

https://dspace.org/

Epidemiological analysis of temporomandibular joint dislocation cases treated at the University of the Witwatersrand, Johannesburg

Boitumelo, Motshoane

2023

University of the Witwatersrand, Johannesburg

https://hdl.handle.net/10539/42264

Boitumelo, Motshoane . (2023). Epidemiological analysis of temporomandibular joint dislocation cases treated at the University of the Witwatersrand, Johannesburg [Master's dissertation, University of the Witwatersrand, Johannesburg]. WireDSpace.

Downloaded from a DSpace repository. https://dspace.org/

Epidemiological analysis of temporomandibular joint dislocation cases treated at the University of the Witwatersrand, Johannesburg

Student name : Motshoane Boitumelo

Student number: 2030511

Course: Masters of Dentistry (Maxillofacial and Oral Surgery)

Supervisor : Dr V Premviyasa
(vinayagie.premviyasa@wits.ac.za)

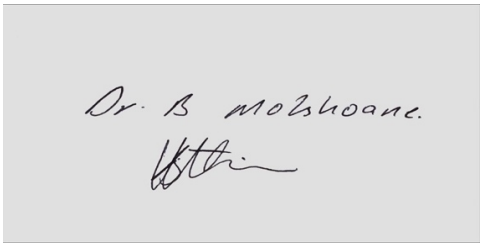
Co-Supervisor: Prof R E Rikhotso
(Risimati.Rikhotso@wits.ac.za)

A research report submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Masters of Dentistry.

Johannesburg, 18 December 2023

Declaration

I Boitumelo Motshoane declare that this Research Report is my own, unaided work. It is being submitted for **Masters of Dentistry** at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.



(Signature of candidate)

18 day of December 2023 Parktown

Dedication

I dedicate this work to my late parents, sisters (Lesego, Kelebogile and Segametsi) and My wonderful Husband Tiisetso Ntsie.

Abstract

Background: Temporomandibular joint (TMJ) dislocation is a rare and debilitating condition of the facial skeleton. The condition manifests itself in acute, recurrent or chronic forms, and with bilateral or unilateral expressions. The purpose of this study was to report on the epidemiological characteristics and management of patients with TMJ dislocation in our unit.

Methods: A retrospective analysis of the demographical and clinical risk factors of TMJ dislocations treated in the Maxillofacial and Oral Surgery Departments, from January 2015 to December 2019, at Charlotte Maxeke Johannesburg Academic Hospital (CMJAH) and Chris Hani Baragwaneth Academic Hospital (CHBAH), University of the Witwatersrand.

Results: There were 46 TMJ dislocation cases, with a bimodal age distribution with peaks at 20 to 25 and above-45-year-old age groups. Acute, chronic and recurrent dislocations were observed in 13 (28%), 9 (20%) and 24 (52%) patients, respectively. Yawning was the commonest cause of dislocation (28 cases, 61%), followed by trauma and spontaneity (both 6 cases, 13%). The type of TMJ dislocation was significantly associated with aetiology, frequency of TMJ dislocation, duration between dislocation and treatment, and type of treatment received ($p<0.001$). Manual reduction was frequently used to treat acute and recurring cases, whereas manual reduction with general anaesthesia was used to treat chronic cases.

Conclusion: Data provided by this retrospective study indicate that the majority of the TMJ dislocations are recurrent and are related to yawning. Most dislocations can be reduced manually under local anaesthesia however, the more prolonged the dislocation, the higher the need for reduction under general anaesthesia and surgical intervention.

Acknowledgements

To the Head of Dept (Maxillo-facial and oral Surgery) Prof RE Rikhotso, It was an honour to train under your guidance, thank you for your support.

To my supervisors, Dr V Premviyasa and Prof RE Rikhotso, thank you for your guidance, knowledge, contribution and support. I am grateful and appreciative.

To My Sisters and Husband, words cannot express how blessed I feel to have your support, prayers and encouragement. Thank you very much.

Table of Content

Declaration II
Dedication III
Abstract IV
Acknowledgments V
Table of Contents VI
List of Figures VII
List of Tables VIII
List of Abbreviations IX
Chapter 1: Literature Review 1
Chapter 2: Aims and Objectives 14
Aim of the study 14
Study objectives 14
Chapter 3: Materials and Methods 15
Study design 15
Study population 15
Data Collection 15
Eligibility criteria 15
Inclusive criteria 15
Exclusion criteria 15
Data analysis 16
Ethical clearance 17
Chapter 4: Results 17
Chapter 5: Discussion 23
Chapter 6: Conclusion 27
References 28
Appendices 32
Appendix A: Ethics Certificate 32
Appendix B: Data Collection Sheet 33
Appendix C: Permission Letters 34
Appendix D: Turnitin Report 36

List of Figures

Figure 1.1 Patient presented at CMJAH showing TMJ dislocation with open bite
Figure 1.2 A panoramic radiograph showing bilateral TMJ dislocation, with the condylar heads positioned in front of the articular eminences.
Figure 1. 2 A & B (A) Reduced right TMJ dislocation and unreduced left TMJ dislocation that will be reduced at the same method one by one. (B) Reduced right TMJ dislocation after mandibular swing with midline mandibulotomy.
Figure 1.4 (A)Oblique osteotomy line of the zygomatic arch in front of the articular eminence
Figure 1.4 (B) Zygomatic arch displaced caudally
Figure 1.4 (C)Internal fixation with a plate to stabilise the zygomatic arch
Figure 4.1 Association between age and gender.
Figure 4.2 Association of age with Pre-existing medical condition
Figure 4.3 Association between gender and the ordinance of episodes.
Figure 4.4 Association of the frequency of episodes and presentation
Figure 4.5 Association between duration prior to treatment and the type of treatment received.
Figure 4.6 Eminectomy surgical procedure

List of Tables

Table 1: Characteristics of the study cohort according to TMJ dislocation type (acute, chronic and recurrent) 21

List of Abbreviations

Temporomandibular joint	TMJ
Human immunodeficiency virus	HIV
Ear nose and throat	ENT
Charlotte Maxeke Johannesburg Academic Hospital	CMJAH
Chris Hani Baragwaneth Academic Hospital	CHBAH

Chapter 1: Literature Review

The temporomandibular joint (TMJ) is a diarthrodial joint better defined as a ginglymoarthrodial joint. TMJ is composed of a synovial cavity, articular cartilage and a capsule that covers the same joint. The joint is also lubricated by synovial fluid and has several ligaments. The joint is the union of the temporal bone cavity with the mandibular condyle (Bender, Lipin and Goudy, 2018).

Sir Astley Cooper was the first author to use the luxation and subluxation terminology about Temporomandibular joint dislocations in 1832. TMJ dislocation occurs when the condyle head is displaced out of the glenoid fossa anterosuperior to the articulating eminence (Shorey and Campbell, 2000). Subluxation describes an imperfect dislocation in which the joint is transiently displaced without full loss of the articulating function and is usually self-reduced by the patient. Luxation is defined as a complete dislocation.

TMJ dislocation is uncommon and the aetiology is relatively unknown. Causes associated with TMJ dislocation are spontaneous, traumatic, iatrogenic, systemic diseases and anatomic. Literature has shown that the presence of underlying illnesses such as Ehlers – Danlors syndrome, neurological and psychotic disorders and the use of medical drugs such as metoclopramide and phenothiazine may lead to an increased risk of TMJ dislocations (Anandhi and Raju, 2018; Okoje, Aladelusi and Abimbola, 2017). HIV-infected patients on antiretroviral drugs complain of pain and pathology of joints including the temporomandibular joint, however, there has been no conclusive cause-effect relationship found to prove or disprove this finding (Fiorentino *et al.*, 2009).

Temporomandibular joint Anatomy

Embryology

The TMJ is a synovial joint formed by the glenoid fossa and the mandibular condyle head. A fibrocartilaginous disc separates the two articulating surfaces. Unlike other synovial joints, the TMJ develops from two blastemata: condyle blastema and temporal blastema. It has fibrocartilage rather than hyaline cartilage. The blastemata develop into condyle cartilage and bony temporal elements. The condyle cartilage has wedge-shaped accessory cartilage that is capped by a condensed layer of fibrous tissue. The mesenchyme between the bony temporal

elements and condyle cartilage forms the articular disc (Allan and Kramer, 2010). The capsule is formed by mesenchyme that surrounds all the parts of the joint. The capsule isolates from the soft tissue by developing a synovial membrane. The articular disc is continuous with the tendon of the lateral pterygoid muscle. From the 12th to the 16th weeks post-fertilization, condyle cartilage ossification occurs and bony temporal elements are completely developed. At birth, the glenoid fossa is flat with no eminence. The articular eminence becomes prominent when deciduous teeth erupt (Allan and Kramer, 2010).

Four TMJ structural components are 1) the squamous portion of the temporal bone, 2) the articular disc within the TMJ, 3) the condyle of the mandible, and 4) the ligaments (Norton and Netter, 2017). The anatomical structures play an important role in the TMJ movements when opening and closing the mouth. Rotational movement occurs when the lateral pterygoid muscle contracts and initiates the opening of the mouth. Depression of the mandible occurs when suprahyoid muscles such as the two bellies of digastric and mylohyoid contract. Geniohyoid muscle also depresses the mandible when the hyoid is immobile (Helland, 1980). When the mandible is depressed, the medial and collateral ligaments attached to the articular disk cause the TMJ to rotate. Translational movement occurs when the articular disk and mandibular condyle move inferiorly on the articular eminence (Norton and Netter, 2017).

Squamous portion of the temporal bone

The squamous part of the temporal bone forms the glenoid fossa, together with the articular tubercle and the articular eminence. The articular surface is composed of dense connective tissue and is thicker in load-bearing areas. The articular surface has avascular fibrous connective tissue instead of hyaline cartilage. The prominence at the base of the zygomatic process is called the articular eminence. The articular tubercle is located on the anterior side of the mandibular fossa which provides attachments to the capsule and the lateral temporomandibular ligament. The glenoid fossa is the depression in which the condyle is located during rest or when not in function.

Articular disc

The articular disc is located between the temporal bone and the condyle and is composed of dense fibrous connective tissue. It is innervated in the peripheral areas and the central part is avascular where load-bearing is at maximum. It is divided into 3 bands: the anterior, intermediate, and posterior bands. Posterior to the articular disc is a bilaminar zone that is composed of the superior lamina, the retrodiscal pad, and the inferior lamina. The articular disc

divides the TMJ into superior and inferior compartments. These compartments are lined by endothelial cells that produce synovial fluid which acts as a lubricant and also provides all metabolic requirements.

Muscles

The muscles that attach to TMJ are four: masseter, temporalis, lateral pterygoid and medial pterygoids. The masseter muscle attaches to the articular disc on the anterior edge. It originates from the zygomatic arch as several muscular layers are inserted on the lateral surface of the mandible and the coronoid process. Its main function is to elevate the jaw. The muscle is innervated via the masseteric branch of the trigeminal nerve (Bordoni and Varacallo, 2022; Bravetti *et al.*, 2004).

