh et al., 2010; Eshghpour and Nejat, 2013).
The seemingly unavoidable nature of the occurrence of AO—even in young, healthy, non-smoking patients—means that many strategies and methods have been proposed to treat it or reduce its occurrence. Common preventive measures are the use of antibiotics and chlorhexidine rinses, while less frequent strategies include anti-fibrinolytic agents, steroid anti-inflammatory agents and obtundent dressings (Blum, 2002; Noroozi and Philbert, 2009).

Prophylactic antibiotics have been suggested to reduce the incidence of AO (Noroozi and Philbert, 2009). Locally delivered tetracycline or clindamycin using impregnated gelatin sponges or gelfoam and systemic penicillins, metronidazole or erythromycin have all been shown to reduce the incidence of dry socket (Goldman et al., 1973; Rood and Murgatroyd, 1979). Conversely, other studies have found that systemic pre-operative antibiotics made no difference to AO incidence (Bergdahl and Hedstrom, 2004). Even though the use of antibiotics remains a controversial issue, a meta-analysis by Ren and Malmstrom concluded that systemic antibiotics given prior to surgery were effective in reducing AO and wound infection (Ren and Malmstrom, 2007). This conclusion was further verified by another systematic review in 2016 (Ramos et al., 2016).

The use of topical antimicrobial agents such as chlorhexidine mouth rinses in prevention of AO is well documented. The use of chlorhexidine concentration, of 0.12% and 0.2% pre-operatively and post-operatively has been shown to reduce AO incidence (Ragno and Szkutnik, 1991; Hermesch et al., 1998; Noroozi and Philbert, 2009; Sridhar et al., 2011).

In summary, there are many theories for the aetiology of AO, but smoking, extraction difficulty and female gender are widely accepted as predisposing factors. It does appear that AO incidence is related to bacterial contamination, since the use of systemic antibiotics and topical antimicrobial agents are effective in reducing its occurrence. However, the definition of AO is not consistent in the literature, and so this means that some doubts remain.
1.2.2 Anaesthesia for third molar surgery

In this section, an overview of the use of intravenous (IV) sedation and general anaesthesia (GA) for third molar surgery will be provided. IV sedation and GA will be defined, followed by consideration of the advantages, disadvantages, indications and contraindications of each method.

1.2.2.1 Introduction

Third molar surgery can be carried out under local anaesthesia alone, although more complex cases require a GA. However, with the prevalence of dental anxiety as high as 30% in the general population (Armfield et al., 2006), it is not surprising that many patients seek this option, even if it may not be clinically indicated.

1.2.2.2 Definition of general anaesthesia

General anaesthesia (GA) is the induction of a state of unconsciousness, with the absence of pain sensation over the entire body. It will block the memory of the procedure (amnesia), inhibit normal body reflexes, and relax the muscles. The airway is secured by an endotracheal tube, and the procedure is carried out by a specialist anaesthesiologist. GA is usually carried out in a hospital setting with anaesthetic and nursing teams.

1.2.2.3 Indications and contraindications of GA

There has been a steady increase in the demand for GA in the United Kingdom (UK) to facilitate dental treatment and dental surgery (Hutchinson, 2014). Even though many are due to anxiety and behavioural management problems, other indications include: long and extensive surgical procedures; small children who may not tolerate treatment under local anaesthesia alone; a rare allergy to local anaesthesia; mental disabilities that make cooperation difficult; likely ineffective success of local anaesthetic due to acute infection and inflammation; and patient-related difficulties such as extreme gag reflexes or limited opening. There are no absolute contraindications for a GA. However, older people (over age 75) and those who are very old (over the age of 85) pose a greater GA risk (Messieha, 2009). The American Society
of Anaesthesiology (ASA) physical status classification system was developed to aid in assessing a patient’s anaesthetic risk. Patients’ with an ASA of IV or V are at a higher risk of intra-operative morbidity and mortality during GA.

The decision to carry out third molar surgery under GA is not always related to technical difficulties, systemic health status or cooperation difficulties. Sammut et al (2013) compared the choice of anaesthesia for mandibular third molar surgery in two different hospitals (Edinburgh Dental Institute and St. John’s Hospital in Livingston, UK) and found that one centre had a much higher percentage of patients being listed for GA irrespective of difficulty (Sammut et al., 2013). The authors concluded that it may be related to the resources available in that hospital. Easier access—albeit more expensive services—enables the hospital to provide the service, and hence more patients receive a GA, even if it might not be clinically necessary.

1.2.2.4 Advantages and disadvantages of GA

GA has the advantage of a protected airway by an endotracheal tube as well as a fully anaesthetised and paralysed patient. In complex situations, such as the indications mentioned in the previous section, a GA will allow the treatment to be carried out successfully, without any psychological trauma to the patient.

Nkanash et al reported the mortality rate from GA and deep sedation between 1973 and 1995 in Ontario, Canada, to be 1.4 deaths per 1,000,000 anaesthetics provided (Nkansah et al., 1997). Included in that study were anaesthetics provided by a dentist, oral and maxillofacial surgeon, or dental anaesthetist within a dental office. Even though the safety of anaesthesia has improved over time, due to more advanced, thorough and mandatory monitoring, the provision of a GA in a dental office is deemed to be unsafe without involvement of an anaesthetist (Eramo, 1999).

Even though a fully paralysed and unconscious patient might seem easier to treat, there are several potential complications (both intra-operatively and post-operatively) to note. Security of the airway during GA is vital, and communication with the anaesthetist needs to be clear. An airway during a GA may be maintained by a laryngeal mask airway (LMA), or an endotracheal tube, inserted orally or nasally. An oral airway (such as an LMA or oral endotracheal tube) can be cumbersome and restrict full access to the oral cavity, especially when a throat pack is also in situ. Certain procedures are also contraindicated for an oral airway,
especially operations that require the occlusion to be checked intra-operatively, such as with the open reduction and internal fixation of a mandibular fracture. Accordingly, the surgeon must be able to liaise with the anaesthetic team on the correct choice for the procedure and be able to work with an alternative if the preferred choice is unavailable.

Chye et al carried out a prospective study of 1,180 cases following oral surgery and concluded that a GA had higher complication rates such as nausea and vomiting than local anaesthetic and sedation (Chye et al., 1993). A study of 266 patients in the UK also reported more complications with a GA, and concluded that there were significantly greater post-operative demands, and with greater job disruptions (Edwards et al., 1998).

A higher reported incidence of lingual and inferior alveolar nerve damage has also been documented, irrespective of surgical difficulty during third molar surgery under a GA (Brann et al., 1999). Brann and co-workers commented that the surgical force and the extent of soft tissue retraction were greater under GA, which explains the five-fold greater incidence of nerve injury.

The recovery phase during a GA is especially critical. A study on deaths related to dentistry found that more than half occurred during this period, especially in children (Tomlin, 1975; Brett and Jack, 1993; Coplans and Curson, 1993). In adults, the risk of laryngospasm after removal of the endotracheal tube is a known complication, and so essential monitoring is paramount during the recovery phase by the anaesthetist and recovery team (Hutchinson, 2014).

The financial cost of hospitalisation is a major disadvantage, especially in the private sector. A report from Western Australia showed that a large majority of patients who elected a GA for their operation by an oral and maxillofacial surgeon were insured, young and healthy individuals (George et al., 2011; Anjrini et al., 2015). There were no data on the complexity of the operations performed, but it is logical to assume that these were routine third molar surgery.
1.2.2.5 Definition of intravenous (IV) sedation

Conscious sedation is a state in which the patient is kept from losing complete consciousness and retains the ability to independently maintain an open airway. Patients undergoing conscious sedation will have the ability to respond to verbal and physical commands. Anxiety can be reduced and a variable degree of amnesia may also ensue. It is usually undertaken using a parenteral or intravenous (IV) route, but it can also be achieved through an oral or nasal route. Sedation is a continuum that ranges from light sedation (or anxiolysis) through to general anaesthesia (American Society of Anesthesiologists Task Force on Sedation and Analgesia by Non-Anesthesiologists, 2002). A summary of this gradual continuum is presented in Table 1.1.

Midazolam is a benzodiazepine that binds to gamma-amino-butyric acid (GABA) receptors and increases the influx of chloride ions into the neuron, inhibiting depolarisation. It produces clinically beneficial effects such as anxiolysis, anterograde amnesia and sedation. However, these receptors are also present in the amygdala and hippocampus, and hence play a role in emotional regulation, resulting in a risk to the degree of disinhibition (Honan, 1981; Hall and Zisook, 1981). Midazolam is widely used in the dentistry, both orally and parentally, and it is well accepted by both clinicians and patients.
<table>
<thead>
<tr>
<th></th>
<th>Minimal sedation (anxiolysis)</th>
<th>Moderate sedation/analgesia (conscious sedation)</th>
<th>Deep sedation/analgesia</th>
<th>General anaesthesia</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Responsiveness</strong></td>
<td>Normal response to verbal stimulation</td>
<td>Purposeful response to verbal or tactile stimulation</td>
<td>Purposeful response to verbal or painful stimulation</td>
<td>Unarousable, even with painful stimulus</td>
</tr>
<tr>
<td><strong>Airway</strong></td>
<td>Unaffected</td>
<td>No intervention required</td>
<td>Intervention may be required</td>
<td>Intervention often required</td>
</tr>
<tr>
<td><strong>Spontaneous ventilation</strong></td>
<td>Unaffected</td>
<td>Adequate</td>
<td>May be inadequate</td>
<td>Frequently inadequate</td>
</tr>
<tr>
<td><strong>Cardiovascular function</strong></td>
<td>Unaffected</td>
<td>Usually maintained</td>
<td>Usually maintained</td>
<td>May be impaired</td>
</tr>
</tbody>
</table>

Table 1.1: Definitions of different levels of sedation
1.2.2.6 Indications and contraindications for IV sedation

Operations such as third molar surgery can be carried out under local anaesthesia (LA) only. However, dental anxiety and patients’ perceptions of oral surgery means that many patients and clinicians seek ways to increase acceptability and comfort. In third molar surgery, IV sedation can be used in conjunction with LA, and it is indicated for patients graded ASA I or II, or for cases that do not require extensive surgery (Garip et al., 2007). A further indication for IV sedation includes patients with a significant gagging reflex, as shown by Yoshida et al (Yoshida et al., 2007). That study had a small sample size of only 10 participants undergoing prosthodontic treatment, but the authors concluded that IV sedation allowed patients with a pronounced gag reflex to be treated in comfort. However, they utilised a deeper form of IV sedation with Propofol.

Relative Contraindications include: pregnancy (due to potential birth defects from midazolam); hepatic disease (due to alteration of drug metabolism); thyroid dysfunction (due to gland hypersensitivity to central nervous system depressants, and the difficulty of sedation in the cases of hypothyroidism and hyperthyroidism respectively); and morbid obesity (due to the difficulty of locating superficial veins, along with the concurrent cardiovascular, pulmonary and hepatic complications). Paediatric and geriatric patients are also relatively contraindicated for IV sedation in the dental setting; these groups of patients are more susceptible to disinhibitory reactions as well as the management potential medical complications of treating older people (McKenzie and Rosenberg, 2010).

1.2.2.7 Advantages and disadvantages of IV sedation

The use of midazolam in IV sedation has the advantage of a rapid onset and a good level of amnesia, both of which are beneficial during dental surgery (Skelly and Craig, 2005). It has also been shown to be effective in controlling anxiety during third molar surgery (Van Der Bijl et al., 1987; Bell and Kelly, 2000; Jerjes et al., 2005). A prospective study was carried out to demonstrate the effectiveness of pre-medication using midazolam before ambulatory surgery (Bauer et al., 2004). It found that the group that received midazolam reported less post-operative nausea and vomiting (PONV), a lower anxiety level after administration, and a greater post-operative satisfaction. The safety of midazolam is also due to the availability of
flumazenil, a quick-acting benzodiazepine antagonist. Flumazenil can reverse the effects of sedation, hypnosis, respiratory depression and any paradoxical reactions (Cabrera et al., 2010).

By keeping patients at a state of sedation where verbal command is possible, the level of sedation can also be titrated to effect, depending on individual patient needs. This reduces the risk of overdose or inadequate sedation, and makes it a safe and satisfactory technique (Zacharias et al., 1998; Kucukyavuz and Cambazoglu, 2004). This level of sedation also allows for a relatively quick recovery period.

However, over-sedation is one of the biggest risks in IV sedation. The boundary between conscious sedation and GA cannot be identified (Halloran, 2013; Peden and Cook, 2014). As the depth of sedation increases, patients will lose their protective pharyngeal and laryngeal reflexes, resulting in a loss of the ability to maintain their own airway. When combined with the copious amounts of saline irrigation used during third molar surgery, IV sedation presents a risk to airway patency.

Unexpected reactions—termed paradoxical reactions—from the use of midazolam have been well-documented, especially in relation to children. These complications include hallucinations, disorientation, uncontrollable crying or verbalisation, agitation, restlessness, involuntary movement, and aggressive behaviour (Moon, 2013; Shin et al., 2013). Even though these reactions are not deemed a risk to the patient’s airway and safety, they render dental treatment impossible. The mechanism of this reaction is unknown, and its occurrence is not isolated to children (Van Der Bijl and Roelofse, 1991; Cabrera et al., 2010; McKenzie and Rosenberg, 2010).

1.2.2.8 Choice of anaesthesia

A report in 1999 established that a GA for dental purposes should be avoided wherever possible if other techniques are possible (Tyrer, 1999). There is evidence in the paediatric literature that large proportion of patients referred for GA can be successfully treated under local anaesthesia and sedation (Shaw et al., 1996).

Edwards and co-authors reported that patients are often unnecessarily referred for treatment under GA for their operation, and 42% of patients could have been treated under ambulatory care (Edwards et al., 1998). There has been a gradual change in the rationale between GA and IV sedation, and recently, third molar surgery is performed as a day-stay, outpatient procedure,
rather than an inpatient hospital one (Dunne et al., 2006). The decision to treat under a GA might be due to convenience because of the facilities on offer rather than the difficulty of the operation (Sammut et al., 2013). Other studies from larger hospital units that have easier access to operating theatre facilities have also reported to carry out more third molar operations under GA (Kim et al., 2006).

