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Orthodontic Versus Surgically assisted expansion

A Project Submitted to
the College of Dentistry, University of Baghdad, Department of Orthodontics
in Partial Fulfillment for the Bachelor of Dental Surgery

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Certification of the Supervisor

I certify that this project entitled "**Orthodontic Versus Surgically Assisted Expansion**" was prepared by the fifth-year student **Ola Haitham Munir** under my supervision at the College of Dentistry/University of Baghdad in partial fulfillment of the graduation requirements for the Bachelor Degree in Dentistry.

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Date:

Dedication

First and foremost, I must acknowledge my limitless thanks to Allah, the Ever-Magnificent the Ever-Thankful help and bless.

I would like to dedicate this work to my loving, my unwavering support, my source of inspiration and wisdom, Mom & Dad. Their presence, prayers and encouragement made me defeat all the tough times and reach this successful stage.

Acknowledgment

First and foremost, praises and thanks to **Allah** Almighty for helping me fulfill my dream, for his blessings throughout my work to complete it successfully.

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Introduction

Dental arch expansion is a procedure used in dentistry to widen the upper or lower dental arches **(Bishara *et al*., 2001)**. It is done to correct various dental problems, including crowding, crossbites, temporomandibular joint disorder (TMJ), and other problems. By expanding the dental arch, more space is created for the teeth, allowing them to align correctly and function properly. The main techniques are used to achieve this expansion are orthodontic expansion and surgically assisted expansion **(Crescini *et al*., 2018)**. Orthodontic treatments are becoming increasingly popular among individuals seeking to enhance their dental aesthetics and function. While traditional orthodontic methods such as braces and aligners are widely used to correct dental malocclusion, surgically assisted expansion is also gaining popularity due to its effectiveness in treating severe cases **(Shih and Salzman, 2015)**.

Orthodontics is a non-surgical method of arch expansion that involves the use of braces, clear aligners, or other dental appliances to gradually apply controlled forces to the teeth and gradually move them into the desired position **(McNamara and Brudon, 2001)**. Orthodontic treatment is commonly used for mild to moderate cases of dental irregularities. However, in cases where the skeletal structure of the jaw is narrow, or there is a significant skeletal discrepancy, orthodontic treatment alone may not be sufficient.

Surgically assisted expansion, on the other hand, involves the use of orthodontic appliances in conjunction with a surgical procedure to widen the arches. This method is often used for patients with more severe skeletal discrepancies or adults whose bones are less flexible and may not respond as well to orthodontic expansion alone **(Norton *et al*., 2001)**. Surgically assisted expansion

can provide more significant changes to the shape and position of the dental arches but is generally more invasive and requires a longer recovery period **(Ahn *et al.*, 2014)**.

While both methods of arch expansion are effective, there is ongoing debate among orthodontists on which method is superior. Some argue that surgically assisted expansion is more effective in widening the arches, while others prefer non-surgical methods as they are less invasive and have fewer risks. The decision to use orthodontic treatment or surgically assisted expansion to correct malocclusion depends on various factors such as the severity of the malocclusion, age of the patient, and personal preferences. Orthodontic treatment is generally preferred for mild to moderate cases of malocclusion, while surgically assisted expansion is recommended for more severe cases. Both treatments have their advantages and disadvantages, and the choice of treatment depends on the individual case **(Liou and Tsai, 2005)**.

Aim of the study

This project aim to have a brief review about the comparison between the orthodontic versus surgically assisted expansion.

Chapter One: Review of literature

1.1 Historical background and development of orthodontic and surgically assisted expansion.

Orthodontics is a specialty of dentistry that focuses on the diagnosis, prevention, and treatment of malocclusions or improper bites. The history of orthodontics dates back to ancient times, where evidence of dental appliances such as wires and ligatures were found in Etruscan and Roman civilizations **(Proffit *et al*., 2018)**. However, it was not until the 18th century that orthodontics as a distinct field began to emerge, with the publication of Pierre Fauchard's "The Surgeon Dentist" in 1728, which included a chapter on correcting irregularities of the teeth **(Proffit *et al*., 2018).**

In the 19th century, the development of orthodontic appliances such as the wire crib, the occipital anchorage, and the rubber band, led to the establishment of orthodontics as a recognized field of dentistry **(Proffit *et al*., 2018)**. Over the years, orthodontic treatment options have expanded, and new techniques have been developed to address different types of malocclusions.

One such technique is surgically assisted expansion, which involves the use of orthodontic appliances in conjunction with a surgical procedure to expand the upper and lower jaw. This technique is typically used in cases where the patient has a narrow upper or lower jaws that cannot be corrected using orthodontic appliances alone **(Baumgaertel, 2017).**

1.2 The principles of orthodontic expansion.

Orthodontic expansion is a technique that involves the application of forces on the teeth and the surrounding bones to create a separation and simulate bone growth and tooth movement. The separation allows for the widening of the upper arch, and in some cases, the lower arch, to correct dental and skeletal discrepancies **(Lee, 2019).**

The expansion of the maxillary arch using orthodontic appliances can be achieved either by the use of a rapid palatal expander (RPE) (Figure 1), or a slow maxillary expansion (SME) device (Figure 2). The RPE is designed to create a rapid separation of the midpalatal suture, which is achieved through the application of high-frequency forces. In contrast, the SME device is designed to apply a continuous low-level force on the maxillary arch, resulting in a gradual separation of the bones **(Zaruba *et al*., 2018)**.