The temporalis muscle originates from the temporal fossa of the skull and the medial surface of the zygomatic process and is inserted into the coronoid process. The temporalis occasionally attaches to the anterior part of the articular disc. Its main function is to elevate the mandible. It receives innervation from the deep temporal nerve branches of the trigeminal nerve Field(Bordoni and Varacallo, 2022; Bravetti *et al.*, 2004).

The lateral pterygoid muscle consists of an upper and a lower head. The upper head originates from the extracranial surface of the large sphenoid wing and inserts anteromedially to the joint capsule or the anteromedial surface of the condyle neck. It contacts the disc at the anteromedial aspect. The inferior head originates from the lateral aspect of the lateral lamina of the pterygoid process and inserts on the pterygoid fovea. Activation of the lateral pterygoid bilaterally, protrudes the mandible, while, unilateral activation, causes contralateral lateral deviation of the jaw. The lateral pterygoid muscle pulls the condyle forward during the opening of the mouth and when closing the mouth, it pulls the disc anteromedially. The upper and lower bundles are active during the early stages of opening and initial stages of closing the mouth (Bordoni and Varacallo, 2022; Bravetti *et al.*, 2004).

The medial pterygoid muscle originates from the pterygoid fossa, the pyramidal process of the palatine bone, and the maxillary tuberosity, to terminate on the medial surface of the angle of the mandibular. The medial pterygoid is innervated by the mandibular branch of the trigeminal nerve. The medial pterygoid muscle functions by elevating and protruding the mandible (Bordoni and Varacallo, 2022; Bravetti *et al.*, 2004).

Intrinsic and extrinsic ligaments

Intrinsic ligaments

1. The temporomandibular ligament on the lateral aspect of the capsule prevents posterior displacement of the condyle
2. The collateral ligament is formed when the temporomandibular ligament and capsule merge. A fan shaped ligament that attaches to the tubercle on the root of the zygoma above and the mandibular neck below. The fan shaped fibers permit restraint of the mandible on retrusion movement and inhibit compressive forces on tissues behind the condyle.

Extrinsic ligaments

1. The sphenomandibular ligament extends from the spine of the sphenoid bone to the lingula of the mandible. It acts as a fulcrum on the mandible by maintaining the same amount of tension during opening and closing and therefore limits anterior protrusion of the mandible
2. The stylomandibular ligament extends from the styloid process to the posterior margin of the angle and ramus of the mandible. It helps limit the anterior protrusion of the mandible.
3. The Pterygomandibular raphe is also known as the pterygomandibular ligament. The pterygomandibular raphe originates from the internal pterygoid plane of the skull and attaches to the retromolar fossa of the mandibular. The ligament is also attached to the buccinator muscle (anteriorly) and the pharyngeal constrictor muscle (posteriorly). pterygomandibular ligament limits excessive mandibular movements.

Temporomandibular joint dislocation

TMJ dislocation occurs when the condyle head is displaced out of the glenoid fossa anterosuperior to the articulating eminence (Shorey and Campbell, 2000). Dislocation is frequently observed in patients with altered structural components e.g. lax capsule, weak ligaments, atrophic condyle, etc.

Clinical features

A patient will present with an inability to close the mouth (Fig 1.1) as well as pain and hollowing of the preauricular region. The chin will be protruded and the patient will have difficulty during mastication, swallowing and speaking due to the inability to close the mouth.

A patient will also present with drooling of saliva (Sharma *et al.*, 2015). The most common radiological image used for screening is an Orthopantomogram which shows the morphology and location of the condyle to the articular eminence. TMJ dislocation will show the condyle anterior to the articular eminence bilaterally or unilaterally (Fig 1.2).

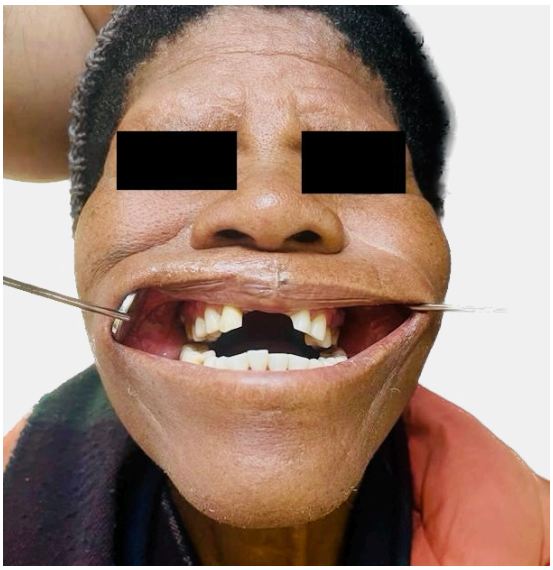


Figure 1.1 Clinical picture showing open bite deformity in a patient who presented with bilateral TMJ dislocation

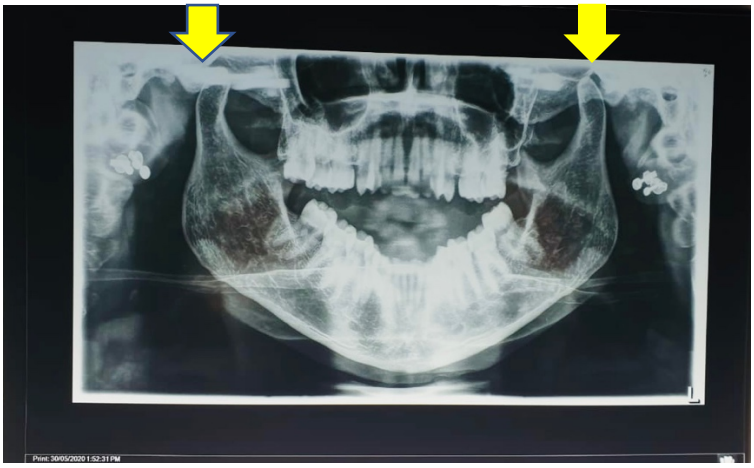


Figure 1.2 An Orthopantomogram radiograph showing bilateral TMJ dislocation, with the condylar heads (yellow arrows) positioned in front of the articular eminences.

Classification

Various classifications of the TMJ dislocation have been reported which take into consideration the displacement based on the mandibular hypermobility, direction of the condyle and duration of the displacement. The relationship between the condyle head and articular eminence is based on a clinico-radiological evaluation (Akinbami, 2011; Sharma *et al.*, 2015).

Type 1 – the head of the condyle is directly below the tip of the eminence.

Type 2 – the head of the condyle is in front of the tip of the eminence
Type 3 – the head of the condyle is high up in front of the base of the eminence

The most popular classification as described by Adekeye et al. (1976) is the acute, chronic, and recurrent dislocations (Akinbami, 2011; Ugboko *et al.*, 2005; Sharma *et al.*, 2015; Marqués-Mateo, Puche-Torres and Iglesias-Gimilio, 2016)

- Acute dislocation is a very painful condition with the patient presenting within 2 weeks and it is readily reducible.
- Chronic dislocation presents after 2 weeks with the shortening of the temporalis and masseter muscle with spasms. The reduction of chronic dislocation is difficult.
- Chronic recurrent dislocation includes those due to habitual wide mouth opening and is usually spontaneous and self-reducible. These may occur relatively often or frequently.

Aetiology

The aetiology of the TMJ dislocation is mostly unknown. The literature reports possible aetiologies to be traumatic, iatrogenic, or may occur spontaneously.

Traumatic causes include direct trauma to the maxillofacial region, and spasms of the masseteric, temporalis, and medial pterygoid muscles during epileptic seizures (Okaje et al., 2017).

The iatrogenic causes related to TMJ dislocation include prolonged mouth opening during lengthy dental and ENT procedures, or when extensive force is applied during endotracheal intubation procedures (Katti et al., 2016).

Excessive mouth opening during yawning, vomiting, laughing, and singing are the most common causes reported for spontaneous onset of TMJ dislocation (Ugboko et al., 2005). Papoutsis et al. (2018) reported that 93.7% of TMJ dislocation is non-traumatic. This study also showed that of 93.7% of non-traumatic dislocations, 76.7% were spontaneous dislocations (Papoutsis et al., 2018).

Literature has shown that the presence of underlying conditions such as Ehlers–Danlos syndrome, neurological and psychotic disorders, and drugs (metoclopramide and phenothiazine) play a role in the dislocation of the TMJ (Anandhi and Raju, 2018; Okoje et al., 2017). Papoutsis et al. (2018) reported that 9.4% of patient comorbidities were responsible for the dislocation due to anatomical alteration. Ugboko et al. (2005) study showed that 10.4 % of

the patients volunteered their underlying systemic conditions, with epilepsy as the most common underlying factor.

Metoclopramide and phenothiazines are common drugs likely to induce a spasm. TMJ dislocation of the mandible was the initial sign of an adverse reaction to the drug. This was demonstrated in a case series conducted by Hiatt et al. (1966). The study showed TMJ dislocation was due to spasm of lateral pterygoid muscle as a side effect. Several cases of dislocations of the mandible were reported as secondary to prochlorperazine intake (Marcus et al., 1960; O'Hara, 1958; Shapiro et al., 1965). Solomon et al. (2010) reported muscle spasms in a 23-year-old female patient who ingested 10 mg of escitalopram. There was no history of any other medications or herbal preparations used. Twenty hours after the first dose, she developed painful spasms of the muscles of her neck on the right side which resulted in forced opening and deviation of the jaw (Solomon et al., 2010).

HIV-infected patients, on antiretroviral drugs, usually present with pain and pathology that targets the joints including the temporomandibular joint (Anandhi and Raju, 2018). Anandhi and Raju's (2018) study reported an HIV-infected patient presenting with TMJ dislocation. Similarly, Ugboko et al. (2005) also reported a TMJ dislocation in a patient with HIV-related candidiasis which occurred while attempting to forcibly dislodge the oral lesion. Florence et al. (2002) reported that TMJ complaints disappeared when the protease inhibitor antiretroviral drug was replaced. They reported that 35.5% of patients treated with a regimen containing protease inhibitors have more pain in the joints, although no conclusive cause-effect relationship has been found (Florence et al., 2002).

Management

Acute TMJ dislocation

Single, acute episodes of TMJ dislocation are often managed by manual reduction techniques, with or without anaesthesia (Akinbami, 2011; Okoje, Aladelusi and Abimbola, 2017.; Ugboko *et al.*, 2005). These reduction techniques may be applied both intra-orally and extra-orally (Ardehali *et al.*, 2009) and require no further intervention (Okoje, Aladelusi and Abimbola, 2017). The conventional intraoral technique is done when the clinician stands facing the patient and inserts two thumbs wrapped with gauze onto the inferior molars with the rest of the fingers around the external mandible, then applying steady firm downward and backward pressure to relocate the jaw (Lum and Poh, 2017; Westjem, 2020). This is also known as Nélaton's manoeuvre or the Hippocratic technique (Sharma *et al.*, 2015). An alternative method called the wrist pivot technique was described in 2004, whereby the physician grasps the mandible at

the mentum with both thumbs and places the fingers on the inferior molars, applying an upward force on the thumbs and downward pressure with the fingers. The wrist is then pivoted to reduce the dislocated jaw (Lowery, Beeson and Lum, 2004; Lum and Poh, 2017).