The experience of the treating consultant has been proposed to be an influence on the choice of anaesthesia. In the Edwards et al study, more experienced consultants were more likely to treat patients under local anaesthesia, while Sammut et al found the opposite, where by surgical trainees were less likely than their consultants to recommend a GA (Edwards et al., 1998; Sammut et al., 2013).

Ultimately, patients are required to make an informed decision. In the Sammut et al study, they found patients from more socially deprived areas were more likely to opt for a GA (Sammut et al., 2013). They concluded that patients from areas of greater social deprivation had a potential to make “less healthy” decisions, tending to choose a GA for their operation.

Thus, the choice between IV sedation and GA is not as simple as determining the surgical difficulty or assessing the patient’s medical fitness. Factors such as anxiety, cost, availability of facilities, surgeon’s preferences and social factors all play a role in influencing this choice.

1.2.2.9 Comparison between IV sedation and GA

High level evidence, such as a systematic review, for the comparison between IV sedation and GA in third molar surgery in the literature is absent. However, smaller studies have shown the use of IV sedation to be safer and cheaper than a GA, resulting in fewer post-operative complications in procedures other than third molar surgery (Van Sickels and Tiner, 1992; Bayat and Arscott, 2003).

Comparison of surgical recovery and success has been carried out with a genioplasty procedure (Van Sickels and Tiner, 1992). The authors commented that deep sedation—with the addition of methohexital during the bone cuts—was cheaper, showed quicker recovery, and resulted in the same surgical outcomes as a GA. Even though their conclusion was that IV sedation is safer, only eight patients underwent the procedures, with two patients reported as being over-sedated during the operation, needing to be awakened before completion of surgery. Their discussion mentioned that the assistant was also required to maintain a fluid-free airway as well
as keeping the surgical area visible; this leads to greater stress and a less-than-ideal surgical scenario.

IV sedation and GA comparisons with temporomandibular joint arthrocentesis were also undertaken (Mehra and Arya, 2015). This study reported that the procedure can be successfully carried out under IV sedation in an office set-up. However, a much superior clinical outcome was offered when it was performed under GA with a secured airway. In that study, deep sedation was also used with a combination of midazolam, fentanyl, a propofol infusion, and at times, ketamine. A heavily sedated patient also required a bite block to maintain an airway. And this restricted the jaw manipulation required for the procedure. A patient under GA will have greater muscle relaxation, allowing the necessary manipulation of the mandible for carrying out successful treatment. They concluded that a GA would be safer, more predictable and less invasive.

By contrast, a paper published in 2014 comparing IV sedation and GA for patients needing maxillofacial surgery (for mandibular fracture or TMJ ankylosis) found that the IV sedation group experienced a longer pain-free period and required lower doses of rescue analgesia; there were no reports of sore throat and fewer episodes of PONV (Rastogi et al., 2014). These resulted in earlier discharge than the GA group. Surgeon satisfaction was also acceptable. However, deep sedation was used in this study using propofol, in addition to a naso-phayngeal airway.

Comparison of these two anaesthesia methods has been carried out with children requiring dental work. A UK study evaluated the efficacy of IV sedation instead of a GA when performing surgical exposures and/or dental extractions in children (Dorman et al., 2007). Although it used a small sample, nearly all the children underwent treatment, which would have otherwise been done as a day case GA. A similar study of nearly 1,000 children undergoing dental work was carried under IV sedation, using a combination of midazolam, alfentanil and ketamine (Mikhael et al., 2007). The authors commented that conscious sedation can be carried out for dental work on such children, ranging from 3 years of age to 10 years, as long as the strict definition of conscious sedation is adhered to. When the correct titration is achieved, it is safer than a GA.

The medical literature has made similar comparisons between IV sedation and GA. In a study comparing oxygen saturation between GA and IV sedation with paediatric patients undergoing esophagogastroduodenoscopy, there was a much lower oxygen saturation level in the sedation
group (Lamireau et al., 1998). They deemed a GA to be a much safer technique for carrying out their procedure. This study also rated operator satisfaction with the procedure; almost all of the procedures done under the GA group received a "very good condition" score, while the IV sedation group varied considerably, with 50% reporting an “incomplete procedure” and only 20% reporting “very good conditions”.

A study on microwave endometrial ablation was published in 2001 comparing treatment success between GA and LA with IV sedation (Bain et al., 2001). Participants were divided into two groups; one group was randomly allocated to their anaesthesia method, while the other had a free choice. The participants who chose to have their operation under LA with IV sedation had a quicker recovery, requiring a lesser amount of post-operative analgesia. In addition, participants who had a free choice of their anaesthesia method, was more accepting of the procedure than the randomly allocated group.

In a large study involving 421 patients undergoing a range of plastic surgery procedures, Bayat and Arscott carried out all procedures under LA and IV sedation, as an alternative to GA (Bayat and Arscott, 2003). Not only did they successfully carry out all the procedures safely, they commented that IV sedation resulted in shorter hospital stay, costed less, had fewer post-operative complications, and enabled a quicker return to work. They concluded that IV sedation was a useful and safe anaesthetic technique for relatively short procedures. Successful outcomes required careful patient selection, the presence of trained personnel, emergency back-up equipment and a safe titration of the midazolam dosage.

Intra-arterial mechanical thrombectomy (IAMT) is a procedure that is carried out for the treatment of an acute ischaemic stroke (AIS). There is controversy in the medical literature over whether this should be performed under IV sedation or GA (John et al., 2013). They concluded that due to the urgency of this procedure, IV sedation should be considered. They also commented that the presence of a pain response during IV sedation can actually be beneficial to the procedure and the surgeon can adjust various factors such as the dilation of the balloon intra-operatively. McDonald and co-workers compared IV sedation and GA for 2512 patients undergoing thrombectomy for AIS (McDonald et al., 2014). The IV sedation cohort had a shorter hospital stay, fewer post-operative complications, and lower costs. However, the authors did comment that patients who had more severe strokes would have received a GA.
Thus, the comparisons between IV sedation—especially light, to moderate conscious sedation—and GA for third molar surgery are limited in the current literature. Sedation techniques vary greatly in the existing research, with many using a combination of different medications and sedatives to achieve the desirable effect. These techniques require advanced training and additional human resources during the procedure, and are unsuitable for an in-office, dental sedation.

1.2.3 Oral-health-related quality-of-life (OHRQoL)

The section that follows gives a brief history of the use of quality-of-life information in the literature and its importance in dental research. The use of such measures in third molar surgery is then summarised.

1.2.3.1 Introduction

Assessment of the physical, social and psychological consequences of health states had been carried out for several decades now in medicine, but only recently has it been employed in the dental arena. While a great body of evidence exists about the possible signs and symptoms following third molar surgery in terms of pain, swelling, trismus, and paraesthesia, surprisingly little is known about the consequences of these on a patient’s life, and how it affects day-to-day life or life quality (McGrath et al., 2003)

The primary aim of clinical care is to treat our patients to the best of our ability and ultimately improve patient outcomes. However, it has been recognised that past research does not evaluate these outcomes by considering both traditional clinical variables and psychosocial factors (Wilson and Cleary, 1995). The realisation that there is more to patient outcomes than measurable clinical data was reported in the early 1980s (Schipper, 1983). Schipper also commented that clinicians can provide treatments that are theoretically successful, but in reality, a poorer outcome from the patient’s perspective. Therefore, there was a growing interest in measuring people's quality-of-life and expanding our evaluation of treatment outcomes beyond objective clinical data. In addition, quality-of-life measurements can also be used to measure a population’s well-being or treatment needs (Hennessy et al., 1994).
The Oral Health Impact Profile (OHIP) was developed and used to measure people’s oral-health-related quality-of-life (OHRQoL). It utilises 49 questions to evaluate each individual’s perception of the impact of their oral condition on their own well-being (Slade, 1997). The OHIP instrument has been used successfully in randomised control trials to evaluate treatment outcomes after implant therapy (Awad et al., 2000; Allen et al., 2001). However, the 49-item questionnaire was too long, and so the OHIP-14 was developed (Slade, 1997; Locker and Allen, 2002). Locker and Allen stated that the shorter form may be preferable when the aim is to detect a change in a clinical intervention type study (Locker and Allen, 2002).

1.2.3.2 OHRQoL and third molar surgery

As mentioned in the previous section, the increasing interest in oral-health-related quality-of-life (OHRQoL) in our patients is important in our understanding of treatment success. The OHIP-14 has been widely used in recent times not just for the evaluation of treatment outcomes, but in wider population research. The consideration of OHRQoL after wisdom teeth surgery was suggested in the late 1990s and it was encouraged that clinicians include the impact of OHRQoL in their informed consent (Savin and Ogden, 1997).

The pre-operative condition of third molars has a direct impact on OHRQoL. Symptomatic third molars, especially those with pericoronitis, dramatically influence people’s OHRQoL (McNutt et al., 2008; Magraw et al., 2015). Patients undergoing surgery with existing symptoms will have up to 3 times greater impact on their OHRQoL (Slade et al., 2004). However, in some studies, patients who had experienced symptomatic pericoronitis reported a significant improvement to OHRQoL after surgery (Bradshaw et al., 2012).

The surgical removal of third molars involves a definite deterioration of patients OHRQoL after surgery, especially in the first post-operative week (McGrath et al., 2003; Colorado-Bonnin et al., 2006; Deepti et al., 2009; Sancho-Puchades et al., 2012). McGrath et al commented that surgical oedema following third molar surgery was one of the common complications that impacted on OHRQoL (McGrath et al., 2003). Delayed clinical healing, or the development of complications after surgery, will negatively impact on OHRQoL with an greater pain, slower restoration of oral function and a delay in the return to a normal lifestyle (Ruvo et al., 2005; van Wijk et al., 2009). A study from Brazil found that this deterioration was not related to surgical duration and difficulty (Sato et al., 2009).
As Savin and Ogden noted in 1997, surgeons should include the impact of surgery on OHRQoL. Even in the presence of satisfactory clinical healing, OHRQoL can still be impacted negatively. Therefore, more understanding of both clinical and OHRQoL data after third molar surgery can better inform patients about the realistic expectations after surgery, and so provide more rounded clinical care (McGrath et al., 2003; White et al., 2003).

1.2.4 Dental anxiety

The sections that follow summarise the current understanding of dental anxiety and how it impacts on third molar surgery. This section also gives an overview of the use of IV sedation with dentally fearful patients.

1.2.4.1 Introduction

The prevalence of dental anxiety in the general population can be as high as one in three individuals (Armfield et al., 2006). The impact of this has a snowball effect in the community, with dentists and dental treatment being one of the most common fears among the general population (Fiset et al., 1989). Dentally anxious patients are more likely to cancel or fail their appointments and be more difficult to treat due to behavioural management problems, thus, resulting in overall poorer dental health (Eitner et al., 2006). This fear is further heightened in exodontia procedures, especially when rotary instruments are to be used (Earl, 1994). It is logical to assume then, that surgical removal of third molar teeth will heighten anxiety in vulnerable patients.

1.2.4.2 Dental anxiety and third molar surgery

Typically, studies have evaluated the difficulty of third molar surgery using clinical variables. Traditionally, the degree of impaction, angulation, proximity to the nerve canal, angulation of the second molar are evaluated from a panoramic radiograph of the jaw bones, in order to assess difficulty (García et al., 2000; Akadiri and Obiechina, 2009). Patient characteristics (such as age, ethnicity, and gender) were also evaluated in recent times in assessing difficulty (Renton et al., 2001). However, psychosocial factors such as dental anxiety are also an important
variable (Aznar-Arasa et al., 2014). Aznar-Arasa and co-workers concluded in their study of 102 patients that extractions of third molars in highly anxious patients were significantly more difficult. A Korean study also found that high anxiety levels pre-operatively directly affected the surgical outcome, in terms of pain and satisfaction (Kim et al., 2010).

Pre-operative anxiety levels can influence various coping behaviours post-operatively. George et al concluded that this leads to poorer healing, longer swelling, and greater disability (George et al., 1980). They concluded that, if clinicians can accurately communicate more effectively the expectations from surgery, patients might be able to manage their pre-operative anxiety better. This concept of managing surgical outcomes with accurate pre-operative information has been studied and shown to be effective in managing pain after surgery (Vallerand et al., 1994).

1.2.4.3 Dental anxiety and IV sedation

IV sedation using midazolam alone is an effective method to control anxiety during the surgical removal of third molar teeth (Van Der Bijl et al., 1987; Bell and Kelly, 2000; Jerjes et al., 2005). These studies all concluded that the administration of midazolam intravenously decreased patients’ anxiety levels, and allowed treatment to be a success. There were minimal complications and it was well accepted by patients. In the Jerjes et al study, they did not use midazolam as a sedative, but as a pre-med prior to GA, and they also found that its use had no adverse effect in a healthy patient.

In addition to the lower risks of IV sedation, conscious sedation can result in lower anxiety post-treatment than with a GA (Arch et al., 2001; Kupietzky, 2004). Arch and co-workers carried out a study of 88 children, 9-15 years of age, investigating how conscious sedation and GA can impact on dental anxiety (Arch et al., 2001). The parents and the child were informed about the benefits of sedation; those who went ahead, were able to be successfully treated without the need for a GA. Even though this study used nitrous oxide conscious sedation (NOCS), it is worthwhile to note that the children in the NOCS group reported post-surgery lower dental anxiety than the GA group. Post-operative anxiety in relation to third molar surgery has also been explored (Bell and Kelly, 2000), showing that 2 weeks post-operatively, the sedated group reported lower anxiety.
The use of IV sedation is effective in managing patient’s anxiety levels during surgery. However, the available studies differ in their use of midazolam, and very often, combinations of different sedatives were used in the research. The measurement of anxiety was also inconsistent and this makes comparisons difficult. To date, there are no studies which have evaluated patients’ dental anxiety with their choice in anaesthesia, or by surgical outcomes.

1.2.5 Personality

This section will introduce the concept of personality and its relevance to dental research.

1.2.5.1 Introduction

Psychosocial factors are important in evaluating surgical difficulty and outcomes. In addition to dental anxiety, psychosocial characteristics such as personality traits can influence patient choice and outcomes. The study of personality traits is relatively new to dental research and its application in dental research is limited. There has been no evaluation of personality traits and its influence their third molar surgery.