Figure 1: Rapid Palatal Expander (RPE). (Caughey, 2023)

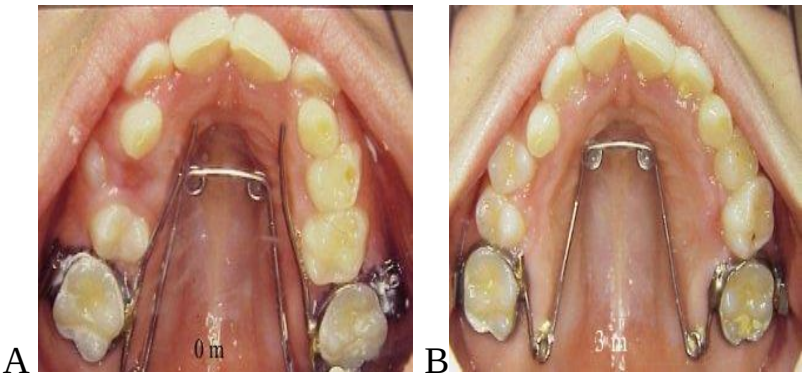


Figure 2: Quad Helix which is slow maxillary expander (SME) A. Insertion of the Quad. B. 3 months later with buccal arms cut. (*Dr. Michel Champagne, BA, 2019).*

Orthodontic expansion of the mandibular arch is achieved through the use of intraoral devices that can help in some expansion in lower arch such as lower

lingual arches and modified hyrax expander for lower arch. These appliances apply forces on the teeth, resulting in a widening of the mandibular arch **(Gupta *et al.*, 2013)** (Figure 3).

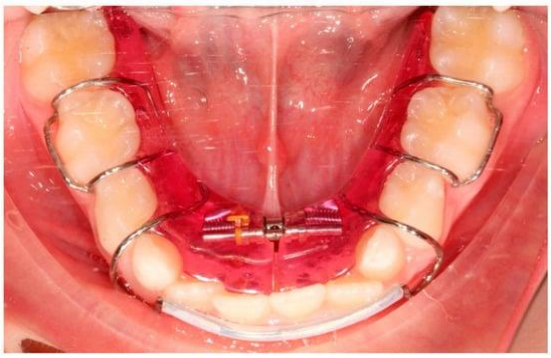
A  B 

Figure 3: Devices that can be used as mandibular expansion devices. A. Schwarz appliance. B. Lingual arch (https://en.wikipedia.org/wiki/Lingual_arch)

1.3 The principles of surgically assisted expansion.

Surgically assisted expansion (SAE) is a type of orthodontic treatment that involves the use of a surgical procedure to expand the upper and/or lower jawbones. The surgical procedure creates an opening in the jawbone, and an appliance is then attached to the teeth and used to gradually widen the jaw over a period of several weeks to months **(McNamara, 2001)**. SAE requires careful case selection and planning, as well as accurate assessment of the patient's skeletal and dental relationships. The amount of expansion is determined by the amount of skeletal discrepancy and the amount of soft tissue resistance to expansion **(Lagravere *et al.*, 2008)**.

In maxilla, the principles of surgically assisted expansion involve using many surgical procedures with combination of orthodontic appliances for separation of the midpalatal suture and expansion of the maxillary arch or other parts of maxilla like in maxillary segmental osteotomy through the use of an expansion device, which is surgically inserted into the palate. This technique

allows for expansion of the maxillary arch beyond what can be achieved through traditional orthodontic methods. Surgically assisted expansion also has the advantage of being able to treat skeletal discrepancies, including transverse maxillary deficiency **(Baik and Ververidou, 2004)** (Figure 4).

Figure 4: After surgically assisted rapid maxillary Expansion 14 NiTi archwire is inserted. **(Martina Bräutigam, 2018).**

In the mandible, surgically assisted expansion can be achieved through many techniques such as distraction osteogenesis, which involves the gradual separation of the mandibular segments using a distractor device. This method can be used to correct mandibular arch constriction **(Rachmiel *et al*., 2004)** (Figure 5).

Figure 5: surgically assisted expansion in mandible. (https://www.accutechortho.com/daryls-lessons-lab-distraction-osteogenesis)

1.4 Dental and skeletal discrepancies that are treated by orthodontics and surgically assisted expansion, indications and contraindications.

1.4.1 Dental and skeletal discrepancies.

Orthodontic and surgically assisted expansion can correct a variety of dental and skeletal discrepancies. Dental discrepancies include: Dental crowding (Figure 6), anterior and posterior crossbite, overbite (deep bite), underbite., and overjet (Protrusion).

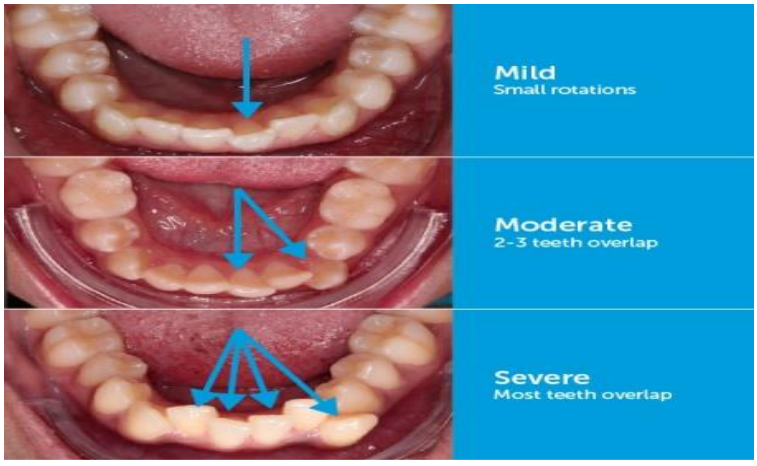


Figure 6: severities of dental crowding (https://www.smilelogicortho.com/crowding-ages-7-14/)

Skeletal discrepancies can include for example:

- Maxillary or mandibular anterioposterior deficiency (Figure 7): Maxillary deficiency can cause a Class III malocclusion, which is commonly treated with surgically assisted maxillary expansion (SAMME). Mandibular deficiency can cause a Class II malocclusion **(Proffit *et al*., 2013).**

- Transverse discrepancies (Figure 7), such as a constricted maxilla or a posterior crossbite, can be corrected with orthodontic expansion or surgically assisted expansion **(Wilcko *et al.*, 2001)**.