The intra-oral reduction method, although effective, has some disadvantages as it may require great effort in patients with strong mastication musculatures; may occasionally necessitate the use of local or systemic analgesics and muscle relaxants; risks of transmittable diseases due to bite injuries; and patient discomfort (Ugboko *et al.*, 2005). Therefore, the extra-oral approach has been derived to avoid some of these issues (Chen *et al.*, 2007). The extra-oral method is based on the observation that once the mandible is dislocated anteriorly, the coronoid process and anterior border of the ramus can be palpated easily over the cheek. By applying steady pressure over this prominent part, the anteriorly dislocated mandible can be reduced easily (Chen *et al.*, 2007). However, the extra-oral approach was found to have a lower success rate at reducing dislocations (Ardehali *et al.*, 2009).

A more recent method, described by Gorchynski et al. in 2014, is known as the syringe technique (Gorchynski, Karabidian and Sanchez, 2014). The patient is instructed to bite down on a 5ml or 10ml syringe between the molars on the affected side. He is then asked to roll the syringe to and from between his teeth until relocation occurs. Neither sedation nor manual manipulation is required, unlike the other methods (Lum and Poh, 2017).

A randomised clinical trial found the wrist-pivot method as the best method for reduction with the highest success rate (Ardehali *et al.*, 2016). Immobilisation post reduction using intermaxillary fixation for 4 weeks leads to fibrosis of soft tissues encompassing the joint therefore preventing further dislocations (Raja, 2021).

Chronic TMJ dislocation

Treatment modalities described for the management of chronic TMJ dislocation in the literature can be classified as conservative or surgical.

Conservative management of chronic TMJ dislocation.

Prolonged cases of dislocation cause the joint cavity to fill with connective tissue, develop adhesions between joint surfaces, and shorten the masticatory muscles. Temporalis muscle fibrosis and impingement of the coronoid have also been reported to increase the difficulty of manual reduction (Tipps and Landis, 1982). In general, conservative methods are the first

choice of treatment before surgical management (Tocaciu, McCullough and Dimitroulis, 2019).

A variety of conservative surgical techniques have been described for reducing chronic protracted dislocations, including the use of a bone hook passed over the sigmoid notch or inserted into bur holes placed at the angles of the mandible. A Bristow elevator placed through a temporal incision can be used to apply posterior pressure to the anterior aspect of the condyle, which may force it to move posteriorly (Caminiti and Weinberg, 1998).

Tipps and Landis (1982) demonstrated another conservative treatment method by using anterior elastic traction with a cork acting as a fulcrum in the molar region, to move the condyles posteriorly beneath the anterior slope of the eminence. This unique approach has been reported by Kao (2019) who reduced a chronic mandibular dislocation using arch bars and posterior bite splints with strong anterior wiring and Class III vector for the posterior wires.

Another conservative treatment modality involved the injection of local anaesthetic in long-standing dislocated joints, to overcome the muscle spasm that is initiated by pain producing stimuli in the region of the joint, as the anaesthetic disrupts the sensory side of pain or the muscle stretch reflexes (Caminiti and Weinberg, 1998).

Chronic recurrent dislocation can also be approached by conservative procedures of injecting sclerosing agents, autologous blood or platelet-rich plasma into the lax pericapsular tissue and superior joint space weekly over 6 weeks (Alpaslan and Alpaslan, 2001; Machon *et al.*, 2009; Gupta, Rana and Verma, 2013).

***Surgical management of Chronic TMJ dislocation*.**

The surgical techniques for TMJ dislocation are into two main groups: those that enable condylar mobility and those whose objective is to limit it. Surgical methods include open reduction (Marqués-Mateo, Puche-Torres and Iglesias-Gimilio, 2016.; Wijmenga, Boering and Blankestijn, 1986), condylar resection or reduction, increase or decrease in the height of the eminence, removal or repositioning of the meniscus (Miller and Murphy, 1976), sometimes extended with coronoidectomy (Wijmenga, Boering and Blankestijn, 1986). When surgery is indicated for chronic protracted/prolonged dislocation, especially cases with longer duration, the goal may be to reposition the condyle in the glenoid fossa and restore movement; or if there is movement in the new position, the goal will be to set back the protruded mandible and correct occlusion (Akinbami, 2011; Rattan, Rai and Sethi, 2013).

When the temporalis muscle is short and spastic, Laskin proposed an intraoral surgical approach to the muscle via a coronoid incision to do a temporalis myotomy (Laskin, 1973). When access is difficult, in fibrosis or adhesions of muscle and cases where the reunion of the muscles may occur, coronoidotomy with or without condylotomy is advocated (Akinbami, 2011; Caminiti and Weinberg, 1998). The ultimate goals of surgery include: reducing TMJ dislocation, restoring function, decreasing morbidity and sequelae, and preventing recurrence (Rattan, Rai and Sethi, 2013).

Midline mandibulotomy, a well-known procedure performed to access oral and pharyngeal tumours can also be utilized in the management of TMJ dislocations. This approach enables free mobility and simple handling of both parts of the mandible in all directions (El-Zohairy, 2007). Midline mandibulotomy does not have complications like facial scarring, nerve damage, the potential for recurrence, or occlusal issues when compared to other surgical procedures like condylectomy (Lee *et al.*, 2006) (Fig 1.3 A & B).

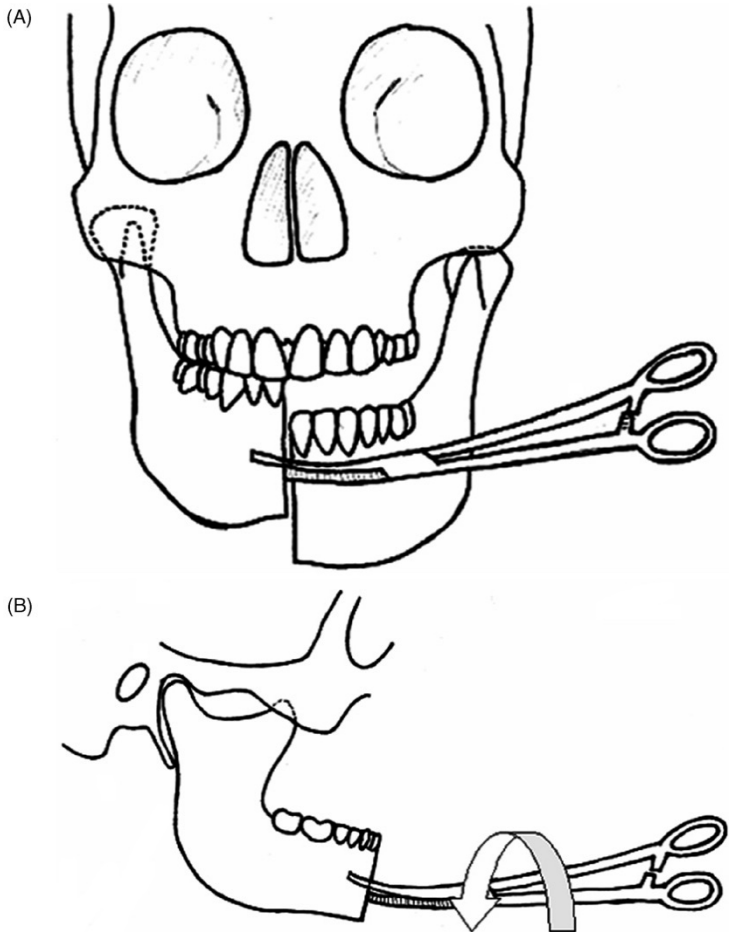


Figure 1. 2 A & B (A) Reduced right TMJ dislocation and unreduced left TMJ dislocation that will be reduced at the same method one by one. (B) Reduced right TMJ dislocation after mandibular swing with midline mandibulotomy (Lee et al, 2006).

The main advantage of this approach is that it enabled condylar reduction with less morbidity than that linked to bilateral TMJ exposure surgery. Anteromedially displaced condyles must be reduced with forces that are directed below and outward. The direction of the forces is such that the opposing side resists it. Each condyle can move independently thanks to the mandibular midline osteotomy, which removes resistance from the opposing side (Rattan, Rai and Sethi, 2013).

There are potential side effects from midline mandibulotomy, including lingual haemorrhage, nearby root apices being accidentally damaged, malocclusion, and non-union. These issues can be prevented with appropriate surgical techniques a stepped midline osteotomy, stable fixation with the aid of miniplates, and preadapting and setting screw holes before beginning the osteotomy cut) (Rattan, Rai and Sethi, 2013).

'Dautrey's procedure', involves a downward and forward oblique osteotomy of the zygomatic arch just in front of the articular eminence; the distal portion of the arch is then carefully mobilised and displaced caudally, which creates a mechanical obstruction in the condylar path, as illustrated in Fig 1.4 by da Costa Ribeiro et al, (2014). This is particularly useful in individuals with pneumatization of the articular eminence of the temporal bone.

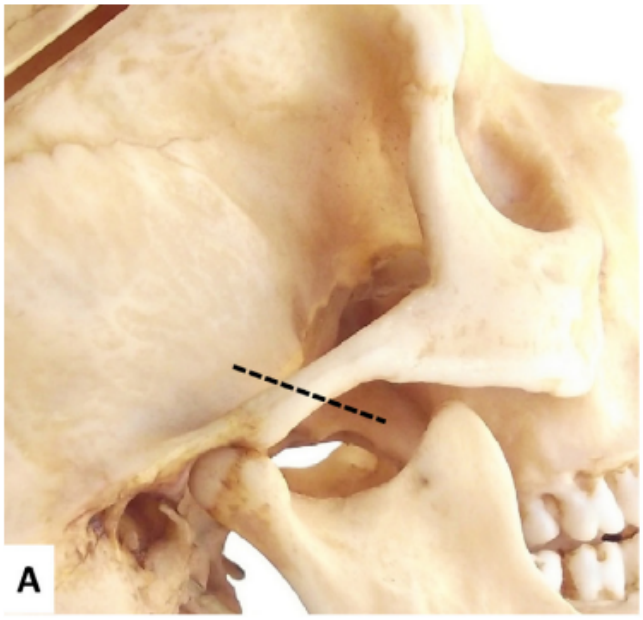


Figure 1.4 (A) Oblique osteotomy line of the zygomatic arch in front of the articular eminence (da Costa Ribeiro et al, 2014)

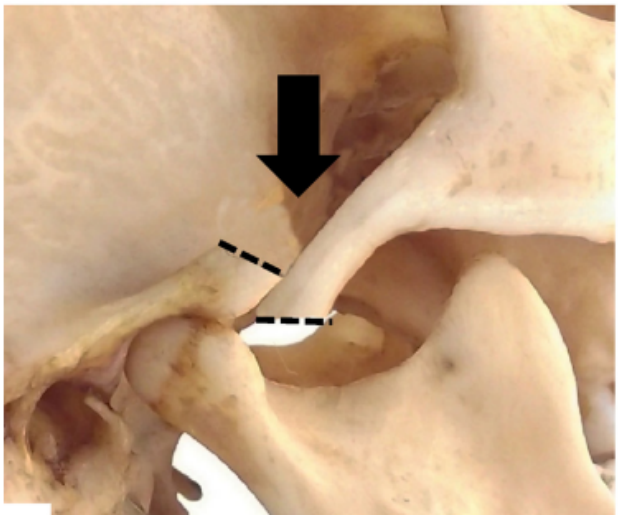


Figure 1.4 (B) Zygomatic arch displaced caudally (da Costa Ribeiro et al, 2014)