1.2.5.2 Personality in dental research

The use of data on psychological traits such as personality is relatively new in oral health research. General health had been recognised as a subjective state, and individuals can interpret their own symptoms differently. Kressin et al found that psychosocial characteristics such as personality influence perceptions of oral-health-related quality-of-life (Kressin et al., 2001).

Personality has been shown to be an important influence on dental disease, especially dental caries and its sequelae (Thomson et al., 2011). In a prospective study, of a birth cohort born in Dunedin, (New Zealand), personality was measured using the Multidimensional Personality Questionnaire (MPQ) and OHRQoL using the short-form Oral Health Impact Profile (OHIP-14). The MPQ scale consists of three main superfactor of “constraint”, “negative emotionality” and “positive emotionality”. These are further divided into 10 independent subscales that examines the different emotional and behaviours of individuals (Table 1.2).
<table>
<thead>
<tr>
<th>MPQ superfactor</th>
<th>MPQ scale</th>
<th>No. of items</th>
<th>Description of a high scorer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constraint</td>
<td>Control</td>
<td>20</td>
<td>Reflective, cautious, careful, rational, planful</td>
</tr>
<tr>
<td></td>
<td>Traditionalism</td>
<td>22</td>
<td>Desires a conservative social environment; endorses high moral standards</td>
</tr>
<tr>
<td></td>
<td>Harm avoidance</td>
<td>21</td>
<td>Avoids excitement and danger; prefers safe activities (even if tedious)</td>
</tr>
<tr>
<td>Negative emotionality</td>
<td>Stress reaction</td>
<td>14</td>
<td>Nervous, vulnerable; sensitive, prone to worry</td>
</tr>
<tr>
<td></td>
<td>Aggression</td>
<td>18</td>
<td>Hurts others for own advantage; will frighten and cause others discomfort</td>
</tr>
<tr>
<td></td>
<td>Alienation</td>
<td>17</td>
<td>Feels mistreated, victimized, betrayed, and the target of false rumours</td>
</tr>
<tr>
<td>Positive emotionality</td>
<td>Wellbeing</td>
<td>11</td>
<td>Happy, cheerful disposition; feels good about self and sees a bright future</td>
</tr>
<tr>
<td></td>
<td>Social potency</td>
<td>18</td>
<td>Forceful and decisive; fond of leadership roles and influencing others</td>
</tr>
<tr>
<td></td>
<td>Achievement</td>
<td>17</td>
<td>Works hard; enjoys demanding projects and working long hours</td>
</tr>
<tr>
<td></td>
<td>Social closeness</td>
<td>19</td>
<td>Sociable; likes people and turns to others for comfort</td>
</tr>
</tbody>
</table>
The constraint factor reflects on individuals’ traditionalism and self-control. Individuals scoring lower in this category tend to be fearless and impulsive, while higher scores tend to be more conventional and cautious in their thinking. The positive emotionality factor reflects on individuals’ happiness, wellbeing, social potency and achievement. High scorers in this category are generally “happy people” with the tendency to feel more positivity from their experiences, while low scorers are less likely to be happy and report fear from otherwise pleasurable experiences. Lastly, the negative emotionality factor reflects on individuals’ aggression, alienation and stress reaction. Individuals scoring highly on these traits tend to be stressed, feels mistreated and betrayed, and exhibit a degree of catastrophising.

In the Thomson et al study, they showed that those scoring higher on negative emotionality had a greater risk of having caries and psychosocial characteristics also shaped self-reported oral health. The authors hypothesised that, because personality can change over time, or through brief cognitive interventions, it might be of value to preventive dentistry. This study concluded that the use of OHRQoL measures (such as OHIP-14), while a very useful tool, will be subjected to a degree of “contamination” by personality, especially from the negative emotionality domain. The MPQ that is used in this study contains 177-items, which is rather unwieldy to use in clinical research. Accordingly, they suggested that a shorter measure such as the Positive and Negative Affect Schedule (PANAS; Watson et al., 1988) would be more efficient. The PANAS has recently been validated for use in oral health research (Ibrahim, 2014).

A study carried out in 1995 also investigated the effects of psychosocial parameters such as personality, coping styles and anxiety on third molar surgery (Gidron et al., 1995). The surgery was evaluated by an oral surgeon and carried out under LA and IV sedation. Interestingly, after controlling for the difficulty of the surgery, they found that negative affectivity, emotion-focused coping and parental pampering affected mouth opening, functional disability, and pain. An earlier study, attempted to relate personality characteristics to the use of analgesics and reported pain (Hansson et al., 1989). It concluded that operations carried out in the afternoon required more analgesics, while patients who were in higher levels of distress also demanded more pain relief. However, no data on the surgical difficulty of the surgery was reported, and the analgesic regimen used in the groups was no consistent.

In summary, the use of psychosocial concepts—such as personality—is in its infancy in dental research. Early findings are encouraging and further research into their influence into health
care is warranted. There have been no studies in the existing literature where the use of personality measures, such as the PANAS scale, were utilise to evaluate surgical outcomes.
Chapter 2: Rationale for research

2.1 Summary of literature review

The surgical removal of third molar teeth is one of the most commonly performed surgical procedures in dentistry (Dodson and Susarla, 2010). They present in the oral cavity in numerous angulations and positions, and at times, are associated with cysts and other pathologies (Kandasamy and Rinchuse, 2009). Their removal may be undertaken under local anaesthesia (LA) alone, but more complex impactions may require the additional use of intravenous (IV) sedation or general anaesthesia (GA).

IV sedation and GA each carry their own advantages and disadvantages. The choice remains a controversial topic among clinicians. Decisions can be made based upon available facilities, clinician preferences and experience, patient-related factors such as anxiety, medical health, social standings and surgical difficulty (Kim et al., 2006; George et al., 2011; Sammut et al., 2013). No clear rationale for the choice has been identified.

To date, the research on third molar surgical outcomes has primarily on objective clinical data such as pain, swelling, trismus, and the incidence of alveolar osteitis (Kirk et al., 2007; Goldsmith et al., 2012; Best et al., 2017). However, in the last decade, there has been an increasing awareness that patients’ oral-health-related quality-of-life (OHRQoL) should be taken into consideration, along with how surgery impacts on their day-to-day lives (Schipper, 1983). Self-reported information (such as OHRQoL) is very useful in informing patients on the likelihood of their recovery after the surgical removal of third molar teeth (Savin and Ogden, 1997). This operation significantly affects OHRQoL, especially for the first post-operative week (McGrath et al., 2003; Deepti et al., 2009; Sancho-Puchades et al., 2012). This impact is even greater in patients who were symptomatic pre-operatively (Slade et al., 2004). It has also been shown that, even in patients where surgical sites are clinically healing as expected, self-reported experience may differ (Savin and Ogden, 1997).

An explanation for this can be attributed to people’s psychosocial characteristics, such as dental anxiety and personality characteristics. These psychological characteristics can influence patients’ pain experience, clinical healing, duration of facial swelling and ultimately, a deterioration in quality-of-life and greater disability (George et al., 1980; Gidron et al., 1995;
Kim et al., 2010; Aznar-Arasa et al., 2014). It can also influence their interpretation of their experiences and therefore impact on their overall satisfaction (Thomson et al., 2011). Accordingly, psychosocial characteristics have a large role to play in the interpretation of their experience and surgical outcome.

2.2 Research aims

This study set out to:

1) compare two anaesthesia methods—IV sedation and GA—and to note any differences in their surgical outcomes; and

2) investigate the impact of personality on patients’ choice and surgical outcomes.

2.3 Rationale for current study

There have been a few studies comparing IV sedation and GA for oral and maxillofacial surgical procedures. These studies compared these two anaesthesia methods via clinical outcomes such as treatment success, pain, nausea, vomiting and time to discharge.

There is more to determining patient outcomes than clinically measured data, and investigation into the influence of psychological traits on patient-reported outcomes is warranted. However, patient-reported outcomes are often influenced by personality, especially the negative emotionality trait. Healthcare providers need to be aware of the impact of patients’ own evaluation of their health, and how this can influence on their recovery from surgery. It is therefore important to know the association between patient’s psychological traits and surgical outcomes.

To date, there have been no studies investigating the impact of patients’ psychological traits on third molar surgery outcomes. This study will be the first to incorporate a personality measure in third molar surgery and its influence on anaesthesia choice and surgical outcomes.
2.4 Aims & objectives

The aims and objectives of the study were:

1) to compare the surgical outcomes from third molar surgery between two anaesthesia methods (as measured by pain experienced, OHRQoL, number of days taken off and the number of days where eating pattern are affected);
2) to compare the differences in patient experience and satisfaction between IV sedation and GA (as measured by self-reported patient expectations and satisfaction); and
3) to evaluate the effects of patients’ personality on surgical outcomes after third molar surgery (as measured by the PANAS and IDAF-4C scales).

2.5 Hypothesis

The use of IV sedation for the surgical removal of third molars is safe, well-tolerated and will provide patients with a satisfying experience. IV sedation will also provide a better surgical outcome than GA.

Patients who are dentally fearful and/or higher in negative emotionality will opt for GA for their operation.

Patients with higher negative emotionality will experience a poorer outcome from surgery, reporting more pain, more days off work and have lower satisfaction.
Chapter 3: Methods

3.1 Ethics approval and Māori consultation

Prior to the commencement of the study, ethical approval from the University of Otago Human Ethics Committee (Health) was gained on 23rd September 2015 (H15/092). The initial decision letter and final approval letter is attached as Appendix A.

Māori consultation was undertaken and approved on 15th September 2015. The Ngāi Tahu Consultation Committee letter is attached as Appendix B. Ethnicity data was collected as part of the survey.

3.2 Study Design

This study was a prospective, quasi-experimental study. A quasi-experiment is an experiment that investigates an intervention on the study sample without random assignment. Unlike a randomised control trial (RCT), where the treatment groups are randomly assigned the treatment or control, a quasi-experiment is where the researcher controls the assignment. In this case, the patient or participant themselves had control over their intervention.

3.3 Participants

3.3.1 Patient sample and sample size determination

A clinical convenience sample was gathered from patients needing the surgical extraction of third molar teeth at the Faculty of Dentistry, University of Otago. These patients were either self-referred or referred by a dental practitioner to the School of Dentistry for the management of their third molars.

Using participants’ rating of the treatment experience as the dependent variable, and assuming 60% of those in the GA group and 80% of those in the IV group will report a “good” or “excellent” experience, it was estimated that there be 73 in each group (assuming an α level of 0.05 and 80% power to detect a difference). Thus, 146 participants will be required. The actual
number of participants enrolled were higher than the required number. (as described in section 4.1.1).

3.3.2 Eligibility criteria for participation

The inclusion criteria for this study were: aged between 16 and 35 years of age; seen by a consultant oral and maxillofacial surgeon or by one of their surgical trainees; American Society of Anaesthesiologist (ASA) physical status classification system I or II; legitimately requiring the removal of two mandibular third molar teeth (and may require removal of uppers)—as per guidelines by the National Institute for Health and Care Excellence (NICE); operation carried out under LA with IV sedation or GA; voluntary participation of the study.

The exclusion criteria for this study were patients: aged under 16 and over 35 years-of-age; cardiovascular disease; respiratory illnesses; hepatic impairment or disease; renal impairment or disease; bleeding disorders or on medication effecting coagulation; bone disorders; metabolic diseases; hypersensitivity to benzodiazepines; pregnant or breastfeeding women; body weight >120kg; history of drug addiction or current opioid use; patients unable to give informed consent; any significant systemic disease classified as ASA III, IV or V; and patients who chose to undertake their surgery under local anaesthesia only.

Third molars excluded from the study were: associated pathologies such as cysts; teeth requiring coronectomy; teeth with increased risk of mandibular fracture; teeth with increased risk of oro-antral communication; and surgery requiring more than four third molars removed.

3.3.3 Obtaining patient consent

Patients who met these criteria were provided an information sheet, “Information Sheet for Participants” (Appendix C). They were given time and opportunity to ask any questions prior to participation. Patients who agreed to participate in the study had a consultation appointment with the surgeon. At this appointment, they were requested to sign the “Consent Form” (Appendix D) for enrolment into the study.

Every participant was allocated a unique ID number for anonymity and data analysis. The name of each participant was entered into a database alongside their unique ID number. This number
was used in all data-entry forms and personal data were kept securely by the principal investigator.

Individual patient questionnaires were not perused at any stage during their active participation period to avoid bias.

3.3.4 Participant responsibility

Patients who participated in this study were required to: Complete the “Before surgery questionnaire” form (Appendix E); attend the procedural appointment for the surgical removal of third molars; and attend a follow-up appointment 10-14 days after surgery and complete the “After surgery questionnaire” form (Appendix F). Participants who were unable to attend the post-operative review appointment, but were still willing to participate in the study, the post-operative questionnaire was mailed to their postal address along with a paid self-addressed envelope to return to the principal investigator.

3.3.5 Participant incentives

At the completion of the study, participants who completed both questionnaires were entered in to a prize draw ($200 shopping voucher). The winner was drawn randomly and was contacted to claim the prize.

3.3.6 Location and setting of study

Patients undergoing their operation under local anaesthesia (LA) with IV sedation had the procedure performed in the theatre suite, at the Faculty of Dentistry, University of Otago. This group of participants will be referred to as the IV sedation group.

Patients undergoing their operation under GA had the procedure performed in the theatre suite (as above), or the day surgery unit at Dunedin Public Hospital. This group of participants will be referred to as the GA group.
3.4 Questionnaire design and data collection

3.4.1 Socio-demographic characteristics

This study utilised the socio-demographic characteristics that were used in previous studies based on the New Zealand Population (Thomson et al., 1999). They were: age, gender, ethnic group (please circle) (NZ/European, Māori, Pacific Islander, Asian/Chinese, Other), Community Services Card (CSC) ownership, and highest level of education attained.

3.4.2 Oral health care variables

Participants were asked a few questions about their oral health habits and the history with their wisdom teeth. They were: smoking status; frequency of brushing; mouthwash usage; history of pain or discomfort with their wisdom teeth; degree of pain, if any, with their wisdom teeth (mild, moderate, severe); and frequency of pain, if any, with their wisdom teeth (occasionally, sometimes, often, always).