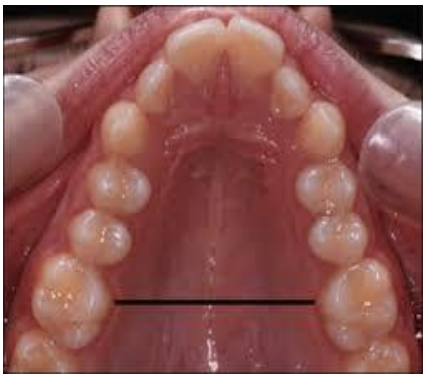
A  B 

Figure 7: A. Maxillary and mandibular anterioposterior deficiency.B. Transpalatal width is measured from the closest points on the lingual surfaces on the maxillary first molars. Normal transpalatal width is 35 to 39 mm in the permanent dentition and 33 to 35 mm in the mixed dentition. (https://pocketdentistry.com/maxillary-deficiency-syndrome/).

1.4.2 Indications for treatment of orthodontic and surgically assisted expansion.

Both orthodontic and surgically assisted expansion can be used to treat these discrepancies. However, the type of treatment that is chosen may depend on the several factors like severity of the malocclusion and the age of the patient. Orthodontic is often the first treatment option for most malocclusions. Orthodontic is a non-invasive, relatively painless treatment that can be performed on patients of all ages. Surgically assisted expansion, on the other hand, is typically reserved for more severe cases of malocclusion that cannot be corrected with orthodontics alone. This involves the use of surgery to expand the jaw and create more space for the teeth to move into. This treatment is usually recommended for adult patients who have stopped growing and whose malocclusions cannot be corrected with orthodontic alone.

1.4.3 Contraindications for treatment of orthodontic and surgically assisted expansion.

Orthodontic and surgically assisted expansion are highly effective treatments for a variety of malocclusions, but they are not suitable for every patient. Some common contraindications for each treatment method are:

1. Contraindications for orthodontic

• Severe periodontal diseases: Orthodontic treatment can exacerbate existing periodontal disease by putting additional pressure on the gums and bones supporting the teeth **(Bollen *et al*., 1996).**

• Poor oral hygiene: Orthodontic appliances make it more difficult to clean the teeth, so patients with poor oral hygiene habits may be at increased risk for developing cavities, gum disease, or white spot lesions **(Bollen *et al*., 1996).**

• Skeletal discrepancies : In some cases, the jaws may be so misaligned that orthodontic treatment alone cannot correct the malocclusion **(Bollen *et al*., 1996).**

2. Contraindications for surgically assisted expansion

• Insufficient bone density: Patients with insufficient bone density may not be good candidates for surgically assisted expansion, as the procedure requires the bone to be expanded and stabilized with screws or plates.

• Facial asymmetry: Surgically assisted expansion can exacerbate pre-existing facial asymmetry in some cases, especially if the expansion is not symmetrical.

• Unfavorable anatomy: Certain anatomical features, such as a thin nasal floor or a high mandibular canal, may make it more difficult to perform surgically assisted expansion safely.

• Poor compliance: Patients who are unwilling or unable to comply with post-operative instructions may be at increased risk for complications following surgically assisted expansion **(Cohen and Carlson, 2011).**

• Systemic conditions: Certain systemic conditions, such as bleeding disorders or uncontrolled diabetes, may make the treatment more risky or less effective **(Proffit *et al*., 2013).**

1.5 Types of orthodontic and surgically assisted expansion appliances

1.5.1 Types of orthodontic expansion appliances.

Orthodontic expansion appliances can be classified into two main types: fixed and removable appliances. Fixed appliances are bonded to the teeth and cannot be removed by the patient, while removable appliances can be taken in and out of the mouth by the patient.

The most commonly used appliances for fixed and removable maxillary expansion appliances can include different forms of rapid maxillary expansion (RME) such as Haas, Hyrax or Fan-type expander and Schwarz expander. RME is the most commonly used appliance for maxillary expansion, which can be achieved by expanding the midpalatal suture **(Gurel *et al*., 2019)**. Other appliances that are used for maxillary expansion is slow maxillary expanders.

The most commonly used appliances for fixed and removable mandibular expansion appliances can include lower Quad Helix, lower lingual arch (LLA), lower Herbst appliances, Schwarz appliance, and sagittal appliance. Schwarz appliance is a fixed appliance that is used commonly for mandibular expansion and protraction in growing patients **(Baccetti *et al*., 2001)**. LLA is a removable

appliance that can be used for mandibular arch maintenance and expansion. Sagittal appliance is a fixed appliance that is used for mandibular expansion in combination with protraction **(Proffit *et al*., 2013)**.

1.5.2 Types of surgically assisted expansion appliances.

Surgically assisted expansion appliances can be categorized into two main groups: tooth-borne and bone-borne appliances. Tooth-borne appliances rely on the teeth for anchorage. The surgical producers in the tooth-borne appliance include miniscrew that attached to bone for expansion such as MARPE (miniscrew-assisted rapid palatal expander). Tooth-borne appliances are used for maxilla and they are not commonly used in the mandible. Bone-borne appliances, on the other hand, anchor to the bone and include appliances such as the SARPE (surgically assisted rapid palatal expander) or external disreactors in mandible. **(Yilmaz *et al*., 2017).**

1.6 Types of surgical procedures that used in surgically assisted expansion

Surgically assisted expansion involves various surgical procedures that are used to expand the dental arches and skeletal structures. These procedures may be performed alone or in combination, depending on the specific needs of the patient.