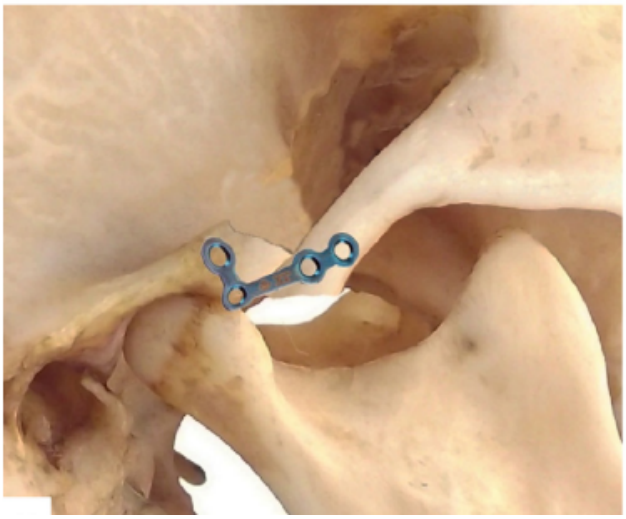


Figure 1.4 (C) Internal fixation with a plate to stabilise the zygomatic arch (da Costa Ribeiro et al, 2014)

The application of conventional and modified miniplates to the eminence without down-fracturing of the arch has also been proposed (Güven, 2008).

The most common procedure used to achieve greater condylar mobility is an eminectomy. This technique is done by resecting the articular eminence of the temporal bone to eliminate the obstacle that the articular eminence presents for the translation of the mandibular condyle (Myrhaug, 1951).

This current study is undertaken to report epidemiological characteristics and management of patients with TMJ dislocation in our unit. It is envisaged that data obtained from this study would serve as baseline data on TMJ dislocation and would add valuable information on the

demographics, risk factors and treatment of patients with TMJ dislocation, and could serve as the basis for a future treatment algorithm.

Chapter 2: Aims and Objectives

2.1 Aim of the study

To describe the epidemiological characteristics and management of patients with temporomandibular joint (TMJ) dislocation

2.2 Study objectives

1. To review the demographics of patients with TMJ dislocation.
2. To determine the aetiology of TMJ dislocation.
3. To determine the risk factors associated with TMJ dislocation
4. To describe management options for TMJ dislocation.

Chapter 3: Materials and Methods

3.1 Study design

The study was quantitative, retrospective, and descriptive.

3.2 Study population

All patients referred to or presenting with a TMJ dislocation to the maxillofacial and oral surgery departments at Charlotte Maxeke Johannesburg Academic Hospital (CMJAH) and Chris Hani Baragwaneth Academic Hospital (CHBAH) were included in the study (CHBAH).

3.3 Data Collection

The records of patients that presented with TMJ dislocations from January 2015 to 31 December 2019 were accessed. The relevant medical information was retrieved from the records which included the demographics, comorbidities, aetiology, the type of TMJ dislocation according to Adekeye classification, and treatment done from conservative to surgical management. Data was retrieved from all patient records that met the eligibility criteria and captured using the data collection sheet. Each eligible patient record was assigned a study number.

3.4 Eligibility criteria

Inclusive criteria

• Patients with TMJ dislocations consulted at CMJAH and CHBAH from January 2015 to 31 December 2019.

• Patients of all ages. (Age grouping)

Patients with all the required data in their files (including medical history and drug/medication history)

• Acute, chronic and recurrent TMJ dislocations patients.

• Patients with histories of reduction of TMJ Dislocation under GA/LA.

Exclusion criteria

• Any TMJ dislocations not within the specified time period

• Missing and incomplete records

• Dislocations associated with condyle neck fractures and condyle head displacement.

• Previous history of TMJ surgery

3.5 Data analysis

All extracted data was entered into Microsoft Excel before being exported to Stata 14® (StataCorp; Texas, USA) for statistical analysis. Age was recorded as the following age groups: < 20, 20-25, 26-35, 36-45, and>45. All the data was summarised using percentages. Using chi-squared tests, the association between the classification of TMJ dislocation (Acute, recurrent and chronic) and other variables (sex, age, aetiology, frequency, and comorbidities) was calculated. The statistical significance level was set at $p < 0.05$.

3.6 Ethical Clearance

Ethical clearance was obtained from the Human Research and Ethics Committee (HREC) of Witwatersrand University prior to data collection. The HREC clearance certificate was issued with reference no: **M210351** (see Annexure A). The head of the Department of Maxillo-Facial and Oral Surgery also granted permission to perform the study (see Annexure C). Furthermore, permission to conduct the study was granted by the Wits Oral Health Centre head of school. Strict confidentiality was adhered to. Codes were allocated to patients in order to protect patient's identity. Patient identifiers were only accessible to the principal investigator.

Chapter 4: Results

During the study period, we identified 46 cases of TMJ dislocations that were treated at CMJAH and CHBAH. The cohort's age distribution was bimodal, with peaks at the 20 to 25, and at the greater than 45-year age brackets (Table 1). Females dominated the greater than 45-year age group, while males dominated the 20-25-year age group (Figure 4.1). Similarly, the 20-35-year-old age groups had no associated medical conditions (p=0.007) (Figure 4.2), while the greater than 45-year group frequently presented with hypertension as an underlying medical condition (Figure 4.2). More than half (55%) of the cases did not have any co-existing medical conditions (Table 1). The most common disease among those with an underlying medical condition was hypertension (8/46, 17%), followed by retroviral disease infection (4/46, 9%). Females outnumbered males in the study cohort (54% vs 46%, Table 1). The frequency of episodes was linked to gender (Figure 4.3). The majority of females reporting TMJ dislocation were experiencing their first and/or second episodes (Table 1). However, only males were reporting with more than 5 episodes (p=0.029, Figure 4.3).

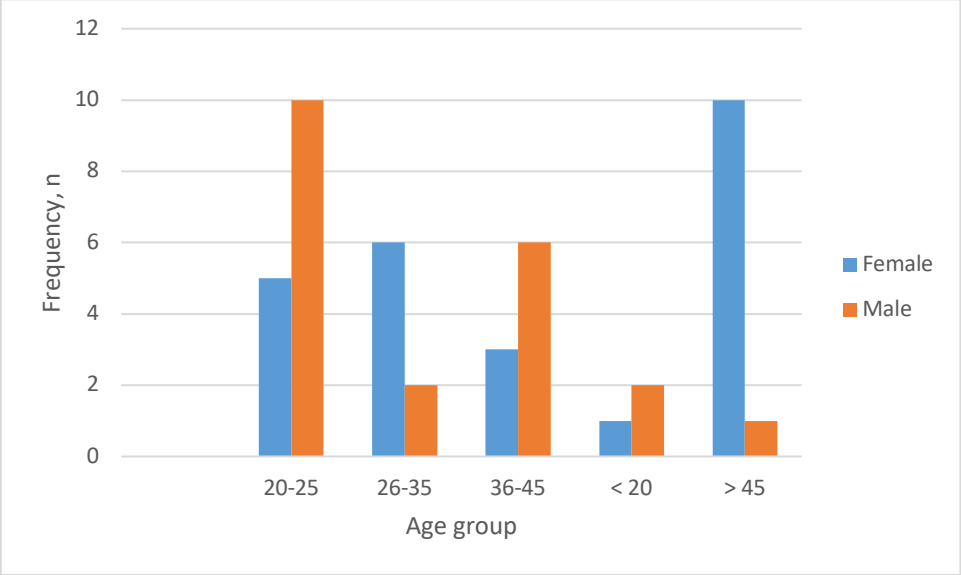


Figure 4.1 Association between age and gender. (p=0.017)

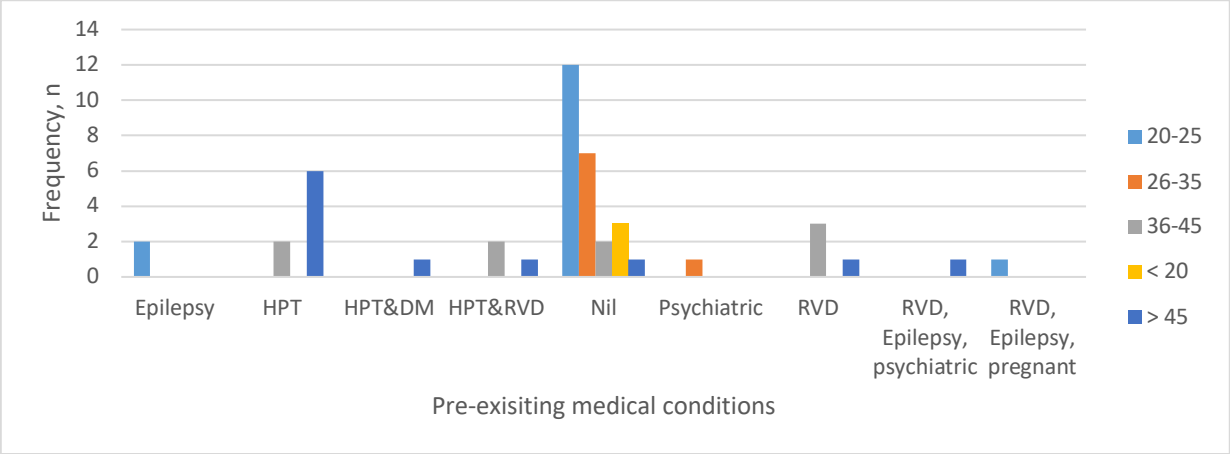


Figure 4.2 Association of age with Pre-existing medical condition

The cohort was divided based on classification. Risk factors were identified based on the subtype of TMJ dislocation (Table 1). Recurrent TMJ dislocations were the most common subtype (24/46, 52%), followed by acute (13/46, 28%; Table 1). The acute subtype was identified as the significant aetiology of TMJ dislocations (p= 0.036, Table 1). Yawning was the most common cause of TMJ dislocation (61%) (Table 1), and the majority of cases with yawning as an aetiology were of the recurrent subtype (Table 1). Chronic cases of TMJ dislocation were associated with muscle spasms, vomiting, eating and iatrogenic reasons, while acute cases were associated with trauma (Table 1).