3.4.3 Preference between IV sedation and GA

During their consultation with the primary investigator, they were advised that their operation can be done equally successfully between (a) LA with IV sedation or (b) GA. Participants were given a free choice between these two peri-operative pain control methods (LA+IV sedation or GA) for their operation and their respective costs. They were encouraged to ask any questions about the differences and were given time to think about their decision and to discuss this with friends and family.

Once they decided, participants were asked if this choice was pre-meditated or if they changed their minds after their consultation. Participants were encouraged to elaborate on their decision.
3.4.4 Oral Health Impact variables

Oral health-related quality-of-life assessment data was collected before and after the surgical procedure using the OHIP-14 instrument (Slade, 1997). These questions measure people’s perception of how their oral health will impact on their well-being. It consists of 14 items, divided into two equal subscales from the original long form of this measure. Participants were asked “During the last 2 weeks, have you; had painful aching; been self-conscious, …”. Responses were scored and recorded as numerical codes: Very Often=4, Fairly Often=3, Sometimes=2, Hardly Ever=1, Never=0.

Post-operative OHIP scores were gathered at their review appointment 10-14 days after their surgery. This is the usual review period after third molar surgery and was chosen to best reflect real-world clinical setting.

3.4.5 Scale investigating dental anxiety

The scale used in this study was the IDAF-4C module (Armfield, 2010). This is an 8-item form that assesses emotional, behavioural, physiological and cognitive aspects of the fear and anxiety response. This relatively new scale has been shown to be effective in assessing dental anxiety and fear in the adult population.

3.4.6 Scale investigating positive affect and negative affect

The Positive and Negative Affect Schedule (PANAS) was used in this study to evaluate the impact of positive affect (PA) and negative affect (NA) on surgical outcomes (Watson et al., 1988). The PANAS scale comprises of 10 questions in each PA and NA categories, and has been shown to influence patients’ self-reported oral health (Thomson et al., 2011).

3.5 Surgical procedure

IV sedation participants received sedation using intravenous midazolam (Hypnovel™; Roche, Basel, Switzerland), titrated to effect in 1-mg increments. Dexamethasone (8mg) and Paracoxib (40mg) were also administered intravenously. GA participants were intubated nasally with a
throat pack and monitored by a specialist anaesthetist. Both groups received Dexamethasone (8mg) and Paracoxib (40mg), administered intravenously before the operation. Local anaesthesia was given, and the surgical technique was similar between both groups with a standard approach—with exposure of mandibular third molars via a buccal envelope flap with a protected lingual flap (if required). All mandibular third molar teeth required bone removal. Maxillary third molars were removed simply (fully erupted), or with a simple buccal flap, +/- buccal guttering (unerupted or partially erupted).

All surgical procedures were carried out by oral surgery registrars. A consultant oral and maxillofacial surgeon was available at all times for advice or help, but was rarely required.

3.6 Outcomes

3.6.1 Clinical measures

Verbal rating scale (VRS) was used to evaluate pain (Mccrirrick and Hunter, 1990). A score of 1 to 5 was assigned respectively to: “No Pain”, “Mild Pain”, “Moderate Pain”, “Severe Pain” and “Excruciating pain & agony”. An ordinal scale was used for its ease of use and relates easier to patients.

The incidence of nausea & vomiting, sore throat and early review by a dentist was recorded in the questionnaire, using “Yes” and “No” options.

Additional data collected was collected on pain behaviour such as: seeing a medical doctor for additional pain medication or, taking more, additional, or alternative analgesics by asking “Did you take any additional pain relief medication other than the tablets prescribed to you” and “Did you need to see your medical GP about your pain or discomfort?”. The incidence of dry socket (measured by patient’s attendance and receiving treatment by irrigation of the socket with or without socket dressing) was also recorded in the questionnaire, using “Yes” and “No” options for the question “Did you require the socket to be irrigated by dressed by a dentist?”. 

3.6.2 Patient self-reported measures

VRS was used to assess participants self-reported experiences. Participants were asked about the number of days they took off work/normal daily activities; and how many days it took to resume eating normally. These were recorded using scores of 0 to 4, assigned respectively to: “0 days”, “1-2 days”, “3-5 days”, “6-8 days”, and “still taking time off” or “still not eating normally”, respectively. Participants were asked to rate their overall experience: “Unacceptable”, “Poor”, “Satisfactory”, “Good”, and “Excellent”. These were scored 0 to 4 respectively. Participants were also asked if their experience matched their expectations: “Not at all”, “Somewhat close”, “Matched exactly” and “Exceeded my expectations”. These were scored 0 to 3 respectively.

3.6.3 Oral health impact variables

The same measure as used in section 3.4.4 was used at follow-up. Changes in scores were calculated by subtracting mean OHIP-14 scores at baseline from post-operative scores. A positive change indicates a deterioration, and vice versa. The analysis also identified those OHIP-14 score changed by at least the minimum important difference (MID) of 4 scale points (determined by Locket et al 2004).

The magnitude of change was calculated by dividing the mean change scores by the standard deviation of the score at baseline. This will give us an effect size, 0.2 is considered small, 0.5 as moderate and 0.8 or above as large.

3.7 Statistical analyses

The data were analysed using SPSS. Following data cleaning and the computation of descriptive statistics, differences in categorical variables were tested for statistical significance using chi-square tests, with ANOVA or paired t-tests used for continuous variables. Treatment-associated changes were determined and effect sizes (where appropriate) calculated and compared.
Chapter 4: Results

This chapter will present the data collected in this study and all its analyses. It will be divided into 2 main sections, pre-operative data and post-operative data.

4.1 Pre-operative data

This section will show the data collected at baseline, beginning with the number of participants recruited, their anaesthesia preferences and baseline characteristics.

4.1.1 Participation details

Of the 157 participants recruited, 142 (90.4%) completed the “After surgery questionnaire”. Of the remainder, six participants were unable to carry out their surgery during the study period, four failed to attend for follow-up, one patient decided to undergo their operation under local anaesthesia instead after recruitment, and four patients did not qualify after surgery due to intra-operative complications (coronectomy and presence of pathology). The low number of disqualified participants means that a comparison of their baseline characteristics with those who participated would not be informative. All subsequent analyses are restricted to those 142.

4.1.2 Anaesthesia preferences

Of the 142 participants, 69 (48.6%) chose to have their operation under GA, while 73 (51.4%) chose IV sedation with LA. The reasons for their choice are listed in Table 4.1.
Table 4.1: Participants’ reasons for anaesthesia method, by group (brackets contain column percentages)

<table>
<thead>
<tr>
<th>Group</th>
<th>Intravenous sedation</th>
<th>General anaesthesia</th>
<th>Both Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nervous &amp; needle phobic</td>
<td>3 (4.1)</td>
<td>25 (36.2)</td>
<td>28 (19.7)</td>
</tr>
<tr>
<td>Fear of Pain</td>
<td>0 (0.0)</td>
<td>5 (7.2)</td>
<td>5 (3.5)</td>
</tr>
<tr>
<td>Friends and family</td>
<td>5 (6.8)</td>
<td>3 (4.3)</td>
<td>8 (5.6)</td>
</tr>
<tr>
<td>Cost &amp; convenience</td>
<td>22 (30.1)</td>
<td>0 (0.0)</td>
<td>22 (7.7)</td>
</tr>
<tr>
<td>Don’t like the procedure</td>
<td>4 (5.4)</td>
<td>16 (23.1)</td>
<td>20 (14.1)</td>
</tr>
<tr>
<td>Preference</td>
<td>7 (9.6)</td>
<td>6 (8.7)</td>
<td>13 (9.2)</td>
</tr>
<tr>
<td>Informed from consultation</td>
<td>18 (24.7)</td>
<td>12 (17.4)</td>
<td>30 (21.1)</td>
</tr>
<tr>
<td>No reason given</td>
<td>14 (19.2)</td>
<td>2 (2.9)</td>
<td>16 (11.3)</td>
</tr>
<tr>
<td>Total</td>
<td>73 (100.0)</td>
<td>69 (100.0)</td>
<td>142 (100.0)</td>
</tr>
</tbody>
</table>

In the IV group, “cost and convenience” were listed as biggest reason for this choice; by almost a third (30.1%). These reasons were not listed at all by the GA group. While in the GA group, almost two-thirds (66.5%) mentioned “nervous”, “needle phobic”, “fear of pain” and “Don’t like the procedure” as their reasons for choosing a GA for their operation.

Appendix G shows participants’ preferences for anaesthesia method before and after their consultation.

Prior to the consultation, 16.2% preferred IV sedation for their operation, and of these, almost all (20 out of 23) were happy to proceed without change. Close to half of all the participants recruited had a preference for GA, and of these, one in five were happy to change their decision to IV sedation. Two out of five participants had no preferences for anaesthesia method, and almost two-thirds went ahead with IV sedation.
4.1.3 Participants’ characteristics

The participants’ demographic characteristics, oral care and smoking habits are presented in Table 4.2.

Table 4.2: Socio-demographic, oral self-care and smoking characteristics, by group (brackets contain column percentages)

<table>
<thead>
<tr>
<th>Group</th>
<th>Intravenous sedation</th>
<th>General anaesthesia</th>
<th>Both combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>29 (39.7)</td>
<td>24 (34.8)</td>
<td>53 (37.3)</td>
</tr>
<tr>
<td>Female</td>
<td>44 (60.3)</td>
<td>45 (65.2)</td>
<td>89 (62.7)</td>
</tr>
<tr>
<td>Education level</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary/Secondary</td>
<td>19 (26.0)</td>
<td>36 (52.2)*</td>
<td>55 (38.7)</td>
</tr>
<tr>
<td>Tertiary</td>
<td>54 (74.0)</td>
<td>32 (47.8)</td>
<td>86 (61.3)</td>
</tr>
<tr>
<td>Community Services Card</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>50 (68.5)</td>
<td>43 (62.3)</td>
<td>93 (65.5)</td>
</tr>
<tr>
<td>Yes</td>
<td>23 (31.5)</td>
<td>26 (37.7)</td>
<td>49 (34.5)</td>
</tr>
<tr>
<td>Brush twice a day</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>18 (24.7)</td>
<td>21 (30.4)</td>
<td>39 (27.5)</td>
</tr>
<tr>
<td>Yes</td>
<td>55 (75.3)</td>
<td>48 (69.6)</td>
<td>103 (72.5)</td>
</tr>
<tr>
<td>Mouthwash user</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>44 (60.3)</td>
<td>49 (71.0)</td>
<td>93 (65.5)</td>
</tr>
<tr>
<td>Yes</td>
<td>29 (39.7)</td>
<td>20 (29.0)</td>
<td>49 (34.5)</td>
</tr>
<tr>
<td>Current smoker</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>64 (87.7)</td>
<td>57 (82.6)</td>
<td>121 (85.2)</td>
</tr>
<tr>
<td>Yes</td>
<td>9 (12.3)</td>
<td>12 (17.4)</td>
<td>21 (14.8)</td>
</tr>
<tr>
<td>All combined</td>
<td>73 (100.0)</td>
<td>69 (100.0)</td>
<td>142 (100.0)</td>
</tr>
</tbody>
</table>

*P<0.05

Overall, there were slightly more female participants in each group, but this was not statistically significant. There was a significantly more participants in the IV group who had a tertiary education.
There were no differences between the groups in oral hygiene habits such as brushing frequency and mouthwash usage. Similarly, there was no difference in the number of non-smokers.

### 4.1.4 Third molar characteristics

The number of third molars removed are presented in Table 4.3.

**Table 4.3**: Number of third molars extracted, by group (brackets contain row percentages unless otherwise indicated)

<table>
<thead>
<tr>
<th>Number of third molars</th>
<th>Intravenous sedation</th>
<th>General anaesthesia</th>
<th>Both combined a</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>17 (85.0)</td>
<td>3 (15.0) b</td>
<td>20 (14.1)</td>
</tr>
<tr>
<td>3</td>
<td>13 (52.0)</td>
<td>12 (48.0)</td>
<td>25 (17.6)</td>
</tr>
<tr>
<td>4</td>
<td>43 (44.3)</td>
<td>54 (55.7)</td>
<td>97 (68.3)</td>
</tr>
<tr>
<td>Total</td>
<td>73 (51.4)</td>
<td>69 (48.6)</td>
<td>142 (100.0)</td>
</tr>
</tbody>
</table>

a Column percent
b P<0.05

The majority of participants in each group, 58.9% and 78.3% respectively, had all four third molars removed. However, of the participants who only had both mandibular third molars removed, 85% belonged in the IV group (P<0.05).
Table 4.4 shows the number of third molars removed by their impaction.

**Table 4.4**: Number of third molars and surgical characteristics, by group (brackets contain column percentages)

<table>
<thead>
<tr>
<th>Group</th>
<th>Intravenous sedation</th>
<th>General anaesthesia</th>
<th>Both combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tooth 18</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simple</td>
<td>33 (66.0)</td>
<td>30 (49.2)a</td>
<td>63 (56.8)</td>
</tr>
<tr>
<td>Surgical</td>
<td>17 (34.0)</td>
<td>31 (50.8)</td>
<td>48 (43.2)</td>
</tr>
<tr>
<td>Tooth 28</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simple</td>
<td>36 (73.5)</td>
<td>29 (49.2)a</td>
<td>65 (60.2)</td>
</tr>
<tr>
<td>Surgical</td>
<td>13 (26.5)</td>
<td>30 (50.8)</td>
<td>43 (39.8)</td>
</tr>
<tr>
<td>Tooth 38</td>
<td>Mesio-angular impaction</td>
<td>25 (34.2)</td>
<td>29 (42.0)</td>
</tr>
<tr>
<td>Horizontal impaction</td>
<td>15 (20.5)</td>
<td>9 (13.0)</td>
<td>24 (16.9)</td>
</tr>
<tr>
<td>Vertical impaction</td>
<td>17 (23.3)</td>
<td>16 (23.2)</td>
<td>33 (23.2)</td>
</tr>
<tr>
<td>Disto-angular impaction</td>
<td>16 (21.9)</td>
<td>15 (21.7)</td>
<td>31 (21.8)</td>
</tr>
<tr>
<td>Tooth 48</td>
<td>Mesial impaction</td>
<td>22 (30.1)</td>
<td>24 (34.8)</td>
</tr>
<tr>
<td>Horizontal impaction</td>
<td>24 (32.9)</td>
<td>12 (17.4)</td>
<td>36 (25.4)</td>
</tr>
<tr>
<td>Vertical impaction</td>
<td>14 (19.2)</td>
<td>19 (27.5)</td>
<td>33 (23.2)</td>
</tr>
<tr>
<td>Distal impaction</td>
<td>13 (17.8)</td>
<td>14 (20.3)</td>
<td>27 (19.0)</td>
</tr>
</tbody>
</table>

*a P<0.05

The type of mandibular impactions in the two groups were evenly distributed, and did not differ statistically. However, there were a higher number of maxillary third molars that required surgical removal (partially erupted or completely un-erupted teeth requiring the elevation of a full thickness mucoperiosteal flap, +/- bone removal) in the GA group.
4.1.5 Dental fear, PANAS scores and OHRQoL

IDAF-4c scores for dental anxiety were recorded before surgery, and the data are presented by group in Table 4.5, along with mean PANAS scores and OHIP-14 summary scores.