1. Maxillary Expansion Procedures: Maxillary expansion procedures aim to widen the maxillary arch. There are several surgical techniques that can be used for maxillary expansion, including:

A. A midline palatal osteotomy for surgically Assisted Rapid Palatal Expansion (SARPE): SARPE is a procedure that involves surgically assisted expansion of the maxilla through the use of a palatal expander after making a midline palatal

osteotomy. It is commonly used for transverse deficiency correction in skeletally mature patients **(Bell *et al*., 2016)** (Figure 8).

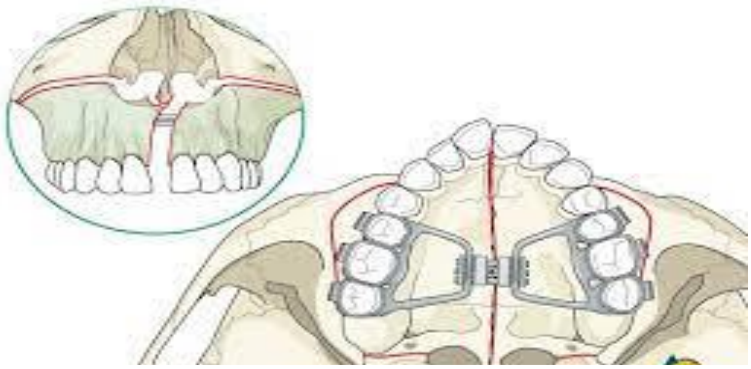


Figure 8 : A midline palatal osteotomy for surgically Assisted Rapid Palatal Expansion (SARPE) (http://jawsurgeryforums.com/index.php?topic=6415.15).

B. Maxillary Skeletal Expander (MSE) or Miniscrew-assisted Rapid Palatal Expander: This hybrid technique combines orthodontic appliances with skeletal anchorage using temporary miniscrew implants in the maxilla for additional stability, followed by activation of a palatal expander to achieve rapid maxillary expansion **(Lee, 2015)** (Figure 9).

Figure 9: Miniscrew-assisted rapid palatal expander (MARPE) device in position without corticopuncture (CP) therapy. (https://www.researchgate.net/figure/Miniscrew-assisted-rapid-palatal-expander-MARPE-device-in-

C. Surgically Assisted Maxillary Expansion (SAME) with Le Fort I: SAME is a newer procedure that involves a Le Fort I osteotomy, which is a surgical cut in the maxilla above the teeth, followed by orthodontic expansion. SAME allows for

three-dimensional expansion of the maxilla, including anterior-posterior and vertical dimensions, and is particularly beneficial in cases with severe transverse maxillary deficiency and asymmetry **(Marşan and Uysal, 2016)**.

D. Maxillary Segmental Osteotomy: Maxillary segmental osteotomy is a surgical technique used to expand a specific segment of the maxilla, such as the posterior maxilla or the alveolar ridge, in cases where localized expansion is required followed by orthodontic appliance **(Proffit *et al*., 2013).**

E. Maxillary alveolar corticotomy: This is a surgical procedure in which small bone cuts or perforations are made in the alveolar bone of the maxilla to facilitate tooth movement in orthodontic treatment. It is often used in conjunction with orthodontic treatment to accelerate tooth movement and achieve faster results (Figure 10).

Figure 10: The osteotomy cuts are made between the maxillary teeth and the bone surface will also be perforated between the osteotomy cuts for rapid expansion. *(https://www.sylvainchamberland.com/en/questions/corticotomy-and-rapid-orthodontics/)*

2. Mandibular Expansion There are several surgical Procedures that can be used for maxillary expansion, including:

A. Osteotomies in the mandible for mandibular Distraction Osteogenesis (MDO): This procedure involves making osteotomies (bone cuts) and these cuts can be vertical, sagittal, trasverse or oblique and then attaching a distractor device. These ostiotomis can be, for examples, bilateral osteotomies (cuts) in the mandibular or

symphysis osteotomy and attaching a distractor device to gradually separate and create new bone in the gap between the segments. The distractor device is adjusted periodically to achieve the desired amount of expansion. Once the desired expansion is achieved, the distractor is left in place for a period of consolidation, after which it is removed **(Katz *et al*., 2000)** (Figure 11).

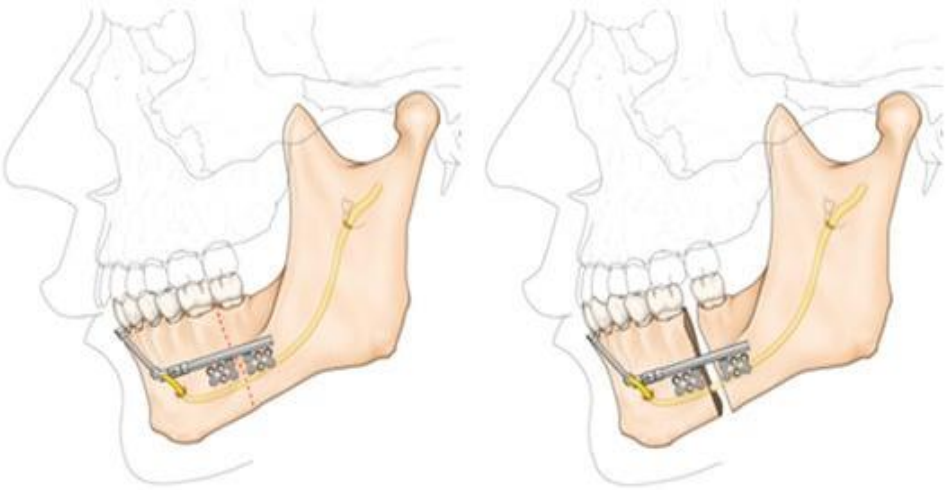


Figure 11: Distractor placement in the molar region of the lower jaw. Osteotomy between first and second molar. (Koyama, 2020)