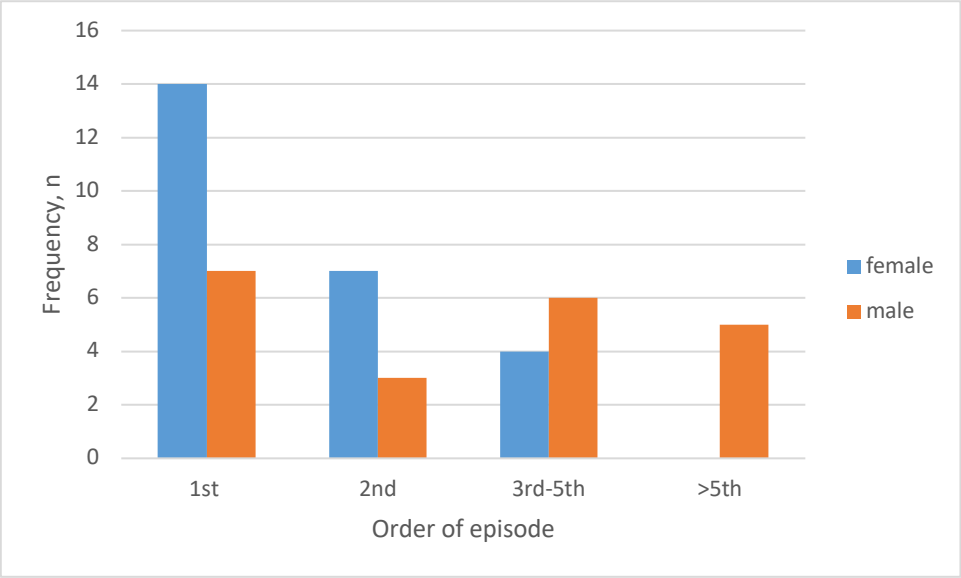


Figure 4.3 Association between gender and the occurrence of episodes. Significant male p=0.029

In this cohort, classification was also associated with the occurrence of episodes ($p < 0.001$, Table 1). Most patients presented with the first episode (21/46, 46%) (Table 1, Figure 6), of which thirteen were acute and eight were chronic. Patients who presented with the third to the fifth episodes of TMJ dislocation were the recurrent subtype (10/10) (Table 1). The duration between TMJ dislocation and treatment was significantly correlated with the sequence of the episodes (Figure 4.4). Cases that presented for treatment within hours of the episode were mostly cases experiencing their first episode. In addition, some cases that presented for treatment after 2 weeks were also experiencing their first episode.

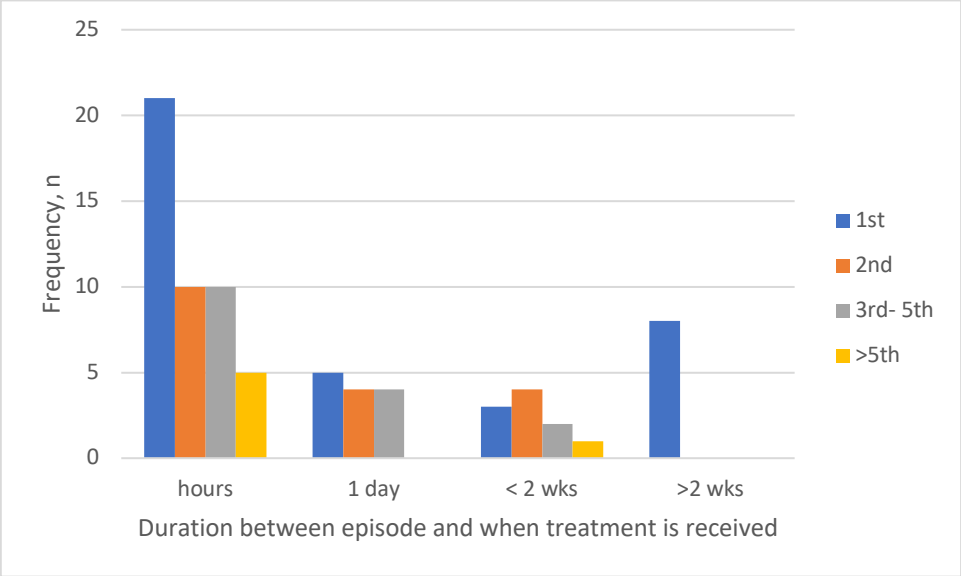


Figure 4.4 Association of the frequency of episodes and presentation

Manual reduction with local anaesthesia (LA) was the most commonly used treatment (80%), followed by manual reduction under general anaesthesia (GA) (15%) (Table 1). TMJ classification was also significantly correlated with treatment ($p<0.001$, Table 1). Manual reduction with local anaesthesia was frequently used to treat the majority of acute and recurring cases. Manual reduction under general anaesthesia was frequently used to treat chronic cases (Table 1). In addition, the type of treatment received was significantly associated with the duration between diagnosis and treatment (Figure 4.5). A shorter duration necessitated manual reduction with LA, while a longer duration required manual reduction under GA and surgical procedures (example of eminectomy surgical procedure in Figure 4.6).

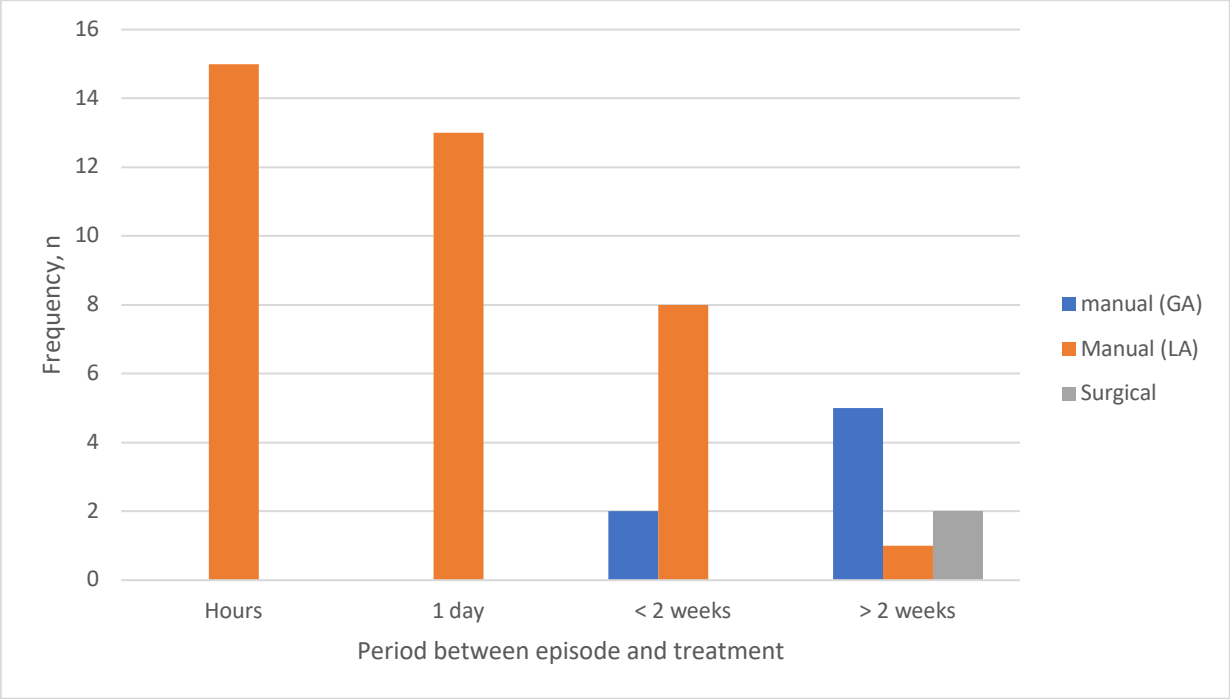


Figure 4.5 Association between duration prior to treatment and the type of treatment received.

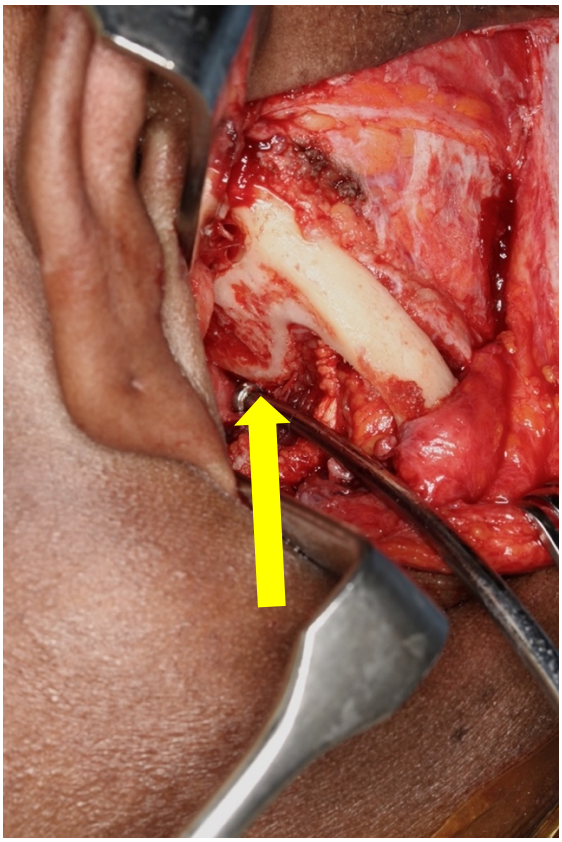


Figure 4.6 Eminectomy surgical procedure

Table 1: Characteristics of the study cohort according to TMJ dislocation type (acute, chronic and recurrent)

Characteristics	Total, N (%) (n=46)	Acute (n=13)	Chronic (n=9)	Recurrent (n=24)	P value p<0.05
Age brackets (n=46)					0,698
< 20	3 (6.52)	1	0	2	
20-25	15 (32.61)	3	2	10	
26-35	8 (17.39)	4	2	2	
36-45	9 (19.57)	3	2	4	
> 45	11 (23.91)	2	3	6	
Gender (n=46)					0,195
Female	25 (54.35)	9	6	10	
Male	21 (45.65)	4	3	14	
Co-existing medical conditions (n=46)					0,599
Nil	25 (54.35)	8	4	13	
Epilepsy	2 (4.35)	0	0	2	
Hypertension	8 (17.39)	2	3	3	
Hypertension, Diabetic Mellitus	1 (2.17)	0	0	1	
Hypertension, RVD	3 (6.52)	1	1	1	
Psychiatric	1 (2.17)	0	0	1	
RVD	4 (8.70)	1	0	3	
RVD, Epilepsy, Psychiatric	1 (2.17)	0	1	0	
RVD, Epilepsy, pregnant	1 (2.17)	1	0	0	
Medication (n=46)					0,711
Nil	25(53)	8	4	12	
ARV	2 (4)	1	0	1	
Epilim	2 (4)	1	0	1	
Epilim, ARV	1(2)	1	0	0	
HAART	2 (4)	0	0	2	
Ridaq	5(11)	1	1	3	
Ridaq , ARV	2(4)	1	1	0	
Ridaq , ARV , Amlodipine	1(2)	0	0	1	
Ridaq, Metformin	1(2)	0	0	1	

Epilim, HAART	1(2)	0	0	1	
lithium, alanzepine	1(2)	0	0	1	
Ridaq, amlodipine	3 (7)	1	1	1	
Aetiology					**0,036**
Eating	2 (4.35)	0	1	1	
Iatrogenic	2 (4.35)	0	1	1	
Spontaneous	6 (13.04)	1	0	5	
Trauma	6 (13.04)	4	2	0	
Yawning	28 (60.87)	8	3	17	
Muscle	1 (2.17)	0	1	0	
Vomiting	1 (2.17)	0	1	0	
Frequency					**0,001**
1st Episode	21 (45.65)	13	8	0	
2nd Episode	10 (21.74)	0	1	9	
3rd-5th Episode	10 (21.74)	0	0	10	
>5th Episode	5 (10.87)	0	0	5	
Duration					**0,001**
Acute Hours	15 (932.61)	5	0	10	
1 day	13 (28.26)	5	0	8	
Chronic < 2 weeks	10 (21.74)	3	1	6	
>2 weeks	8 (17.39)	0	8	0	
Treatment					**0,001**
Manual reduction (GA)	7 (15.22)	0	6	1	
Manual reduction (LA)	37 (80.43)	13	1	23	
Surgical reduction	2 (4.35)	0	2	0	

Chapter 5: Discussion

Temporomandibular joint dislocation is reported to be a rare event, however, exact estimates for South Africa are lacking. The highest and longest retrospective study was conducted in Finland over 14 years and observed 260 cases by Tarhio *et al.*, (2022). A study conducted in Switzerland observed 32 cases over 4 years (Papoutsis *et al.*, 2018). Another study from Nigeria observed 11 cases over 10 years (Okoje, Aladelusi and Abimbola, 2017). A cross-sectional study conducted in Nairobi, Kenya, observed 29 cases over 10 years (Sang *et al.*, 2010). Our study observed 46 cases over a 5-year period, which is the highest prevalence rate observed thus far in African countries.