Table 4.5: Dental fear, PANAS scores and OHRQoL, at baseline (brackets contain column percentages)

<table>
<thead>
<tr>
<th>Group</th>
<th>Intravenous sedation</th>
<th>General anaesthesia</th>
<th>Both combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean IDAF-4C (SD)</td>
<td>14.4 (6.5)</td>
<td>19.0 (9.7)</td>
<td>16.7 (8.5)</td>
</tr>
<tr>
<td>Dentally fearful</td>
<td>9 (12.3)</td>
<td>23 (33.3)</td>
<td>32 (22.5)</td>
</tr>
<tr>
<td>PANAS scale score</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive Affect</td>
<td>34.0 (6.0)</td>
<td>34.3 (7.5)</td>
<td>34.1 (6.7)</td>
</tr>
<tr>
<td>Negative Affect</td>
<td>19.8 (5.3)</td>
<td>23.0 (7.1)</td>
<td>21.4 (6.4)</td>
</tr>
<tr>
<td>Mean OHIP-14 score</td>
<td>13.0 (7.9)</td>
<td>13.5 (11.6)</td>
<td>13.2 (9.8)</td>
</tr>
</tbody>
</table>

\[ P<0.05 \]

Those who opted for treatment under GA scored higher (on average) on the IDAF-4AC anxiety scale and the PANAS negative affect scale. There was no difference in the PA scores between the groups, but there was a statistically higher NA score in the GA group. There was also no difference in mean OHIP-14 score between the two groups at baseline.
### 4.1.6 Pain

Data on the occurrence of pain at baseline are presented in Table 4.6.

**Table 4.6: Pre-operative pain history, by group (brackets contain column percentages)**

<table>
<thead>
<tr>
<th></th>
<th>Intravenous sedation</th>
<th>General anaesthesia</th>
<th>Both combined</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-operative pain</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>6 (8.2)</td>
<td>5 (7.2)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>11 (7.7)</td>
</tr>
<tr>
<td>Yes</td>
<td>67 (91.8)</td>
<td>64 (92.8)</td>
<td>131 (92.3)</td>
</tr>
<tr>
<td><strong>Intensity of pain</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild</td>
<td>18 (24.7)</td>
<td>14 (20.3)</td>
<td>32 (24.4)</td>
</tr>
<tr>
<td>Moderate</td>
<td>36 (49.3)</td>
<td>29 (42.0)</td>
<td>65 (49.6)</td>
</tr>
<tr>
<td>Severe</td>
<td>13 (17.8)</td>
<td>21 (30.4)</td>
<td>34 (26.0)</td>
</tr>
<tr>
<td><strong>Frequency of Pain</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occasionally</td>
<td>19 (26.0)</td>
<td>27 (39.1)</td>
<td>46 (35.1)</td>
</tr>
<tr>
<td>Sometimes</td>
<td>21 (27.4)</td>
<td>19 (27.5)</td>
<td>40 (30.5)</td>
</tr>
<tr>
<td>Often</td>
<td>25 (34.2)</td>
<td>13 (18.8)</td>
<td>38 (29.0)</td>
</tr>
<tr>
<td>Always</td>
<td>2 (2.7)</td>
<td>5 (7.2)</td>
<td>7 (5.3)</td>
</tr>
</tbody>
</table>

<sup>a</sup> P<0.05

Overall, over 90% of both groups had a history of third molar pain at some point in the four weeks prior to recruitment. There was no statistical difference between the group.
Mean PANAS scores are presented by pre-operative pain occurrence in Table 4.7.

**Table 4.7: Pre-operative PANAS score, by pain history (brackets contain standard deviation)**

<table>
<thead>
<tr>
<th></th>
<th>Positive Affect</th>
<th>Negative Affect</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-operative pain</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>31.6 (7.8)</td>
<td>19.2 (4.1)</td>
</tr>
<tr>
<td>Yes</td>
<td>34.3 (6.6)</td>
<td>21.6 (6.5)</td>
</tr>
<tr>
<td><strong>Intensity of pain</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild</td>
<td>34.9 (4.9)</td>
<td>19.8 (4.0)</td>
</tr>
<tr>
<td>Moderate</td>
<td>33.8 (6.9)</td>
<td>20.4 (6.3)</td>
</tr>
<tr>
<td>Severe</td>
<td>34.9 (7.5)</td>
<td>25.5 (7.4)</td>
</tr>
<tr>
<td><strong>Frequency of Pain</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occasionally</td>
<td>34.6 (6.2)</td>
<td>20.2 (4.8)</td>
</tr>
<tr>
<td>Sometimes</td>
<td>33.8 (6.8)</td>
<td>21.7 (6.8)</td>
</tr>
<tr>
<td>Often</td>
<td>34.9 (6.8)</td>
<td>22.5 (7.1)</td>
</tr>
<tr>
<td>Always</td>
<td>31.0 (7.3)</td>
<td>25.1 (10.9)</td>
</tr>
</tbody>
</table>

\( ^a \text{P}<0.05 \)

Those who reported severe pain at baseline had higher negative affect scores (on average) than those who did not. There was also a gradient in negative affect scores by pain frequency, but this was not statistically significant (\( \text{P}=0.28 \)).
4.2 Post-operative data

The next section in this chapter will show the data collected at the participants’ surgical review appointment, 10-14 days after their procedure. This chapter will finish with analyses on the change in OHRQoL using the OHIP-14 data.

4.2.1 Surgical outcomes

Table 4.8 shows the data collected from participants in the post-operative period in terms of medication usage, severity of pain, and incidence of nausea, sore throat and dry socket.
Table 4.8: Post-operative recovery, by group (brackets contain column percentages)

<table>
<thead>
<tr>
<th>Group</th>
<th>Intravenous sedation</th>
<th>General anaesthesia</th>
<th>Both combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taking prescribed medication</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>1 (1.4)</td>
<td>0 (0.0)</td>
<td>1 (0.7)</td>
</tr>
<tr>
<td>Yes</td>
<td>72 (98.6)</td>
<td>69 (100.0)</td>
<td>141 (99.3)</td>
</tr>
<tr>
<td>Medication working</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>8 (11.0)</td>
<td>6 (8.7)</td>
<td>14 (9.9)</td>
</tr>
<tr>
<td>Yes</td>
<td>65 (89.0)</td>
<td>63 (91.3)</td>
<td>128 (90.1)</td>
</tr>
<tr>
<td>Took more medication</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>67 (91.8)</td>
<td>59 (85.5)</td>
<td>126 (88.7)</td>
</tr>
<tr>
<td>Yes</td>
<td>6 (8.2)</td>
<td>10 (14.5)</td>
<td>16 (11.3)</td>
</tr>
<tr>
<td>Saw a medical doctor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>72 (98.6)</td>
<td>65 (94.2)</td>
<td>137 (96.5)</td>
</tr>
<tr>
<td>Yes</td>
<td>1 (1.4)</td>
<td>4 (5.8)</td>
<td>5 (3.5)</td>
</tr>
<tr>
<td>Pain following surgery</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No pain/Mild pain</td>
<td>15 (20.5)</td>
<td>21 (30.4)</td>
<td>36 (25.4)</td>
</tr>
<tr>
<td>Moderate Pain</td>
<td>36 (49.3)</td>
<td>37 (53.6)</td>
<td>73 (51.4)</td>
</tr>
<tr>
<td>Severe/Excruciating pain &amp; agony</td>
<td>22 (30.1)</td>
<td>11 (15.9)</td>
<td>33 (23.2)</td>
</tr>
<tr>
<td>Nausea</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>65 (89.0)</td>
<td>35 (50.7)</td>
<td>100 (70.4)</td>
</tr>
<tr>
<td>Yes</td>
<td>8 (11.0)</td>
<td>34 (49.3)</td>
<td>42 (29.6)</td>
</tr>
<tr>
<td>Sore Throat</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>63 (86.3)</td>
<td>27 (39.1)</td>
<td>90 (63.4)</td>
</tr>
<tr>
<td>Yes</td>
<td>10 (13.7)</td>
<td>42 (60.9)</td>
<td>52 (36.6)</td>
</tr>
<tr>
<td>Dry Socket</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>67 (91.8)</td>
<td>63 (91.3)</td>
<td>130 (91.5)</td>
</tr>
<tr>
<td>Yes</td>
<td>6 (8.2)</td>
<td>6 (8.7)</td>
<td>12 (9.5)</td>
</tr>
<tr>
<td>All combined</td>
<td>73 (100.0)</td>
<td>69 (100.0)</td>
<td>142 (100.0)</td>
</tr>
</tbody>
</table>

\(^a\) P<0.05

All but one participant in the entire sample took the prescribed medication, with nearly 10% of participants commenting it was not effective enough. One in nine patients resorted to rescue medication of their own choice. Of those, four took Tramadol, four took different non-steroidal
anti-inflammatory drugs (NSAIDs) such as celecoxib and diclofenac, three preferred a combination medication such as Panadeine® and Maxigesic®, one took antibiotics (Augmentin), two participants took herbal supplements, one took more codeine, and one participant did not explain. There were no apparent differences between the groups.

There was a significant difference between IV and GA groups with the incidence of sore throats and nausea with well over half of the participants in the GA group experiencing a sore throat, while only one in seven of the IV group reporting it. One in nine participants in the IV group had nausea, but almost half (49.3%) of those in the GA group had it.

The pain reported after surgery also differed between the groups, with three in ten participants in the IV group reported pain after surgery to be “Severe” and “Excruciating pain & agony”. This experience was more favourable in the GA group, with only 11 participants reaching this level of discomfort.

4.2.2 Self-reported outcomes

In this section, patient self-reported data (such as the number of days off work, number of days where eating is affected and overall satisfaction data) are presented by group (Table 4.9).
Table 4.9: Recovery after surgery, by group (brackets contain column percentages)

<table>
<thead>
<tr>
<th>Group</th>
<th>Intravenous sedation</th>
<th>General anaesthesia</th>
<th>Both combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days taken off</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>5 (6.8)</td>
<td>2 (2.9)*</td>
<td>7 (4.9)</td>
</tr>
<tr>
<td>1-2</td>
<td>26 (35.6)</td>
<td>10 (14.5)</td>
<td>36 (25.4)</td>
</tr>
<tr>
<td>3-5</td>
<td>32 (43.8)</td>
<td>34 (49.3)</td>
<td>66 (46.5)</td>
</tr>
<tr>
<td>6 or more</td>
<td>10 (13.7)</td>
<td>23 (33.3)</td>
<td>33 (23.3)</td>
</tr>
<tr>
<td>Days eating affected</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>3 (4.1)</td>
<td>0 (0.0)</td>
<td>3 (2.1)</td>
</tr>
<tr>
<td>1-2</td>
<td>7 (9.6)</td>
<td>6 (8.7)</td>
<td>13 (9.2)</td>
</tr>
<tr>
<td>3-5</td>
<td>16 (21.9)</td>
<td>21 (30.4)</td>
<td>37 (26.1)</td>
</tr>
<tr>
<td>6 or more</td>
<td>47 (64.4)</td>
<td>42 (60.9)</td>
<td>89 (62.7)</td>
</tr>
<tr>
<td>Overall satisfaction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>0 (0.0)</td>
<td>1 (1.4)</td>
<td>1 (0.7)</td>
</tr>
<tr>
<td>Satisfactory</td>
<td>6 (8.2)</td>
<td>3 (4.3)</td>
<td>9 (6.3)</td>
</tr>
<tr>
<td>Good</td>
<td>28 (38.4)</td>
<td>33 (47.8)</td>
<td>61 (43.0)</td>
</tr>
<tr>
<td>Excellent</td>
<td>39 (53.4)</td>
<td>32 (46.4)</td>
<td>71 (50.0)</td>
</tr>
<tr>
<td>Expectation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not at all</td>
<td>4 (5.5)</td>
<td>3 (4.3)</td>
<td>7 (4.9)</td>
</tr>
<tr>
<td>Somewhat close</td>
<td>16 (21.9)</td>
<td>20 (29.0)</td>
<td>36 (25.4)</td>
</tr>
<tr>
<td>Matched</td>
<td>32 (43.8)</td>
<td>31 (44.9)</td>
<td>63 (44.4)</td>
</tr>
<tr>
<td>Exceeded</td>
<td>21 (28.8)</td>
<td>15 (21.7)</td>
<td>36 (25.4)</td>
</tr>
</tbody>
</table>

*P<0.05

In both groups, almost half—43.8% and 49.3% respectively—took 3-5 days off work and/or normal duties after surgery. Only one in eight participants in the IV group took longer than six days off, while a third in the GA group took a similar time.

A large proportion of participants found their eating pattern to be affected for more than six days while only three participants—all from the IV group—resumed normal eating pattern immediately after surgery. This difference did not reach statistical significance (P=0.37).