B. Intraoral osteotomies in the mandibular body for intraoral Distraction Osteogenesis (IDO): This procedure involves making intraoral osteotomies in the mandibular body and attaching a distractor device to gradually separate the mandibular segments. The distractor device is adjusted periodically to achieve the desired amount of expansion. Once the desired expansion is achieved, the distractor is left in place for a period of consolidation, after which it is removed **(Mercuri *et al*., 1999)** (Figure 12).

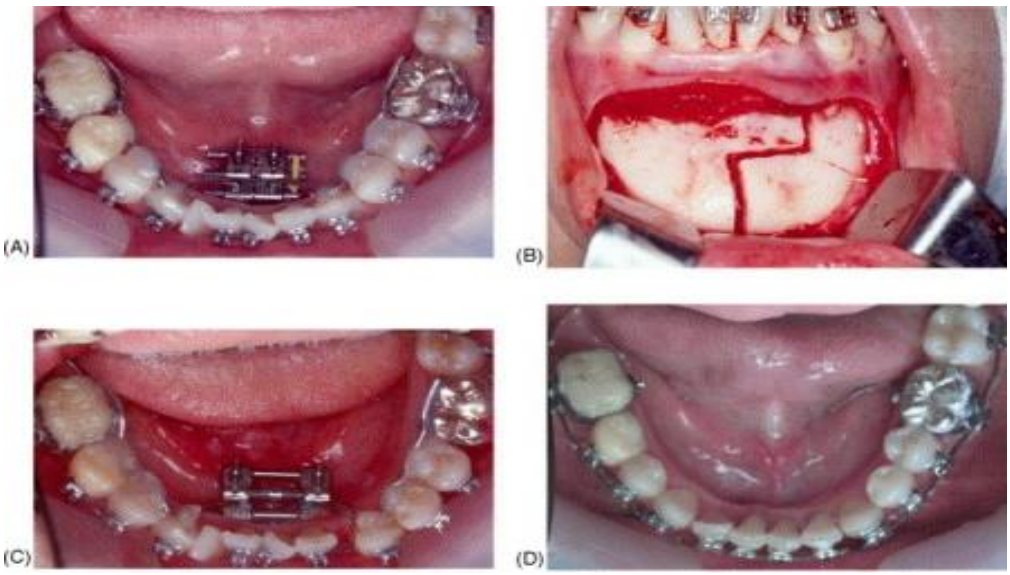


Figure 12: Distractor placement in the molar region of the lower jaw. Osteotomy between first and second molar. (University of Wonkwang, 2005)

C. Orthognathic Surgery with Tooth-borne or Bone-borne Appliances: This procedure involves combined orthognathic surgery and the use of tooth-borne or bone-borne appliances to achieve mandibular expansion. The appliances, such as rapid palatal expanders or bone-borne expanders, are used in conjunction with the surgical procedures to provide controlled expansion of the mandible **(Epker and Wolford, 1980; Koudstaal *et al*., 2018).**

D. Corticotomy-facilitated Orthodontics with Distraction Osteogenesis: This procedure involves making corticotomies in the mandibular bone, followed by distraction osteogenesis or expander in conjunction with orthodontic treatment to achieve mandibular expansion (Figure 13).

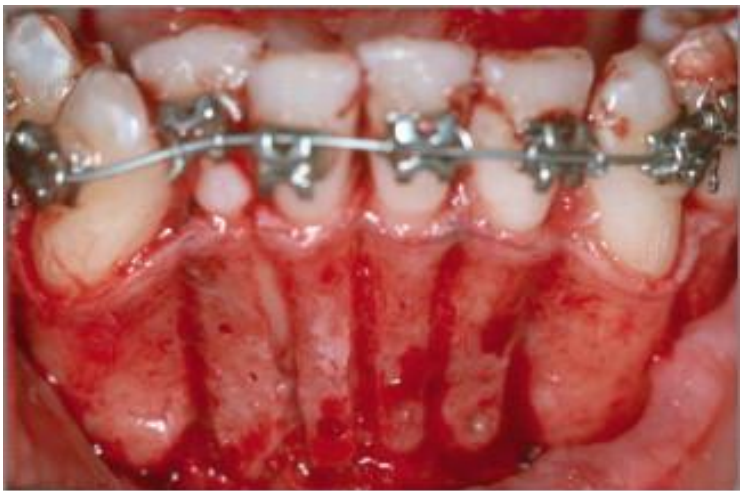


Figure 13: The corticotomy cuts are made between the mandibular in patient with dental crowding for rapid expansion.

1.7 Comparison Between Orthodontics and Surgically assisted Expansion.

Orthodontic treatment and surgical intervention are two approaches used to correct dental and skeletal malocclusions. In order to compare these methods, various factors such as effectiveness, complexity, treatment time, and patient satisfaction need to be considered.