We observed, in this study, that there was a bimodal age distribution with peaks at 20-25 and greater than 45-year groups, confirming previous studies. The study from Nairobi, Kenya observed majority of cases in the third to fifth decades (Sang *et al.*, 2010), while a study conducted in China observed a high prevalence in the seventy-year-old (Tohyama *et al.*, 2008). In contrast, a Nigerian study observed a peak incidence in the 20-29 age bracket (Ugboko *et al.*, 2005). There generally seem to be two major age groups that are affected by TMJ dislocations which may differ by geographical location. Additional studies are required to elucidate this further and determine whether they may also differ in aetiology or presentation. Our study observed an association between age and gender, with females dominating the older age spectrum and males in the younger age brackets.

Concerning gender, there seems to be contrasting data available. Some studies report a female predominance (Okoje, Aladelusi and Abimbola, 2017; Sang *et al.*, 2010; Ugboko *et al.*, 2005), while others report no gender differences (Papoutsis *et al.*, 2018; Tohyama *et al.*, 2008). The contrasting data may be due to geographical location, as all the studies in African countries report female predominance (Okoje, Aladelusi and Abimbola, 2017; Sang *et al.*, 2010; Ugboko *et al.*, 2005), while European and Asian countries do not (Papoutsis *et al.*, 2018; Tohyama *et al.*, 2008). The female predominance may also be due to aetiological factors of TMJ dislocations including yawing and chewing, as there are gender differences in chewing (Park and Shin, 2015).

The major aetiology for TMJ dislocation was yawning, which has been previously reported by other studies (Okoje, Aladelusi and Abimbola, 2017; Sang *et al.*, 2010; Ugboko *et al.*, 2005). The aetiology was associated with the type of TMJ dislocation in our study, for example, yawning

was associated with acute and recurrent dislocations, while spontaneous aetiology was found in chronic dislocations.

This study showed that the majority of the cases with an underlying medical condition was that of hypertension. This may also vary depending on the population or location which will have its own prevalent underlying medical conditions. Hypertension is one of the major diseases affecting women in South Africa (Kandala *et al.*, 2021), which may not be a major condition in other countries. HIV- infection cases were the second most underlying condition in this study. Retroviral disease patients frequently have chronic pain and other diseases that affect their major joints when receiving antiretroviral medication. However, no conclusive cause-and-effect connection between TMJ dislocation and HIV antiviral therapy has been discovered (Fiorentino *et al.*, 2009). Other studies have reported epilepsy (Ugboko *et al.*, 2005) and psychiatric diseases (Tohyama *et al.*, 2008) as the major underlying conditions Both underlying medical conditions and treatment were not associated with the type of dislocation.

More than half of the cases were recurrent, which is shown in a review of 260 cases by Tarhio *et al.*, (2022). The majority of these cases were due to yawning. The wide opening of the mouth seems to be the main cause of TMJ dislocation in general (Okoje, Aladelusi and Abimbola, 2017; Papoutsis *et al.*, 2018; Sang *et al.*, 2010; Ugboko *et al.*, 2005). Recurrent TMJ luxation is often associated with neurological and cardiovascular conditions (Tarhio *et al.*, 2022). A large number of patients had cardiovascular disease (n=12) and a few patients had neurological (n=5) diseases.

Trigeminal nerve branches innervate the temporomandibular joint, (Barkhordarian, Demerjian and Chiappelli, 2020), hence conditions that may damage the local nerves may result in dislocations (Yin *et al.*, 2020). Furthermore, patients who experienced repeated TMJ dislocations due to excessive spasticity in the muscles that press the lower jaw are usually linked to severe central nervous system diseases, including declines in motor and cognitive function (Vázquez Bouso *et al.*, 2010).

This study did not find any association between medical conditions and the subtype of TMJ dislocation. The subtype was identified to have a significant association with aetiology, frequency of the event, presentation and treatment. Yawning and spontaneous dislocations were more prevalent in the recurrent subtype. Recurrent TMJ dislocation is attributed to a combination of factors including loosening of the TMJ ligaments, weakening of the TMJ capsule, atypical projection and irregular chewing movements that prevent the condyle from moving back properly

(Cohen *et al.*, 2022; Gupta, Rana and Verma, 2013). This may also be the reason why we observed an association of TMJ dislocation subtype with the frequency of episodes.

The majority of the cases in this study were treated with manual reduction which is the least invasive procedure. Literature reports support that the initial treatment offered for TMJ dislocations is manual reduction, (Prechel *et al.*, 2018; Rattan, Rai and Sethi, 2013). We observed an association between the treatment received and the type of TMJ dislocation. Manual treatment with local anaesthesia was often used to treat acute and recurrent cases in this study, while the more invasive procedures were reserved for chronic cases. This is in line with data from previous studies confirming the ineffectiveness of conservative treatment for chronic cases, (Gupta, Rana and Verma, 2013; Prechel *et al.*, 2018; Tarhio *et al.*, 2022; Tohyama *et al.*, 2008).

The surgical management of TMJ dislocation is designed to either limit the range of movement of the mandibular condylar head (by creating an obstacle at the articular eminence) or enhance condylar head translation by removing structures considered to be obstacles, the articular eminence in particular. Some of the techniques used to restrict mandibular movement include the oblique osteotomy and miniplating of the zygomatic arch., known as Dautrey's procedure, and oblique osteotomy and 2mm V-notch anterior–superior margin of the osteotomized zygomatic arch, known as modified LeClerc. Reports in the literature seem to suggest that the Dautrey's procedure is often not recommended over the age of 30 years as the is increasing hardness and brittleness of bone, which makes it difficult to achieve a green stick fracture at the distal end of the arch (Lawlor, 1982).

In the present study, two patients (well over 30 years) with chronic dislocation were treated by eminectomy. Eminectomy is empirically considered the 'gold standard' for chronic recurrent dislocation with fewer relapses (De Almeida et al., 2016). None of these patients reported any relapse postoperatively. Eminectomy was chosen as it is less time consuming, less invasive, does not encroach into the joint space, and does not involve any bony osteotomy of the arch, grafting, or fixation (Weinberg 1984). It is critical to remove the articular eminence in its entire medial extent to prevent further impingement of the condylar head (Oatis and Baker, 1984). A preoperative CT scan is a prerequisite before eminectomy to evaluate the degree of pneumatization of the eminence to prevent a possible perforation into the middle cranial fossa which may result in a CSF leak or exposure of the temporal lobe.

This study has several limitations. There was no long-term follow-up period to monitor the stability of the acute subtype of treatment provided. Secondly, our sample size may not have been large enough to detect differences between the type of dislocation, duration, and treatment necessary to reach statistical significance. Thirdly, there was no standardisation of post-reduction methods and duration of intermaxillary fixation.

Chapter 6: Conclusion

In this study observation of a bimodal peak presentation was made at the 20-25-year age and greater than 45-year-old age brackets. There were more females in the cohort who presented with co-morbidities such as hypertension. Yawning was the most common cause of TMJ dislocation, and many cases of yawning were of the acute subtype. Manual reduction under LA was the most common treatment modality. Treatment was frequently offered within hours of the dislocation episode.

Notwithstanding its limitations, this study has added valuable information on the demographics, risk factors, and treatment of patients with TMJ dislocation, and could serve as the basis for future treatment algorithms.

This study highlights the need to elucidate predisposing factors to TMJ dislocations. Additional studies comparing conservative and surgical treatment outcomes may assist in providing valuable evidence that will guide treatment protocols for patients with TMJ dislocations.

References

Akinbami, B.O., 2011. Evaluation of the mechanism and principles of management of temporomandibular joint dislocation. Systematic review of literature and a proposed new classification of temporomandibular joint dislocation. *Head & Face Medicine*, *7*(1), pp.1-9.

Allan, J., 2010. *Fundamentals of Human Embryology: Student Manual*. Wits University Press.

Alpaslan, G.H. and Alpaslan, C., 2001. Efficacy of temporomandibular joint arthrocentesis with and without injection of sodium hyaluronate in treatment of internal derangements. *Journal of oral and maxillofacial surgery*, *59*(6), pp.613-618.

Anandhi, D. and Raju, K.P., 2018. Management of temporomandibular joint dislocations in the emergency department-a case series. *Indian Journal of Case Reports*, pp.82-86.

Ardehali, M.M., Kouhi, A., Meighani, A., Rad, F.M. and Emami, H., 2009. Temporomandibular joint dislocation reduction technique: a new external method vs. the traditional. *Annals of plastic surgery*, *63*(2), pp.176-178.

Ardehali, M.M., Tari, N., Bastaninejad, S. and Amirizad, E., 2016. Comparison of different approaches to the reduction of anterior temporomandibular joint dislocation: a randomized clinical trial. *International Journal of Oral and Maxillofacial Surgery*, *45*(8), pp.1009-1014.

Barkhordarian, A., Demerjian, G. and Chiappelli, F., 2020. Translational research of temporomandibular joint pathology: a preliminary biomarker and fMRI study. *Journal of Translational Medicine*, *18*(1), pp.1-19.

Bender, M.E., Lipin, R.B. and Goudy, S.L., 2018. Development of the pediatric temporomandibular joint. *Oral and Maxillofacial Surgery Clinics*, *30*(1), pp.1-9.

Bordoni, B. and Varacallo, M., 2019. Anatomy, head and neck, temporomandibular joint.

Bravetti, P., Membre, H., El Haddioui, A., Gérard, H., Fyad, J.P., Mahler, P. and Gaudy, J.F., 2004. Histological study of the human temporo-mandibular joint and its surrounding muscles. *Surgical and Radiologic Anatomy*, *26*, pp.371-378.