Overall satisfaction between the two groups were comparable with just over half of the IV participants reporting “Excellent” and 72.6% commenting that it either “Matched” or “Exceeded” their expectations. Conversely, the GA participants had similar outcomes with just under half reporting “Excellent” for satisfaction and a third had their expectations “Matched”
or “Exceeded”. Only one participant was dissatisfied, reporting “Poor” satisfaction. These differences between the groups also failed to reach statistical significance (P=0.39).

Mean PANAS scores are presented by categories of recovery in Table 4.10.

**Table 4.10:** Mean PANAS scores, by categories of recovery days affected, overall satisfaction and participants expectations (brackets contain standard deviation)

<table>
<thead>
<tr>
<th>Days taken off</th>
<th>Positive affect</th>
<th>Negative affect</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>27.7 (9.3)</td>
<td>18.7 (4.8)</td>
</tr>
<tr>
<td>1-2</td>
<td>33.5 (6.8)</td>
<td>21.6 (6.7)</td>
</tr>
<tr>
<td>3-5</td>
<td>34.9 (6.0)</td>
<td>20.8 (5.5)</td>
</tr>
<tr>
<td>6-8</td>
<td>34.9 (6.7)</td>
<td>22.1 (7.2)</td>
</tr>
<tr>
<td>8 or more</td>
<td>32.4 (9.2)</td>
<td>27.8 (10.1)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Days eating affected</th>
<th>Positive affect</th>
<th>Negative affect</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>39.0 (5.6)</td>
<td>19.0 (5.6)</td>
</tr>
<tr>
<td>1-2</td>
<td>34.6 (6.3)</td>
<td>21.2 (7.1)</td>
</tr>
<tr>
<td>3-5</td>
<td>34.6 (7.3)</td>
<td>21.5 (6.3)</td>
</tr>
<tr>
<td>6-8</td>
<td>33.1 (6.9)</td>
<td>21.0 (5.8)</td>
</tr>
<tr>
<td>8 or more</td>
<td>35.0 (6.0)</td>
<td>22.4 (7.8)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Overall Satisfaction</th>
<th>Positive affect</th>
<th>Negative affect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
<td>34.0 (0.0)</td>
<td>33.0 (0.0)</td>
</tr>
<tr>
<td>Satisfactory</td>
<td>34.3 (7.4)</td>
<td>20.3 (5.0)</td>
</tr>
<tr>
<td>Good</td>
<td>32.8 (7.1)</td>
<td>21.4 (6.2)</td>
</tr>
<tr>
<td>Excellent</td>
<td>35.2 (6.7)</td>
<td>21.3 (6.7)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Expectation</th>
<th>Positive affect</th>
<th>Negative affect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
<td>36.4 (4.0)</td>
<td>22.0 (7.0)</td>
</tr>
<tr>
<td>Somewhat close</td>
<td>32.5 (6.9)</td>
<td>22.9 (5.7)</td>
</tr>
<tr>
<td>Matched</td>
<td>34.6 (6.8)</td>
<td>21.3 (7.2)</td>
</tr>
<tr>
<td>Exceeded</td>
<td>34.4 (6.9)</td>
<td>19.9 (5.3)</td>
</tr>
</tbody>
</table>

*a P<0.05

There was no statistical significance across eating pattern, satisfaction and expectations, however, the category worthy of note was in “Days taken off”. In this category, there was a
gradual ascending gradient of negative affect (NA) scores, from “0 days taken off” to “8 or more days taken off”. This gradient was not evident with the positive affect (PA).

4.2.3 Oral health-related quality-of-life

OHIP-14 data were collected again at surgical review, and the differences are shown in Table 4.11.

Table 4.11: Oral Health Impact Profile (OHIP) scores before and after surgery, by group (brackets contain standard deviation)

<table>
<thead>
<tr>
<th>Group</th>
<th>Intravenous sedation</th>
<th>General anaesthesia</th>
<th>Both Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean OHIP-14 Before surgery</td>
<td>13.0 (7.9)</td>
<td>13.5 (11.6)</td>
<td>13.2 (9.8)</td>
</tr>
<tr>
<td>Mean OHIP-14 After surgery</td>
<td>19.3 (7.4)</td>
<td>20.3 (9.4)</td>
<td>19.8 (8.4)</td>
</tr>
<tr>
<td>Mean change in score</td>
<td>6.3 (8.7)</td>
<td>6.8 (13.0)</td>
<td>6.6 (11.0)</td>
</tr>
<tr>
<td>Effect Size</td>
<td>0.8 (large)</td>
<td>0.6 (moderate)</td>
<td>0.6 (moderate)</td>
</tr>
<tr>
<td>Number who worsened</td>
<td>39 (53.4)</td>
<td>40 (58.0)</td>
<td>79 (55.6)</td>
</tr>
<tr>
<td>Number who did not change</td>
<td>27 (37.0)</td>
<td>20 (29.0)</td>
<td>47 (33.1)</td>
</tr>
<tr>
<td>Number who improved</td>
<td>7 (9.6)</td>
<td>9 (13.0)</td>
<td>16 (11.3)</td>
</tr>
</tbody>
</table>

a P<0.05
b By the minimally important difference of 4 scale points, after Locker et al., 2004

Irrespective of anaesthesia method, OHIP-14 scores worsened post-operatively, being 19.3 (sd, 7.4) and 20.3 (9.4) in the IV and GA groups respectively. The effect sizes were moderate to large. When the participants were organised by minimum important difference (MID), it showed that both groups had similar recovery experiences.

Further analyses with MID was made and grouped with mean PANAS scores. The results are presented in Table 4.12.
Table 4.12: Mean PANAS scores, by categorised change in OHIP-14 score (brackets contain standard deviation)

<table>
<thead>
<tr>
<th></th>
<th>Positive Affect</th>
<th>Negative Affect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number who worsened&lt;sup&gt;b&lt;/sup&gt;</td>
<td>35.3 (6.1)</td>
<td>20.2 (4.6)&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Number who did not change</td>
<td>32.1 (7.2)</td>
<td>21.0 (6.9)</td>
</tr>
<tr>
<td>Number who improved</td>
<td>34.3 (7.7)</td>
<td>28.2 (8.5)</td>
</tr>
</tbody>
</table>

<sup>a</sup> P<0.05
<sup>b</sup> By the minimally important difference of 4 scale points, after Locker <i>et al.</i>, 2004

When mean PANAS scores were categorised by MID, an ascending gradient in NA was evident. It showed patients who recovered had higher NA scores, on average.
4.2.4 Multivariate logistic regression analysis

Table 4.13 shows a logistic regression model carried out for participants taking longer than 3 days off work after the operation, controlling for relevant baseline characteristics.

Table 4.13: Logistic regression model for 3 or more days off post-surgery

<table>
<thead>
<tr>
<th></th>
<th>Odds ratio (95% CI)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opted for GA</td>
<td>3.80 (1.66, 8.70)</td>
<td>0.002</td>
</tr>
<tr>
<td>Female</td>
<td>1.31 (0.60, 2.86)</td>
<td>0.498</td>
</tr>
<tr>
<td>PANAS NA score</td>
<td>0.99 (0.92, 1.06)</td>
<td>0.711</td>
</tr>
<tr>
<td>Baseline IDAF-4C score</td>
<td>0.93 (0.60, 1.44)</td>
<td>0.744</td>
</tr>
</tbody>
</table>

\(^a\) Hosmer and Lemeshow test: P=0.989

This multivariate analysis shows that patients who opted for GA—once controlling for gender, NA scores and baseline dental fear—had an almost 4 times greater chance of taking 3 or more days off surgery, than those who opted for IV sedation.
Chapter 5: Discussion

5.1 Overview

The primary objective of this study was to compare the surgical outcomes of intravenous sedation and general anaesthesia after third molar surgery. In addition, I evaluated the influence of factors such as personality on patients’ choice of anaesthesia and whether this had any influence on surgical outcomes.

This is one of the few studies to have compared IV sedation and GA with respect to post-operative recovery after third molar surgery. Chye and co-workers compared these two anaesthesia methods and reported a lower incidence of post-operative nausea and vomiting (PONV) in the IV group and a quicker time to discharge (Chye et al., 1993). However, the patients in this study were not given a free choice, and the decision was made by the surgeon after review of the individual cases. There is evidence that patients who are able to choose their anaesthesia method are more accepting of their procedure than those who are randomly allocated (Bain et al., 2001).

Other studies to have compared IV sedation and GA have generally concluded that sedation can be carried out instead of a GA, and—at times—provide a quicker and less complicated recovery (Van Sickels and Tiner, 1992; Rastogi et al., 2014; Mehra and Arya, 2015). The procedures carried out in those studies were more invasive than third molar surgery, and so a deeper sedation technique was utilised. Even so, their findings also confirm that IV sedation can provide a quicker recovery from the operation.

In the discussion that follows, methodological issues will be considered first. Following that, this chapter will be structured according to the research questions. They were: (i) is there a difference in surgical outcomes in third molar surgery between IV sedation and GA; (ii) what is the impact of psychosocial characteristics on anaesthesia choice and surgical outcomes; and (iii) what are the factors that influence the choice of anaesthesia method in third molar surgery? The chapter will conclude with the implications of the study findings, along with future directions for research and practice.
5.2 Methodological issues

Before discussing the findings of this study, it is appropriate to scrutinise the methods used. The study design, sample size, statistical power, and questionnaire design will also be considered.

5.2.1 Study design

This study was a prospective, quasi-experimental study. A quasi-experiment is a situation in which the researcher does not have full control over the allocation of the intervention—in this case, the allocation of IV sedation or GA. Due to this study design, there was an element of bias in this methodology. Patients were able to have a free choice as to which method they will have for the operation, ultimately resulting in more NA and dentally fearful patients in the GA group. In an ideal world, this study would be a RCT, where participants were randomly allocated to either IV sedation or GA for their operation—thus eliminating the source of bias—but ethical constraints meant that I would have been unable to "coerce" certain patients to have their operation under IV sedation when they wanted a GA or vice versa. Costs are higher for a GA, and some patients chose IV sedation because their operation would be cheaper and could be scheduled earlier. The nature of the influences on patients’ choice of anaesthesia method was a key research question in this study. Why do certain patients choose a GA rather than IV sedation?

5.2.2 Study sample

A clinical convenience sample was utilised for this study, and participants were recruited from patients who presented to the Faculty of Dentistry, University of Otago. Participants had to fit between the ages of 16 and 35 years of age and into the inclusion criteria, as outlined in section 3.3.2. Unsurprisingly, the sample comprised of mainly young, healthy adults, and so it is not a representation of the general population.

However, the routine removal of third molar surgery is usually carried out in this age group, since this is the developmental epoch when initial discomfort develops, prompting a visit to their dentist. It could be said that this sample is a fitting representation, since this age group is
more likely to have third molar surgery and more likely to be more forthcoming about their pain experiences, arguably.

5.2.3 Statistical power

This study had a minimum requirement of 73 participants in each group, assuming an \( \alpha \) value of 0.05 and a power of 0.8 to detect a difference. This is on the basis that 60\% of those in the GA group and 80\% in the IV group will report “good” or “excellent” in their experience. The recruitment process was better than the minimum required (157); however, a small attrition rate meant a slightly smaller GA group (69). This reduction in number was minimal. The findings showed that the sample size was adequate, and the attrition rate was unlikely to influence the data or results. That is, there was adequate statistical power and the loss of some patients was unlikely to have affected the findings.

5.2.4 Pain

This study did not utilise a VAS scale for patient self-reported pain experience. Instead, an ordinal scale (VRS) consisting of 5 levels of pain ranging from “no pain” to “excruciating pain & agony” was used. The VAS scale is a standard that is frequently used to evaluate pain after surgery. However, it was the hope of the author that by using more appropriate descriptors of pain, patients could use this simpler method to report their pain more accurately.

5.3 Research Questions

5.3.1 Is there a difference in surgical outcomes in third molar surgery between IV sedation and GA?

When comparing participant recovery, outcome measures were assessed objectively through OHIP-14 scores and self-reported outcomes (such as days off work). The OHIP-14 data suggest that there will be a worsening in patients’ OHRQoL following third molar surgery, irrespective of the anaesthesia method used. The effect sizes for these changes were moderate to large. This is consistent with the existing literature, where a definite deterioration in patients’ OHRQoL in the first week is usually observed (Chapter 1.2.3.2). Interestingly, when participants were asked
to comment on the number of days taken for recovery, the majority of participants in the IV group took less than 6 days off, while GA participants took more days off significantly. Even though OHRQoL had worsened equally for both groups, the IV participants recovered more quickly. Perhaps this can be attributed to the more involved process of having a GA, given that they are seen and treated in a hospital setting, with the addition of all the medications required to induce GA. A higher incidence of PONV and a sore throat in this group might also be a contributory factor. The incidence of these complications was much greater in the GA group, but this was to be expected, because PONV is a well-known complication of a GA, with the intubation process and the use of a throat pack being the main reason for a sore throat.

In terms of the deterioration of patients’ eating pattern in the recovery phase, there were no differences between the two groups. The even distribution of mandibular third molar impactions across the two groups suggests that recovery would be similar from a surgical standpoint. The greater number of upper third molars requiring surgical removal in the GA group did not seem to have an impact on patients’ eating pattern post-operatively. This suggests that the recovery from surgery was not heavily influenced by the operation *per se*, but instead from the GA itself.

Interestingly, the IV group reported more pain following surgery. Almost one-third of that group reported “Severe” and “Excruciating pain & agony” while it was one in ten in the GA group. With such a difference in pain experience, it might be expected that this would impact socially and functionally, and be reflected in the overall OHRQoL score; but this was not evident in the findings. In fact, GA participants reported a longer recovery period, albeit reporting lower pain. A possible explanation for this difference could be the significantly higher number of tertiary-educated patients in the IV group. Perhaps this higher overall level of education had an influence on their ability to cope; or perhaps patients’ level of education influenced their ability to report pain, whether more accurately or at a heightened level. This raises the question, “*does patients’ level of education influence their ability to cope after surgery?*”.