1.7.1 Effectiveness and results of each method in treating different types of dental and skeletal malocclusions.

Orthodontic treatment and surgical treatment are two main approaches to correct dental malocclusions and skeletal discrepancies. In general, Orthodontic treatment gives good results in treating (mild to moderate) dental and skeletal malocclussion, whereas surgical treatment is more effective in correcting (severe) skeletal and dental discrepancies (especially skeletal discrepancies) that cannot be treated by orthodontic treatment alone **(Proffit *et al*., 2018**). For example**,** a systematic review and meta-analysis of 13 studies, **Mousoulea *et al*. (2020)** found

that SAE was more effective than orthodontics in correcting sever transverse maxillary deficiency. In mandible, studies found that SAE is more effective for treating severe dental and skeletal malocclusions, the procedure involves cutting the jawbone and using an appliance to gradually widen it.

Overall, the available evidence suggests that both orthodontic and surgically assisted expansion can effectively treat dental and skeletal malocclusions and give good results. Orthodontic treatment has been found to be effective in correcting dental and skeletal malocclusion especially mild to moderate malocclusions, while SAE is more effective in correcting skeletal and dental malocclusion especially severe skeletal discrepancies. However, surgically assisted expansion may result in greater skeletal expansion and more stable results than orthodontic expansion in especially skeletal malocclusion, because it can treat severe casese, so it gives better results in all cases even in mild and moderate cases.

1.7.2 Complexity of Treatment.

The complexity of treatment is an important factor when comparing orthodontic and surgically assisted expansion methods.

Orthodontic treatment is a non-invasive and conservative approach that aims to correct malocclusions by applying forces to the teeth and jaws using various appliances such as braces, aligners, and functional appliances **(Proffit, 2018)**. Orthodontic treatment can be relatively simple or complex, depending on the type and severity of the malocclusion. For example, treating a patient with mild crowding may require only a few months of orthodontic treatment with a fixed appliance, whereas treating a patient with severe skeletal discrepancies may require

several years of treatment with a combination of fixed appliances, and functional appliances **(Janson and Valarelli, 2015)**.

On the other hand, surgically assisted expansion involves a combination of orthodontic treatment and surgery to correct more severe skeletal discrepancies that cannot be addressed by orthodontic treatment alone **(Turpin, 2018)**. The surgical component involves breaking and repositioning bones in the jaw to achieve the desired expansion. Surgically assisted expansion is generally more complex than orthodontic treatment, as it involves invasive procedures and multiple stages of treatment and may require hospitalization and more postoperative visits **(Melsen, 2001)**.

Overall, Orthodontic treatment is generally less complex and invasive than surgically assisted expansion, but may not be suitable for patients with severe skeletal discrepancies that require more extensive correction.

1.7.3 Treatment time.

The treatment time is an important factor to consider when deciding between the two methods. Orthodontic treatment time varies depending on the other factors such as type and severity of the malocclusion, age of the patient, and compliance with treatment, but we will talk about the average treatment time with all factors constant and normal. According to a study by **Kim *et al*. (2015)**, the average treatment time for orthodontic expansion was 11.6 months. In another study by **Bishara *et al*. (2001)**, the average treatment time for maxillary expansion using a rapid palatal expander (RPE) was 7.1 months. However, the treatment time can be longer for more severe cases.

Surgically assisted expansion is usually faster than orthodontic expansion. According to a study by **Pelo *et al*. (2012)**, the average treatment time for surgically assisted expansion was 6.6 months. This is because the surgical procedure allows for a more rapid expansion of the maxilla and mandible. However, it is important to note that the surgery itself may require a longer recovery time than orthodontic treatment.

Overall, the treatment time for surgically assisted expansion is generally shorter than that of orthodontic expansion, but this can vary depending on the individual case. Factors such as the severity of the malocclusion, age of the patient, and compliance with treatment can all affect the treatment time.

1.7.4 Age limitations.

The age limitations of these methods differ, and it is important to consider them when selecting a treatment option. Orthodontic expansion is typically recommended for children and adolescents who have not yet reached skeletal maturity **(Baysal *et al*., 2014; McNamara, 1996)**. This is because the bones of the skull are more pliable and can be more easily manipulated at a younger age. Also, surgery can cause problems with bone formation since it is still in the growth phase. However, orthodontic expansion can also be effective in adults, although the treatment may take longer and may require additional procedures **(Baysal *et al*., 2014).**

Surgically assisted expansion, on the other hand, is typically recommended for adults who have already reached skeletal **maturity (Haas, 1961; McNamara, 1996)**. This is because the bones of the skull have fused and are less pliable, making it more difficult to achieve effective expansion with orthodontic appliances alone. Surgically assisted expansion can also be used in younger patients who have

already reached skeletal maturity, but it is important to carefully consider the risks and benefits of the procedure in these cases **(Baysal *et al*., 2014)**.

Overall, both orthodontic and surgically assisted expansion can be effective in treating dental and skeletal malocclusions that require maxillary expansion, but the age limitations of each method should be carefully considered when selecting a treatment option.

1.7.5 Patient discomfort, pain ,psychological factors and overall patient satisfaction

Orthodontic treatment and surgically assisted expansion (SAE) have both been found to improve patients' psychosocial well-being, self-esteem, and overall satisfaction with their oral health **(Kim *et al*., 2015; Preetha *et al*., 2016)**. However, the experience and perception of these treatments may differ between patients.

Orthodontic treatment is non-invasive and is often seen as less intimidating and less painful compared to SAE, which involves surgical intervention **(Shalish *et al*., 2015; Petricevic *et al*., 2016)**. Patients undergoing SAE may experience more discomfort, pain, and swelling, which may impact their overall satisfaction with the treatment **(Petricevic *et al*., 2016)**. In contrast, patients undergoing orthodontic treatment may experience some discomfort and pain during initial placement or adjustment of the orthodontic appliances, but this typically resolves within a few days **(Shalish *et al*., 2015)**.