Caminiti, M.F. and Weinberg, S., 1998. Chronic mandibular dislocation: the role of non-surgical and surgical treatment. *Journal of the Canadian Dental Association*, *64*(7), pp.484-491.

Chen, Y.C., Chen, C.T., Lin, C.H. and Chen, Y.R., 2007. A safe and effective way for reduction of temporomandibular joint dislocation. *Annals of plastic surgery*, *58*(1), pp.105-108.

Cohen, A., Rushinek, H., Sela, M.C., Sharafan, D., Talisman, S. and Casap, N., 2022. Are there cephalometric measurements associated with recurrent temporomandibular joint dislocation? *Journal of Oral and Maxillofacial Surgery*, *80*(10), pp.1587-1592.

El-Zohairy, M.A., 2007. Straight midline mandibulotomy: technique and results of treatment. *Journal of the Egyptian National Cancer Institute*, *19*(4), pp.292-298.

Fiorentino, P.M., Piancino, M.G., Debernardi, C. and Attard, N., 2009. Temporomandibular joint disorders during HIV infection: a case report. *Journal of Orofacial Pain*, *23*(2).

Gorchynski, J., Karabidian, E. and Sanchez, M., 2014. The "syringe" technique: a hands-free approach for the reduction of acute nontraumatic temporomandibular dislocations in the emergency department. *The Journal of Emergency Medicine*, *47*(6), pp.676-681.

Guasti, L., Grimoldi, P., Diolisi, A., Petrozzino, M.R., Gaudio, G., Grandi, A.M., Rossi, M.G. and Venco, A., 1998. Treatment with enalapril modifies the pain perception pattern in hypertensive patients. *Hypertension*, *31*(5), pp.1146-1150.

Gupta, D., Rana, A.S. and Verma, V.K., 2013. Treatment of recurrent TMJ dislocation in geriatric patient by autologous blood–A technique revisited. *Journal of Oral Biology and Craniofacial Research*, *3*(1), pp.39-41.

Helland, M.M., 1980. Anatomy and function of the temporomandibular joint. *Journal of Orthopaedic & Sports Physical Therapy*, *1*(3), pp.145-152.

Kandala, N.B., Nnanatu, C.C., Dukhi, N., Sewpaul, R., Davids, A. and Reddy, S.P., 2021. Mapping the burden of hypertension in south africa: A comparative analysis of the national 2012 sanhanes and the 2016 demographic and health survey. *International Journal of Environmental Research and Public Health*, *18*(10), p.5445.

Kao, T.Y., Chang, C.L. and Yang, P.Y., 2019. Prosthodontic rehabilitation of patient with prolonged TMJ dislocation reduced by midline man-dibulotomy. *Journal of Prosthodontics and Implantology*, *8*(1), pp.16-21.

Krishnakumar Raja, V.B., 2021. Temporomandibular joint dislocation. *Oral and Maxillofacial Surgery for the Clinician*, pp.1381-1399.

Laskin, D.M., 1973, January. Myotomy for the management of recurrent and protracted mandibular dislocations. In *Transactions of the International Conference on Oral Surgery* (Vol. 4, pp. 264-268).

Lawlor, M.G., 1982. Recurrent dislocation of the mandible: treatment of ten cases by the Dautrey procedure. *British Journal of Oral Surgery*, *20*(1), pp.14-21.

Lee, S.H., Son, S.I., Park, J.H., Park, I.S. and Nam, J.H., 2006. Reduction of prolonged bilateral temporomandibular joint dislocation by midline mandibulotomy. *International journal of oral and maxillofacial surgery*, *35*(11), pp.1054-1056.

Liddell, A. and Perez, D.E., 2015. Temporomandibular joint dislocation. *Oral and Maxillofacial Surgery Clinics*, *27*(1), pp.125-136.

Lowery, L.E., Beeson, M.S. and Lum, K.K., 2004. The wrist pivot method, a novel technique for temporomandibular joint reduction. *The Journal of emergency medicine*, *27*(2), pp.167-170.

Lum, V.W. and Poh, J., 2017. Refractory Temporomandibular Joint Dislocation–Reduction Using the Wrist Pivot Method. *Clinical Practice and Cases in Emergency Medicine*, *1*(4), p.380.

Machon, V., Abramowicz, S., Paska, J. and Dolwick, M.F., 2009. Autologous blood injection for the treatment of chronic recurrent temporomandibular joint dislocation. *Journal of oral and maxillofacial surgery*, *67*(1), pp.114-119.

Marqués-Mateo, M., Puche-Torres, M. and Iglesias-Gimilio, M.E., 2016. Temporomandibular chronic dislocation: The long-standing condition. *Medicina oral, patologia oral y cirugia bucal*, *21*(6), p.e776.

Middeke, M., Lemmer, B., Schaaf, B. and Eckes, L., 2008. Prevalence of hypertension-attributed symptoms in routine clinical practice: a general practitioners-based study. *Journal of human hypertension*, *22*(4), pp.252-258.

Miller, G.A. and Murphy, E.J., 1976. External pterygoid myotomy for recurrent mandibular dislocation: Review of the literature and report of a case. *Oral Surgery, Oral Medicine, Oral Pathology*, *42*(6), pp.705-716.

Myrhaug, H., 1951. A new method of operation for habitual dislocation of the mandible. Review of former methods of treatment. *Acta Odontologica Scandinavica*, *9*(3-4), pp.247-261.

Norton, N.S., 2016. *Netter's head and neck anatomy for dentistry e-book*. Elsevier Health Sciences.

Oatis Jr, G.W. and Baker, D.A., 1984. The bilateral eminectomy as definitive treatment: a review of 44 patients. *International journal of oral surgery*, *13*(4), pp.294-298.

Okoje, V.N., Aladelusi, T.O. and Abimbola, T.A., 2017. Managing temporomandibular joint dislocation in Ibadan: A review of 11 cases. *Annals of Ibadan Postgraduate Medicine*, *15*(2), pp.96-102.

Papoutsis, G., Papoutsi, S., Klukowska-RÃ¶tzler, J., Schaller, B.T. and Exadaktylos, A.K., 2018. Temporomandibular joint dislocation: a retrospective study from a Swiss urban emergency department. *Open access emergency medicine*, pp.171-176.

Prabhakara, B.S., 1980. Conservative treatment of bilateral persistent anterior dislocation of the mandible. *Journal of oral surgery (American Dental Association: 1965)*, *38*(1), pp.51-52.

Prechel, U., Ottl, P., Ahlers, O.M. and Neff, A., 2018. The treatment of temporomandibular joint dislocation: A systematic review. *Deutsches Aerzteblatt International*, *115*(5), p.59.

Rattan, V., Rai, S. and Sethi, A., 2013. Midline mandibulotomy for reduction of long-standing temporomandibular joint dislocation. *Craniomaxillofacial Trauma & Reconstruction*, *6*(2), pp.127-131.

Sang, L.K., Mulupi, E., Akama, M.K., Muriithi, J.M., Macigo, F.G. and Chindia, M.L., 2010. Temporomandibular joint dislocation in Nairobi. *East African Medical Journal*, *87*(1), pp.32-37.

Sharma, N.K., Singh, A.K., Pandey, A., Verma, V. and Singh, S., 2015. Temporomandibular joint dislocation. *National journal of maxillofacial surgery*, *6*(1), p.16.

Shorey, C.W. and Campbell, J.H., 2000. Dislocation of the temporomandibular joint. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*, *89*(6), pp.662-668.

Tarhio, R., Toivari, M., Snäll, J. and Uittamo, J., 2023. Causes and treatment of temporomandibular luxation—a retrospective analysis of 260 patients. *Clinical Oral Investigations*, pp.1-7.

Tipps, S.P. and Landis, C.F., 1982. Prolonged bilateral mandibular dislocation. *Journal of Oral and Maxillofacial Surgery*, *40*(8), pp.524-527.

To, E.W.H., 1991. A complication of the Dautrey procedure. *British Journal of Oral and Maxillofacial Surgery*, *29*(2), pp.100-101.

Tocaciu, S., McCullough, M.J. and Dimitroulis, G., 2019. Surgical management of recurrent TMJ dislocation—a systematic review. *Oral and Maxillofacial Surgery*, *23*, pp.35-45.

Tohyama, H., Kurita, H., Uehara, S. and Kurashina, K., 2008. Retrospective analysis of clinical findings of TMJ dislocation and treatment. *THE SHINSHU MEDICAL JOURNAL*, *56*(4), pp.191-194.

Ugboko, V.I., Oginni, F.O., Ajike, S.O., Olasoji, H.O. and Adebayo, E.T., 2005. A survey of temporomandibular joint dislocation: aetiology, demographics, risk factors and management in 96 Nigerian cases. *International journal of oral and maxillofacial surgery*, *34*(5), pp.499-502.

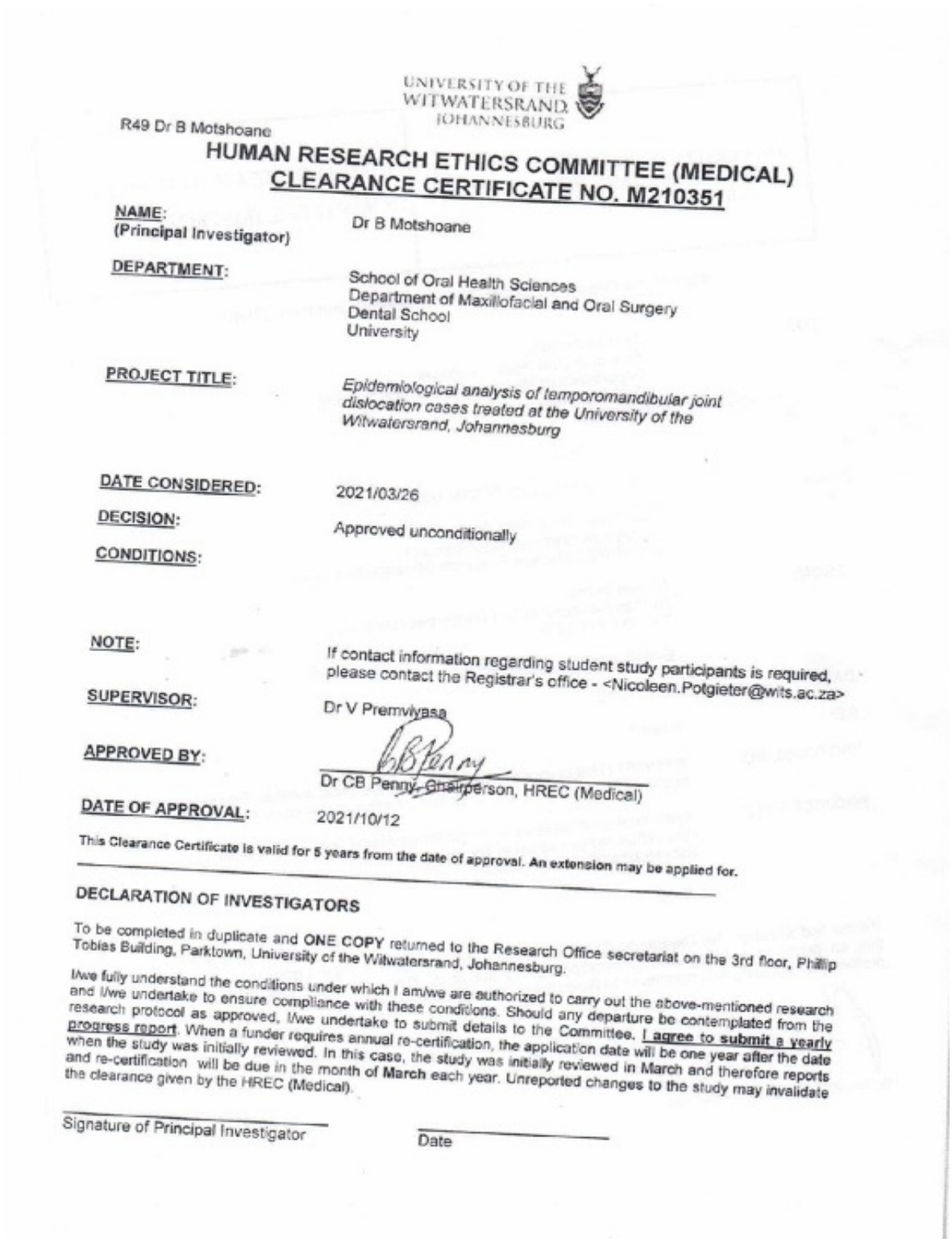
Weinberg, S., 1984. Eminectomy and meniscorhaphy for internal derangements of the temporomandibular joint: Rationale and operative technique. *Oral surgery, oral medicine, oral pathology*, *57*(3), pp.241-249.