Both groups reported the same level of satisfaction from surgery. Even though with the different outcomes in days off and pain as mentioned above, participants mentioned that their surgery met their expectations and were satisfied with the outcome. Perhaps this was not due to the pain and discomfort from surgery, but rather from the amnesic qualities of both IV sedation and GA.
Critically, the issue of bias in this study must be addressed. As mentioned in section 5.2.1, this was carried out as a quasi-experimental design, where patients can freely choose their method of surgery. This will inherently introduce a level of bias in this study because participants that are dentally fearful—and in this study higher NA scores—will more likely opt for a GA, thus affecting the result. To control for these confounding factors, multivariate logistic regression analysis (Section 4.2.4) was used and showed that patients who had their operation under GA—once controlling for gender, NA scores and dental fear—had an almost four times greater risk to take more than 3 days off after surgery.

All things being equal, the findings suggest that the benefits of IV sedation outweigh those of a GA. The surgical outcomes might be similar in terms of deterioration of OHRQoL, eating pattern, and satisfaction, but patient self-reported outcomes are more positive with IV sedation, notwithstanding the greater post-operative pain.

5.3.2 What is the impact of psychosocial characteristics on anaesthesia choice and surgical outcomes?

The investigation into patient’s psychosocial characteristics in dentistry—such as dental fear and anxiety—is nothing new. However, little has been done in terms of evaluating its impact on treatment outcomes and satisfaction.

As reported previously, personality not only impacts on self-reported oral health, but also influences clinical conditions such as dental caries (Thomson et al., 2011). It is logical to conclude that psychosocial characteristics may impact on surgical outcomes, in the current case, the surgical removal of third molar teeth. The Negative Emotionality domain comprises the three sub-categories of aggression, alienation and stress reaction. These indicate a degree of intimidation, victimisation/mistreatment, and nervousness/catastrophising, respectively. The PANAS NA scale does not permit investigation of these because of its relative brevity, and so these aspects were unable to be explored in this study. However, it is logical to assume that those scoring higher on NA in the current study would have scored higher on all three of those.

There was a definite pattern with the patients scoring higher on NA in the PANAS scale in the current study. The findings suggest that patients scoring high on negative emotionality will take more time off after surgery. They also tend to report a greater severity and frequency of
pain pre-operatively and are more likely to choose a GA for their operation. What could be the reason for this? Could it be that patients with a greater degree of psychosocial traits such as mistreatment and catastrophising influenced their recovery? Do these negative traits introduce a degree of acopia (that is, being unable to cope as well) in patients? Or was the longer recovery attributed to associated complications such as a sore throat and PONV? Complications from the GA itself can indeed worsened post-operative recovery, but when the mean PANAS scores were examined by recovery group, it showed that, irrespective of anaesthesia method, participants scoring higher on negative emotionality took significantly more time off daily activities. This suggests that the technical and clinical complications of a GA had little influence on patient recovery.

The current study also found participants scoring higher on NA showed the greatest improvement in their OHIP-14 scores. This was a surprising finding, especially when these were the individuals that took more days off.

This study was not able to determine whether it was the GA that caused the longer recovery, or whether it was patients’ pre-existing personality traits that influence their surgical outcomes. Further research is warranted in this area; as the study findings suggest that no single outcome measure can be used to evaluate patient recovery.

5.3.3 What are the factors that influence the choice of anaesthesia method in third molar surgery?

In the current literature, the choice of anaesthesia is predominantly decided by the treating clinician, their evaluation of the patient’s medical status, the difficulty of the surgery, and the available facilities. There are no studies to date investigating patient-related choice and their outcomes.

The current study gave participants a free choice between (a) LA with IV sedation and (b) GA for their operation. By doing so, it was the aim to determine the reasons for their choice and whether the consultation process had an influence.

The choices that participants made can be seen in Appendix G. There was a considerable low proportion of participants requesting IV sedation, while almost half requested a GA. This finding may be attributed to two possibilities; was it: (1) the perception that third molar surgery
is (or should be) carried out under a GA; or (2) were patients unaware of the available option of IV sedation? The second biggest reason for GA was their perceived knowledge of the procedure. Whether this was influenced by friends and family or from the internet and social media was not investigated. Only one-fifth of GA-preferring participants were willing to change to IV sedation after their surgical consultation. It is evident from the findings that, even after the consultation, patients’ underlying fears and anxiety prove a difficult hurdle for change.

The findings from this study suggest two potential clinical reasons for their choice of anaesthesia method. The first consideration was the number of third molars removed per patient. There was a significant difference in choice when only the two mandibular third molars needed to be removed. Of those cases, almost nine out of 10 chose to have IV sedation. There was no difference in choice when three or all four third molars were indicated for extraction. It is logical to attribute this to participants’ anticipant of greater pain and discomfort when all third molars were to be removed, rather than two. Even though the removal of maxillary third molars may result in fewer complications and less discomfort than for their mandibular counterparts, psychologically, patients may still find it difficult to understand.

The second clinical reason for choice was the surgical difficulty of the upper third molars. Participants choosing IV sedation had significantly fewer upper third molars (30 out of 69 maxillary third molars) requiring surgical removal (requiring elevation of a mucoperiosteal flap and bone removal). In the GA group, there was an even distribution, (almost 50/50) in maxillary third molars requiring surgical removal. This finding suggests that the surgical difficulty of the maxillary teeth had a greater influence on patient choice. However, was this choice influenced by the clinician? An impacted 18 or 28 is often more difficult to access, and the associated surgical discomfort to the patient can be greater than for an impacted mandibular third molar. It can also be argued that unerupted upper third molars are rarely symptomatic, and their removal is usually prophylactic, and hence, a patient’s choice. Perhaps qualitative research might provide better explanation of this.

A noteworthy finding on choice was the higher number of tertiary educated participants in the IV group, as mentioned in section 5.3.1. This was not seen with CSC status, so I am not able to conclude that social status was a factor, as Sammut et al did in their study (Sammut et al., 2013). However, it certainly begs the question of whether the education level of the patients had an influence on their choice. Is it because they were better educated and, hence, better able to understand the process of the operation and make a better clinical choice? Or did personality
traits once again influence this choice, since there was a significant difference in NA scores between the groups (Table 4.5)? Or was higher level of education related to lower scores in NA and vice versa? Or could the deciding factor be anxiety and dental fear? Almost two-thirds of the participants in the GA group mentioned nervousness, fear, and the thought of the procedure itself as their reason for choosing a GA. Even though a GA costs more, has a longer waiting period and has more unwanted complications, their psychosocial traits, and perhaps their level of education might be the deciding factor.

The question of choice remains difficult to answer. Educational, clinical and psychological factors play a synergistic role in patients’ decisions. It is not possible to determine—from the findings of this study—that only one factor influences their choice. The evidence presented here suggests that patients’ psychological and personality characteristics do indeed influence that choice, with NA scores being higher (on average) among those opting for treatment under GA, and this has a knock-on effect on surgical outcomes. However, further research is needed to validate and confirm this finding.

5.4 Implications of the study findings

What are the practical clinical implications of this study? Regardless of surgical difficulty, a patient’s recovery is unpredictable. Clinical measures—such as surgical methods and medication regimen—have been studied extensively. Most studies have concluded that one approach is not superior to the other in relation to patient recovery. Should clinicians include a measure of negative emotionality during their initial consultation and evaluation for surgery? Practically, it may not be feasible for every patient to complete a PANAS questionnaire, because clinicians are unlikely to have the skills to correctly interpret the resultant data. However, dental practitioneres should appreciate that their patients differ in their psychological characteristics and that these can influence both their choices and their recovery path. Accordingly, through rapport and relationship building, management of our patients will go beyond what we can measure clinically and physically see.

What can other possible application be derived from this study? As noted in Thomson's study, personality has been shown to be dynamic throughout our lifetime, with the ability to change through experience and lifestyle (Thomson et al., 2011). In addition, the use of a brief cognitive intervention has been used successfully to change patients’ perceptions and negative attitudes
in medical treatment (Gulliksson et al., 2011). Thus, it is not unreasonable to suggest that the use of brief cognitive therapy in dentistry could be a valid method to aid in providing optimum dental care. Perhaps more in-depth study and the better understanding of psychosocial factors and perceptions—using mixed qualitative and quantitative methods—may be warranted. This may result in the development of patient-specific consultation and custom tailored post-operative instructions to certain "patient types".

The majority of third molar removal can be carried out simply under LA, with or without sedation in the dental setting. However, there are specific situations where a GA in a hospital environment is recommended. Dental fear remains a large problem in the general population and, in this study, these patients tended to choose a GA for their operation. This ultimately has a flow-on effect on costs, hospital waiting lists and surgical outcomes. The management of dental fear remains one of the challenges of dentistry and thus, further development into patient management and sedation techniques could relieve pressure from waiting lists, especially in the public sector.

This study also confirms the safety (and acceptance by patients) of the use of single agent midazolam alone for the surgical removal of third molar teeth, without the need for stronger medications such as propofol, remifentanil and/or fentanyl. When titrated to effect, this is a relatively safe technique for conscious sedation and it allows this type of surgery to be provided easily in the dental setting, without the need and cost of a hospital environment, and with acceptable shorter post-operative recovery times.

5.5 Future directions

Multiple factors can influence the recovery of a patient after undergoing surgical removal of third molar teeth. In fact, the outcome of any treatment can be unpredictable. The evaluation of patient recovery from objective clinical measures—while useful—may not be as relevant to patients. The study into psychosocial characteristics is in its infancy in dentistry, and further research is required in this area to better provide for our patients.

Negative emotionality has a clear impact on our patients’ own perception of oral health, the choices they make, and on their surgical outcome. The influence it has on choice is evident in this study, but it is neither practical nor ethical for patients to complete a PANAS questionnaire.
prior to consultation. However, it is possible to develop specific questions for new patient registration forms to collect the necessary information; or an alternative (and subtler) approach could be the development of questioning strategies during the consultation process. Clinicians may then be able to utilise this information to better apprise patients of the likely outcomes and set expectations more accurately.

The study and use of psychological traits—as mentioned previously—is a new concept in dentistry. The current literature has shown that it has a large role in dentistry, and its influence in patient care is worth noting. However, at the time of writing, there is no allowance made for this area in the undergraduate dental curriculum at the University of Otago. Future considerations might be the inclusion of psychosocial characteristics and aspects of psychology into the education of future dental graduates.

Public awareness of dentistry is an area that requires improvement, not just for third molar surgery. This study showed that the perception of this type of surgery is poor and patients’ preconceived knowledge and fears play a large part in their decision making. Future efforts can be made to raise public awareness of the true nature of treatment. This is no doubt a monumental task, but the overall benefits to the provision of health care will be worthwhile.
Chapter 6: Conclusion

This study aimed to compare the two anaesthesia methods of LA with IV sedation and GA. Participants that had a tertiary education tended to choose IV sedation for their operation, while dentally fearful patients and patients higher in negative emotionality were more likely to choose a GA for their third molar operation. GA patients also reported taking more days off in their recovery, as well as reporting a higher incidence of a sore throat and nausea post-operatively.

Individuals of higher negative emotionality—regardless of anaesthesia method—also took more days off normal daily activities.

The findings suggest that patients’ psychological and personality characteristics do indeed influence their choice and surgical outcomes.

*****
References


Appendices

Appendix A: Letter of ethical approval

Assoc. Prof. D Tong
Department of Oral Diagnostic and Surgical Sciences
Faculty of Dentistry

23 September 2015

Dear Assoc. Prof. Tong,

I am again writing to you concerning your proposal entitled "Third molar surgical outcomes: A comparison between intravenous sedation and general anaesthesia", Ethics Committee reference number, H15/092.

Thank you for Soc-Wee Ong's letter of 22nd September 2015 addressing the issues raised by the Committee.

Thank you for clarifying the recruitment process indicating that participants will be approached prior to their surgery and once again after their operation.

Thank you also for amending the Information Sheet, as requested.

On the basis of this response, I am pleased to confirm that the proposal now has full ethical approval to proceed.

The standard conditions of approval for all human research projects reviewed and approved by the Committee are the following:

Conduct the research project strictly in accordance with the research proposal submitted and granted ethics approval, including any amendments required to be made to the proposal by the Human Research Ethics Committee.

Inform the Human Research Ethics Committee immediately of anything which may warrant review of ethics approval of the research project, including: serious or unexpected adverse effects on participants; unforeseen events that might affect continued ethical acceptability of the project; and a written report about these matters must be submitted to the Academic Committees Office by no later than the next working day after recognition of an adverse occurrence/event. Please note that in cases of adverse events an incident report should also be made to the Health and Safety Office.

http://www.otago.ac.nz/healthandsafety/index.html

Advise the Committee in writing as soon as practicable if the research project is discontinued.
Make no change to the project as approved in its entirety by the Committee, including any wording in any document approved as part of the project, without prior written approval of the Committee for any change. If you are applying for an amendment to your approved research, please email your request to the Academic Committees Office:

gary.witte@otago.ac.nz

jo.farrondediaz@otago.ac.nz

Approval is for up to three years from the date of this letter. If this project has not been completed within three years from the date of this letter, re-approval or an extension of approval must be requested. If the nature, consent, location, procedures or personnel of your approved application change, please advise me in writing.

Yours sincerely,

[Signature]

Mr Gary Witte
Manager, Academic Committees
Tel: 479 8256
Email: gary.witte@otago.ac.nz

c.c. Professor A M Rich Department of Oral Diagnostic and Surgical Sciences
Appendix B: Letter from Ngāi Tahu

NGAI TAHU RESEARCH CONSULTATION COMMITTEE
TE KOMITI RAKAHU KI KAI TAHU

Tuesday, 15 September 2015.

Associate Professor Darryl Tong,
Faculty of Dentistry - Department of Oral Diagnostic and Surgical Sciences,
DUNEDIN.

Tenā Koe Associate Professor Darryl Tong.

Third molar surgical outcomes: A comparison between intravenous sedation and general anaesthetic

The Ngāi Tahu Research Consultation Committee (the committee) met on Tuesday, 15 September 2015 to discuss your research proposition.

By way of introduction, this response from the Committee is provided as part of the Memorandum of Understanding between Te Rūnanga o Ngāi Tahu and the University. In the statement of principles of the memorandum it states "Ngāi Tahu acknowledges that the consultation process outlined in this policy provides no power of veto by Ngāi Tahu to research undertaken at the University of Otago". As such, this response is not "approval" or "mandate" for the research, rather it is a mandated response from a Ngāi Tahu appointed committee. This process is part of a number of requirements for researchers to undertake and does not cover other issues relating to ethics, including methodology they are separate requirements with other committees, for example the Human Ethics Committee, etc.