In terms of treatment duration, orthodontic treatment may take longer than SAE to achieve the desired results **(Kilic *et al*., 2014)**. This may lead to a sense of frustration or impatience among some orthodontic patients, which may impact their overall satisfaction with the treatment. On the other hand, SAE typically results in

more rapid expansion and correction of malocclusion, which may lead to greater patient satisfaction with the treatment process **(Petricevic *et al*., 2016)**.

Another factor that may influence patient satisfaction with orthodontic vs. SAE treatment is the degree of control patients feel they have over the treatment process. Orthodontic patients may feel more involved and informed about their treatment plan, as they are often able to see the gradual changes in their teeth and have the ability to adjust their oral hygiene practices accordingly **(Shalish *et al*., 2015)**. In contrast, SAE patients may feel less involved in the process due to the surgical nature of the intervention **(Petricevic *et al*., 2016).**

Overall, patient satisfaction and psychological factors related to orthodontic and SAE treatment are complex and multifactorial. While both treatments have been shown to improve psychosocial well-being and self-esteem, the experience and perception of these treatments may differ between patients.

1.7.6 Maintenance and follow-up Care.

Maintenance and follow-up care are essential components of orthodontic and surgically assisted expansion treatment to achieve long-term stability and prevent relapse. Orthodontic treatment primarily involves the use of fixed or removable appliances to move teeth into the desired position gradually. Maintenance and follow-up care after orthodontic treatment include regular dental visits, monitoring the retention appliances, and proper oral hygiene practices to prevent decay and gum disease **(Littlewood, 2004)**.

On the other hand, the maintenance and follow-up care for surgically assisted expansion include more frequent dental visits, monitoring of the healing process, and possible use of fixed or removable orthodontic appliances **(Li, 2016)**.

A study by **Ngan *et al*. (2008)** found that patients who underwent surgically assisted RME treatment required more follow-up care and had more frequent dental visits compared to those who underwent orthodontic treatment alone. The study also reported a higher incidence of relapse in surgically assisted RME patients, highlighting the importance of follow-up care and retention.

Overall, maintenance and follow-up care are crucial aspects of orthodontic and surgically assisted expansion treatment to achieve long-term stability and prevent relapse. Patients who undergo surgically assisted expansion treatment require more frequent dental visits, monitoring of the healing process, and retention appliances to prevent relapse.

1.7.7 Success Rate.

Orthodontic expansion involves the use of a palatal or mandibular expander to apply force to the maxillary or mandibular bones to create more space for the teeth. It is a non-invasive and reversible treatment that can be used to correct mild to moderate skeletal discrepancies. The success rate of orthodontic expansion varies depending on the other factors such as severity of the malocclusion and the age of the patient **(Ngan, 2007)**. The overall success rate of orthodontic expansion has been reported to be between 50% and 90% **(Bishara, 2001)**.

Surgically assisted expansion, on the other hand, involves the use of a surgical procedure to expand the maxillary or mandibular bones. It is a more invasive and irreversible treatment that is typically reserved for cases of severe skeletal constriction that cannot be corrected with orthodontic expansion alone. The success rate of surgically assisted expansion is reported to be between 85% and 95% **(Tuncay, 2005)**.

In summary, both orthodontic and surgically assisted expansion can be effective in treating maxillary and mandibular constriction, but the success rate and degree of skeletal change may be greater with surgically assisted expansion, particularly in cases of severe skeletal discrepancy.

1.7.8 Long-term Stability .

Long-term stability is an essential aspect to consider while comparing these methods. Several studies have reported good long-term stability with both methods. One study compared the long-term stability of surgically assisted rapid palatal expansion (SARPE) and RME and found no significant difference in the long-term stability of the two methods **(Baysal, 2020)**. Another study compared the long-term stability of surgically assisted mandibular expansion (SAME) and RME and found that both methods had excellent stability after a follow-up of three years **(Shigeta, 2017)**. A systematic review on the long-term stability of orthodontic and surgically assisted maxillary expansion concluded that both methods are effective in achieving long-term stability **(Garib, 2015)**.

However, some studies have reported better long-term stability with surgically assisted expansion. One study compared the long-term stability of SARPE and RME and found that SARPE resulted in better long-term stability **(Hernandez-Alfaro, 2016)**. Another study compared the long-term stability of

SAME and RME and found that SAME resulted in better long-term stability **(Kanomi, 1997)**. These studies suggest that surgically assisted expansion may be more effective in achieving long-term stability than orthodontic expansion.

Overall, both orthodontic and surgically assisted expansion methods have been reported to be effective in achieving long-term stability. While some studies have reported better long-term stability with surgically assisted expansion. The choice of method should be based on individual patient factors and preferences.

1.7.9 Risks and complications .

Orthodontic and surgically assisted expansions are both effective methods for correcting dental and skeletal malocclusions. However, they differ in their risks and complications. Orthodontic expansion is a non-invasive and relatively low-risk procedure compared to surgically assisted expansion, which involves a surgical incision and can lead to more serious complications.

The risks associated with orthodontic expansion include root resorption, periodontal damage, and relapse of the treated teeth **(Ghafari, 2014)**. Root resorption occurs when the tooth's roots shorten as a result of pressure exerted by the orthodontic appliance. Although this risk is relatively low, it can lead to tooth loss in some cases **(Martins, 2010)**. Periodontal damage can occur if the orthodontic appliance is not properly placed, leading to gum recession or bone loss around the teeth **(Bollen, 2008)**. Relapse of the treated teeth can occur if the patient does not wear their retainers as prescribed, resulting in the teeth shifting back to their original position **(Artun, 1988)**.