Wijmenga, J.P.H., Boering, G. and Blankestijn, J., 1986. Protracted dislocation of the temporomandibular joint. *International journal of oral and maxillofacial surgery*, *15*(4), pp.380-388.

Yin, Y., He, S., Xu, J., You, W., Li, Q., Long, J., Luo, L., Kemp, G.J., Sweeney, J.A., Li, F. and Chen, S., 2020. The neuro-pathophysiology of temporomandibular disorders-related pain: a systematic review of structural and functional MRI studies. *The Journal of Headache and Pain*, *21*(1), pp.1-20.

Appendixes

Appendix A: Ethics certificate



UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

R49 Dr B Motshoane

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
CLEARANCE CERTIFICATE NO. M210351

NAME: (Principal Investigator) Dr B Motshoane

DEPARTMENT: School of Oral Health Sciences
Department of Maxillofacial and Oral Surgery
Dental School
University

PROJECT TITLE: *Epidemiological analysis of temporomandibular joint dislocation cases treated at the University of the Witwatersrand, Johannesburg*

DATE CONSIDERED: 2021/03/26

DECISION: Approved unconditionally

CONDITIONS:

NOTE: If contact information regarding student study participants is required, please contact the Registrar's office - <Nicoleen.Potgieter@wits.ac.za>

SUPERVISOR: Dr V Premvlyasa

APPROVED BY: Dr CB Penny, Chairperson, HREC (Medical)

DATE OF APPROVAL: 2021/10/12

This Clearance Certificate is valid for 5 years from the date of approval. An extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office secretariat on the 3rd floor, Phillip Tobias Building, Parktown, University of the Witwatersrand, Johannesburg.

I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated from the research protocol as approved, I/we undertake to submit details to the Committee. **I agree to submit a yearly progress report**. When a funder requires annual re-certification, the application date will be one year after the date when the study was initially reviewed. In this case, the study was initially reviewed in March and therefore reports and re-certification will be due in the month of **March** each year. Unreported changes to the study may invalidate the clearance given by the HREC (Medical).

Signature of Principal Investigator

Date

Appendix B: Data Collection Sheet

Patient factors						
Study number						
Age						
Gender						
Medical condition						
Medication						
TMJ dislocation factors						
Aetiology						
Type						
Frequency						
Duration						
Treatment						

Appendix C: Permission letters

Prof S Nemutandani
Head/ CEO SOHS
University of Witwatersrand
Parktown
2196

19 November 2020

Dear Prof

RE: REQUEST TO CONDUCT RESEARCH IN ORAL HEALTH SCIENCES.

I am currently enrolled for Masters of Dentistry in Maxillo-Facial and Oral Surgery at University of Witwatersrand. The research is in partial fulfilment towards this degree. I would like to conduct a study, which involves accessed to data from patients' records presented at oral health center. The study is titled: **Epidemiological analysis of temporomandibular joint dislocation cases treated at the University of the Witwatersrand, Johannesburg.** I would like to retrieve data from the records of patients that presented with TMJ dislocations to the maxillofacial and oral surgery department at CMJAH and CHBAH from January 2015 to 31 December 2019.

The study will be supervised by Dr V Premviyasa, 0719370372 (vinayagie.premviyasa@wits.ac.za) co-supervisor Prof R E Rikhotso (Maxillo-Facial consultant), 011 717 2130 (Risimati.Rikhotso@wits.ac.za).

Thanking you in advance.

Dr B Motshoane
0798530322

APPROVED/NOT APPROVED

Prof: MS Nemutandani
CEO/HOS-Wits Oral Health Centre

Prof R. E. Rikhotso
Head of department: Maxillo-Facial and Oral surgery department
University of Witwatersrand
Parktown
2196

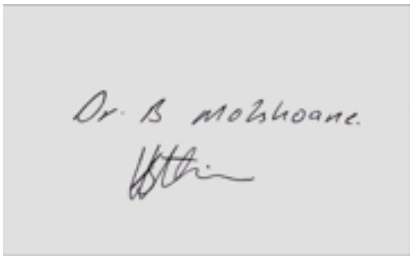
Dear Prof

RE: REQUEST TO CONDUCT RESEARCH IN ORAL HEALTH SCIENCES.

I am currently enrolled for Masters of Dentistry in Maxillo-Facial and Oral Surgery at University of Witwatersrand. The research is in partial fulfilment towards this degree. I would like to conduct a study, which involves accessed to data from patients' records presented at oral health center. The study is titled: **Epidemiological analysis of temporomandibular joint dislocation cases treated at the University of the Witwatersrand, Johannesburg.** I would like to retrieve data from the records of patients that presented with TMJ dislocations to the maxillofacial and oral surgery department at CMJAH and CHBAH from January 2015 to 31 December 2019.

The study will be supervised by Dr V Premviyasa, 0719370372 (vinayagie.premviyasa@wits.ac.za) co-supervisor Prof R E Rikhotso (Maxillo-Facial consultant), 011 717 2130 (Risimati.Rikhotso@wits.ac.za).

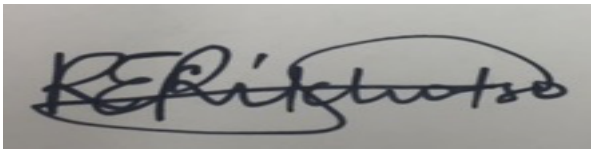
Thanking you in advance.



Dr B Motshoane

0798530322

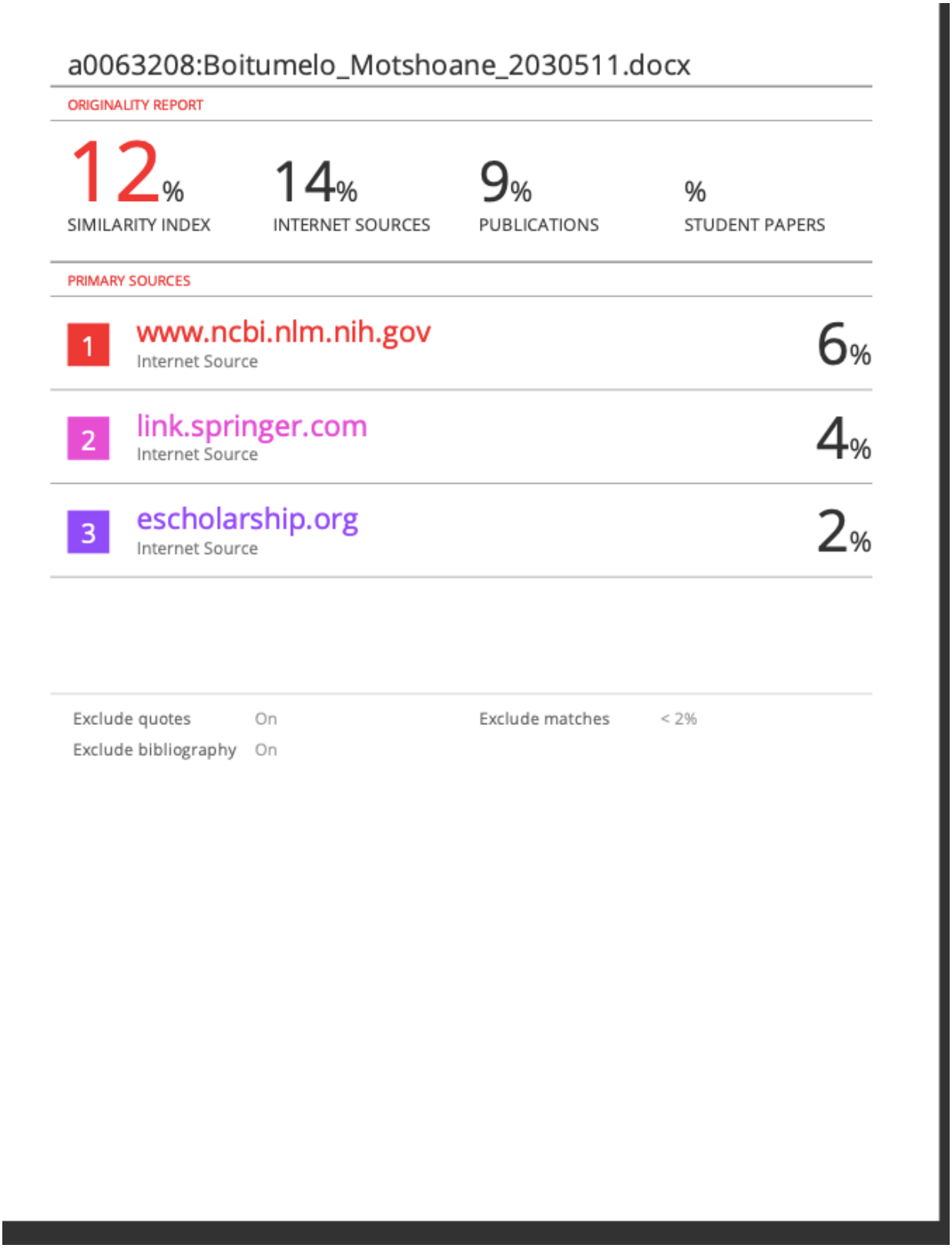
APPROVED



Head of department: MFOS

Prof R E Rikhotso

Appendix D: Turnitin report



a0063208:Boitumelo_Motshoane_2030511.docx

ORIGINALITY REPORT

12%	14%	9%	%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	www.ncbi.nlm.nih.gov Internet Source	6%
2	link.springer.com Internet Source	4%
3	escholarship.org Internet Source	2%

Exclude quotes	On	Exclude matches	< 2%
Exclude bibliography	On		