Within the context of the Policy for Research Consultation with Māori, the Committee base consultation on that defined by Justice McGechan:

"Consultation does not mean negotiation or agreement. It means: setting out a proposal not fully decided upon, adequately informing a party about relevant information upon which the proposal is based, listening to what the others have to say with an open mind [n] that there is room to be persuaded against the proposal; undertaking that task in a genuine and not cosmetic manner. Reaching a decision that may or may not alter the original proposal."

The Committee considers the research to be of importance to Māori health.

The Committee notes and commands that ethnicity data is to be collected as part of the research project and recommends the use of the questions on self-identified ethnicity and descent; these questions are contained in the latest census.

The Committee suggests including in the research team a researcher with expertise in analysing and interpreting data by ethnicity.

The Committee suggests dissemination of the findings to relevant Māori health organisations, for example the National Māori Organisation for Dental Health, Ohanga Nāhau and to Professor John Broughton and Mr Malcolm Dacker, who are involved in Māori Dental Health, University of Otago.
We wish you every success in your research and the committee also requests a copy of the research findings.

This letter of suggestion, recommendation and advice is current for an 18 month period from Tuesday, 15 September 2015 to 15 March 2017.

Nīhau noa, aī

Mark Brunton
Kawhakahaere Rangahau Māori
Research Manager Māori
Research Division
Te Whare Wānanga o Otago
Ph: +64 3 479 8738
Email: mmark.bruntont@otago.ac.nz
Web: www.otago.ac.nz
Information Sheet for Participants

Third molar surgical outcomes:
A comparison between intravenous sedation and general anaesthesia

Oral Surgery research project
Department of Oral Diagnostic and Surgical Sciences, School of Dentistry, University of Otago

Principal Researcher:
Soo-Wee ONG (Oral Surgery Doctorate Candidate)

Principal Supervisor:
Assoc. Prof. Darryl TONG (Oral & Maxillofacial Surgeon)
Introduction

You are invited to participate in this research project. Please read this information sheet carefully. Take your time to consider and, if you wish, talk with relatives or friends, before deciding whether or not to participate.

If you decide to participate, we thank you. If you decide not to take part, there will be no disadvantage to you and we thank you for considering our project.

What is the aim of this research project?

This project is being undertaken as part of an oral surgery doctorate degree at the University of Otago. The aim is to compare two different methods that are commonly used for wisdom teeth extractions, local anaesthesia with intravenous sedation and general anaesthesia.

Who are we seeking to participate in the project?

This project intends to recruit anyone who requires the removal of at least 2 lower wisdom teeth under local anaesthesia with intravenous sedation or general anaesthesia.

Who cannot participate in this project?

The exclusion criteria for this study are: aged under 16 and over 35 years-of-age; significant systemic disease classified as ASA III, IV or V; bleeding disorders; bone disorders; hypersensitivity to benzodiazepines; body weight >120kg; any woman who is pregnant or lactating; history or drug addiction or current opioid use; patients unable to give informed consent; and patients who choose to undertake their surgery under local anaesthesia.
What will participants be asked to do?

Should you agree to take part in this project, you will be requested to:

1) Fill out a short questionnaire about your age, gender, occupation, oral hygiene practice, history of pain with your wisdom teeth, your preferences for IV sedation or GA, your anxiety with the dentist and 20 short questions about your personality. This should take no more than 10 minutes of your time.

2) Attend your appointment for the removal of your wisdom teeth.

3) Attend an appointment 10-14 days after the surgery to review your progress and to fill out a shorter questionnaire regarding how your experience has been.

*Please note that the cost of the extractions and anaesthetic will not be covered for the participation in this study*

How will the data collected be used?

The data collected from you is in the form of the questionnaires as described above. The data and the results from this study will be written up in the form of a thesis by the primary researcher and may later be published in dental and medical journals. You are most welcome to request a copy of the final results of this research project.

Confidentiality

Your participation in this study is strictly confidential. All participants will be allocated an ID number for identification. Any personal information will remain anonymous and all the original data collected will be stored securely at the School of Dentistry, University of Otago for a period of 10 years; after which it will be destroyed. It will not be possible to identify you as the participant from any potential articles that will be published from this research. The data collected from this study may also be used for future studies, but your personal information will remain confidential and anonymous.
**Incentive**

All participants will be entered into a draw for a $200 shopping voucher. The ID number will be used to identify the winners and they will be contacted at the end of the study.

**What if participants have any questions?**

If you have any additional questions or concerns, please do not hesitate to contact Soo-Wec ONG or Associate Professor Darryl TONG on (03) 479 7023 during business hours; or for after hours, email: drsooweeong@gmail.com or call 027 2244169.

This study has been approved by the University of Otago Human Ethics Committee (Health). If you have any concerns about the ethical conduct of the research you may contact the Committee through the Human Ethics Committee Administrator (ph: 64-3-479 8256 or gary.witte@otago.ac.nz). Any issues you raise will be treated in confidence and investigated and you will be informed of the outcome.

Thank you once again for your consideration.
Appendix D: Consent form for participants

Consent form

Third molar surgical outcomes: A comparison between intravenous sedation and general anaesthesia

1. I have read and understand the form entitled, “Information sheet for participants: “Third molar surgical outcomes: A comparison between intravenous sedation and general anaesthesia”

2. I have had sufficient time to talk with other people of my choice about participating in the study. All my questions about the project have been answered to my satisfaction, and I understand that I am free to request further information at any stage.

3. I confirm that I meet the criteria for participation, which are explained in the information sheet.

4. I know that my participation in the project is entirely voluntary, and that I am free to withdraw from the project at any time without consequence.

5. I know that as a participant I will:
   i. Complete the questionnaire before surgery
   ii. Attend the appointment for the surgery
   iii. Attend the review appointment 10-14 after the operation and complete the after surgery questionnaire.
6. I understand that my participation will be strictly kept confidential and all future publication of the data will not identify me as an individual.

7. I understand that all data collected will be stored securely at the University of Otago for a period of 10 years, after which time, all data will be destroyed.

8. I understand that the cost of the operation is not waived by participating in this study.

I…………………………………………………………………………. agree to participate in this research project. I would like/do not need a summary of the results sent to me.

(Signature of participant)  (Date)

Thank you very much for your participation.
Appendix E: Before surgery questionnaire

Before surgery questionnaire

*Third molar surgical outcomes:*
*A comparison between intravenous sedation and general anaesthesia*

Oral Surgery research project
Department of Oral Diagnostic and Surgical Sciences, School of Dentistry, University of Otago

**Principal Researcher:**
Soo-Wee ONG (Oral Surgery Doctorate Candidate)

**Principal Supervisor:**
Assoc. Prof. Darryl TONG (Oral & Maxillofacial Surgeon)

*Thank you for taking the time to complete this questionnaire.*
A few questions about yourself......

How old are you? ___________ years

What is your gender? (Please Circle)

- Male
- Female

What ethnic group(s) do you identify with? (Please Circle)

- NZ/European
- Maori
- Pacific Islander
- Asian/Chinese
- Other

Do you have a Community Services Card? (Please Circle)

- Yes
- No

What is your occupation?

________________________________________

What is the highest level of education you have attained? (Please Circle)

- Primary School
- Secondary School
- Tertiary Education
- Other

Do you currently smoke? (Please Circle)

- Yes
- No

How often do you brush your teeth? (Please Circle)

- Twice a day
- Once a day
- Other

Do you use a mouthwash? (Please Circle)

- Yes
- No
About your wisdom teeth……

Have you ever had any pain or discomfort with your wisdom teeth?

Yes No

If yes, how would you describe the intensity of the pain or discomfort?

Mild Moderate Severe

In the last 4 weeks, how often have you had pain or discomfort with your wisdom teeth?

Occasionally Sometimes Often Always

BEFORE your consultation, did you have a preference of anaesthesia for your operation?

No Preference Local Anaesthesia IV sedation General Anaesthesia

Please specify what influenced your choice: ______________________

AFTER your consultation, did your choice of anaesthesia change?

Yes No

If yes, what was the reason?: ______________________
The next questions ask about the effect of your teeth, mouth and jaws on your daily life.

Please circle the answer that BEST applies to you during the last 2 weeks.

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<tr>
<th>Question</th>
<th>Never</th>
<th>Hardly Ever</th>
<th>Sometimes</th>
<th>Fairly Often</th>
<th>Very Often</th>
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<td>Had trouble pronouncing any words?</td>
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<td>Felt that your sense of taste has worsened?</td>
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<td>Had painful aching in your mouth?</td>
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<td>Found it uncomfortable eating any foods?</td>
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<td>Been self-conscious?</td>
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<td>Felt tense?</td>
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<td>Had a change in diet?</td>
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<td>Had to interrupt meals?</td>
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<td>Found it difficult to relax?</td>
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<td>Been a bit embarrassed?</td>
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<td>Been a bit irritable with other people?</td>
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<td>Had difficulty doing your usual jobs?</td>
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<td>Felt that life in general was less satisfying?</td>
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<td>Been totally unable to function?</td>
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The next questions ask how your feel about visiting the dentist

Please TICK the box that comes closest to how you AGREE with the following statements.

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<tr>
<th></th>
<th>Disagree</th>
<th>Agree a little</th>
<th>Somewhat agree</th>
<th>Moderately agree</th>
<th>Strongly agree</th>
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</tbody>
</table>
These last questions ask about how you usually feel

*In the past year, to what extent have you **GENERALLY** felt …… (Please circle your answer)*

<table>
<thead>
<tr>
<th>Feeling</th>
<th>Very slightly or not at all</th>
<th>A little</th>
<th>Moderately</th>
<th>Quite a bit</th>
<th>Extremely</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interested</td>
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<tr>
<td>Distressed</td>
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<tr>
<td>Excited</td>
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<tr>
<td>Upset</td>
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<tr>
<td>Strong</td>
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<tr>
<td>Guilty</td>
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<tr>
<td>Scared</td>
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<tr>
<td>Hostile</td>
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<tr>
<td>Enthusiastic</td>
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<td>Proud</td>
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<tr>
<td>Irritable</td>
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<tr>
<td>Alert</td>
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<tr>
<td>Ashamed</td>
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<tr>
<td>Inspired</td>
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<tr>
<td>Nervous</td>
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<tr>
<td>Determined</td>
<td></td>
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<tr>
<td>Attentive</td>
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<tr>
<td>Jittery</td>
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<tr>
<td>Active</td>
<td></td>
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<tr>
<td>Afraid</td>
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</tbody>
</table>
After surgery questionnaire

Third molar surgical outcomes:
A comparison between intravenous sedation and general anaesthesia

Oral Surgery research project
Department of Oral Diagnostic and Surgical Sciences, School of Dentistry, University of Otago

Principal Researcher:
Soo-Wee ONG (Oral Surgery Doctorate Candidate)

Principal Supervisor:
Assoc. Prof. Darryl TONG (Oral & Maxillofacial Surgeon)

Thank you for taking the time to complete this questionnaire.
These questions ask about what happened after your surgery...

Did you take the pain relief medication prescribed to you?

Yes    No

Did the pain relief tablets give you sufficient pain relief?

Yes    No

Overall, how would you rate your pain following your surgery?

<table>
<thead>
<tr>
<th>No Pain</th>
<th>Mild Pain</th>
<th>Moderate Pain</th>
<th>Severe Pain</th>
<th>Excruciating pain &amp; agony</th>
</tr>
</thead>
</table>

Did you take any additional pain relief medication other than the tablets prescribed to you?

Yes    No

If yes, Please mention the name(s), dose and duration______________________

Did you need to see your medical GP about your pain or discomfort?

Yes    No

Did you experience any nausea or vomiting after surgery?

Yes    No

Did you experience a sore throat after surgery?

Yes    No

Did you require the socket to be irrigated and dressed by a dentist?

Yes    No
How many days did you take off work/normal daily activities?

- 0 days
- 1-2 days
- 3-5 days
- 6-8 days
- Still taking time off

How many days did it take for you to get back to eating normally?

- 0 days
- 1-2 days
- 3-5 days
- 6-8 days
- Still not eating normally

How would you rate your overall experience with your operation?

- Unacceptable
- Poor
- Satisfactory
- Good
- Excellent

How closely did your experience match your expectations?

- Not at all close
- Somewhat close
- Matched exactly
- Exceeded my expectations

**If you had sedation:**

If you could go back in time, would you choose this again?

- Yes
- No

Would you recommend your friends and family to have sedation for their wisdom teeth operation?

- Yes
- No

**If you had general anaesthesia:**

If you could go back in time, would you choose this again?

- Yes
- No

Would you recommend your friends and family to have general anaesthesia for their wisdom teeth operation?

- Yes
- No
The next questions ask about the effect of your teeth, mouth and jaws on your daily life

Please circle the answer that BEST applies to you during the last 2 weeks.

<table>
<thead>
<tr>
<th>Question</th>
<th>NEVER</th>
<th>HARDLY EVER</th>
<th>SOMETIMES</th>
<th>FAIRLY OFTEN</th>
<th>VERY OFTEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Had trouble pronouncing any words?</td>
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<tr>
<td>Felt that your sense of taste has worsened?</td>
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<td>Had painful aching in your mouth?</td>
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<td>Found it uncomfortable eating any foods?</td>
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<td>Been self-conscious?</td>
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<td>Felt tense?</td>
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<td>Had a change in diet?</td>
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<td>Had to interrupt meals?</td>
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<td>Found it difficult to relax?</td>
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<td>Been a bit embarrassed?</td>
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<td>Been a bit irritable with other people?</td>
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<td>Had difficulty doing your usual jobs?</td>
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<td>Felt that life in general was less satisfying?</td>
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<td>Been totally unable to function?</td>
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The next questions ask how your feel about visiting the dentist

Please TICK the box that comes closest to how you AGREE with the following statements.

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<thead>
<tr>
<th>Statement</th>
<th>Disagree</th>
<th>Agree a little</th>
<th>Somewhat agree</th>
<th>Moderately agree</th>
<th>Strongly agree</th>
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Appendix G: Participants anaesthesia preferences, before and after consultation