The risks associated with surgically assisted expansion include bleeding, infection, nerve damage, and failure of the bone to heal properly **(Vercellotti, 2001)**. Bleeding and infection are common risks associated with any surgical

procedure. Nerve damage can occur if the surgeon accidentally damages a nerve during the procedure, leading to numbness or tingling sensations in the affected area. Failure of the bone to heal properly can result in instability or loss of the treated teeth.

Overall, orthodontic expansion is a low-risk procedure compared to surgically assisted expansion. However, both methods carry some risks and complications that should be discussed with the patient before treatment.

1.7.10 The cost of each method.

Cost is an important factor to consider when choosing between orthodontic and surgical treatment. The cost of orthodontic treatment varies depending on several factors such as the type of treatment, the severity of the malocclusion, and the location of the orthodontist. Generally, the cost of surgically assisted expansion is significantly higher than the cost of orthodontic treatment **(Lee *et al*., 2019; Medeiros *et al*., 2019)**.

In terms of cost-effectiveness, orthodontic treatment is often more cost-effective than surgical treatment for most malocclusions. However, in cases of severe skeletal discrepancies, surgical treatment may be necessary to achieve the desired results **(Proffit *et al*., 2014)**. Additionally, orthodontic treatment may require longer treatment time and more frequent visits to the orthodontist, which can increase the overall cost. It is important to note that cost should not be the only factor considered when choosing between orthodontic and surgical treatment.

1.8 Timing of surgical procedures and orthodontic appliances.

In cases of surgically assisted expansion, the sequence of orthodontic and surgical procedures can vary depending on the specific treatment plan and the

patient's individual needs. However, generally, orthodontic treatment is initiated before the surgical procedure.

Orthodontic treatment is typically used to align and level the teeth, create sufficient space for expansion, and establish a stable occlusion before the surgical procedure. This may involve the use of braces or aligners to move the teeth into their proper positions and optimize the dental arches. Once the teeth are aligned and sufficient space is created, the surgical procedure can be performed to physically separate and expand the maxilla and/or mandible. Following the surgical procedure, orthodontic treatment continues to fine-tune the occlusion and achieve the desired tooth and jaw relationships. This may involve the use of orthodontic appliances to guide the teeth and jaws into their optimal positions and ensure stability of the achieved expansion **(Neville, 2018)**.

The specific sequence and timing of orthodontic and surgical procedures may vary depending on the treatment plan, the patient's age, growth potential, and other individual factors. It is essential for the treatment plan to be carefully coordinated and customized for each patient to achieve the best results.

Chapter two: Discussion

The decision or the dividing line that determines whether we use orthodontics or surgically assisted expansion depends on various factors which we discussed in the chapter one of this research which are:

1. Patient’s age and skeletal maturity.

2. Treatment time.

3. Severity of the dental and skeletal malocclusions.

4. Risks and complications.

5. Success rate.

6. Long-term stability.

7. Maintenance and follow-up care.

8. Pain, discomfort and psychological factors.

9. Complicity of treatment.

10. Cost.

Orthodontic maxillary expansion is typically recommended for growing patients with skeletal discrepancies that can be corrected through dental and skeletal remodeling. This approach is usually preferred in younger patients who have not yet reached skeletal maturity, as their sutures and bones are more responsive to orthopedic forces. On the other hand, surgically assisted expansion is often considered in skeletally mature patients, where the sutures have fused, and orthodontic expansion alone may not be sufficient to achieve the desired outcome.

The severity of malocclusion is another factor that can influence the decision between orthodontic and surgically assisted maxillary expansion. In cases of mild to moderate malocclusions, orthodontic expansion with appliances may be adequate to achieve the desired outcome. However, in cases of severe malocclusions, surgically assisted expansion may be necessary to achieve the desired amount of expansion and prevent relapse.

Orthodontic expansion typically requires a longer treatment duration compared to surgically assisted expansion. Orthodontic expansion involves the use

of appliances which gradually apply forces to expand the maxilla or mandible over a period of several months to a year or more, depending on the amount of desired expansion and patient response. In contrast, surgically assisted expansion involves a surgical procedure that allows for more immediate and significant expansion, usually completed in a shorter period of time. The shorter treatment duration of surgically assisted expansion can be advantageous in certain situations. On the other hand, the longer treatment duration of orthodontic expansion may be preferred in cases where a more gradual and controlled approach is desired.

Also risks and complication factors are an important factor to decide, orthodontic treatment is safer than surgically assisted expansion. Complication of surgically assisted expansion can include infection, bleeding or nerve injury, so it may be not indicated for patient who has systemic diseases like immune diseases or others.

Pain and discomfort of patient affects the decision, orthodontics is less painful a discomfortable. Success rate is more in surgically assisted expansion. Cost of orthodontic treatment is less. These are all factors that affect decision-making between orthodontics and surgically assisted expansion. Overall, surgically assisted expansion has more advantages than orthodontics.

Chapter three: Conclusion and suggestions

3.1 Conclusion.

There are several factors that influence the decision-making for the type of treatment whether orthodontics or surgically assisted expansion. Each treatment has cases in which it is preferable to use it, and each treatment has its negatives and positives, but the surgical method has more positives in terms of several factors such as time, success rate, stability, and orthodontics has more positives in terms of several factors such as complications and cost. In general, surgically assisted expansion is a modern technique that combines between orthodontic appliances and surgical procedure to treat dental and skeletal malocclusions, so it will gives better results than orthodontic treatment alone.

3.2 Suggestions.

1) Further researches about the long-term stability of orthodontics and surgically assisted expansion outcomes.

2) Doing researches about the impact of orthodontics and surgically assisted expansion on patient, such as quality of life and psychosocial well-being.

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