

## Osteopathy in Dentistry – Review of the Literature

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### Abstract:

**Background:** Osteopathic Manipulative Treatment (OMT) is often defined as “the therapeutic application of manually guided forces by an Osteopathic Physician to boost physiologic function and/or support homeostasis that has been altered by somatic dysfunction.” The purpose of this paper was to provide an update of the current status of OMT, to shed light on potential areas of dentistry where application of OMT is effective and to supplement the Literature Review with a list of available centers that deliver OMT in the Kingdom of Saudi Arabia.

**Materials and Methods:** A review of the literature about the efficacy of OMT in addressing dental problems was carried between August and December 2020.

**Result:** Osteopathy can manage various dental conditions, such as, pain following root canal treatment (RCT) and extraction, temporomandibular disorders (TMDs),

malocclusion and neck and back pain frequently encountered by dentists through mobilization of soft tissues like fascia, ligaments and muscles. **Conclusion:** Interdisciplinary cooperation between dentists and osteopaths is desired, however, centers that deliver OMT in the Kingdom of Saudi Arabia are very few and were all found in the private sector.

**Keywords:** Osteopathy; Malocclusion; TMDs; Cranial Osteopathy; Osteopathy dental pain; Extraction; RCT

### **Introduction**

Osteopathic manipulative treatment (OMT) is often defined as “the therapeutic application of manually guided forces by an osteopathic physician to boost physiologic function and/or support homeostasis that has been altered by somatic dysfunction.” Osteopathy was established by A.T. Still within the 19<sup>th</sup> century in the United States. It is a “noninvasive, drug-free manual medicine” that includes two professions: non-physician osteopaths and osteopathic physicians. The non-physician osteopaths are recognized as alternative medicine practitioners, while osteopathic physicians exist only in the United States; they receive identical training as conventional physicians. The difference between chiropractors and non-physician osteopaths is that chiropractors “focus on the connection between the body’s structure, mainly the spine, and it’s functioning.” They mostly manipulate the spine or the limbs to correct subluxations. However, osteopaths apply mostly mobilizations of soft tissues like fascia, ligaments and muscles <sup>[1-2]</sup>. Using proper diagnostic techniques, the osteopathic approach assures finding the particular anatomical region causing the pain or movement limitation <sup>[3]</sup>.

The osteopathic student William G. Sutherland in the 20<sup>th</sup> century noticed that the osseous, temporal and parietal bones junction has a definite bevel because this articulation was for sliding motion. He spent 40 years theorizing and demonstrating the five principles of his cranial concept:

1. “Movement of the brain and spinal cord.”

The brain motion is in a physiological cycle. As the lateral dimension widens, the anteroposterior dimension shortens, and vice versa. The force of the craniosacral mechanism is obtained from this movement.

2. “The fluctuation of the cerebrospinal fluid.”

The fluid arises from the choroid plexus of the lateral ventricles reaching every cell of the body. As the brain moves in its cycle, the fluid is biomechanically pumped throughout the central nervous system. If the movement of the brain is restricted, the fluctuation action of the fluid will decrease.

3. “Cranial dural membrane movement.”

The dural membrane consists of the flax cerebri, the tentorium cerebelli and the flax cerebelli, and they join at the straight sinus. The supporting dural membrane directs the cranial tissue as the brain and cerebrospinal fluid move.

4. “Cranial bones movement.”

The sutures consist of living connective tissue permit a slight articulation between the bones. The movement of the brain, fluid and the dura is proportional to the movement of the cranial bones since the dura is directly connected to the internal periosteal surface of the bones.

5. “Involuntary movement of the cranial tissues with the sacrum.”

The sacrum moves in conjunction with the cranium due to the attachment between the spinal dural sheath and the occiput at the foramen magnum to the second and third cervical vertebrae and second sacral segment.

Sutherland found that these anatomical components move in a specific cycle in healthy individuals consisting of flexion and extension.

In flexion movement, when the sphenobasilar junction and midline bones in the head (vomer, sphenoid, occiput and perpendicular plate of the ethmoid) move superiorly, the lateral bones (temporal, parietal, maxillae, palatine, and zygoma, lacrimal, nasal and frontal) move into external rotation and widen the face. Whereas, in extension, when the sphenobasilar junction moves inferiorly, the lateral bones move into internal rotation and narrow the face; additionally, the sacrum’s tip moves anteriorly in flexion while moves posteriorly in extension. This cycle is called a cranial rhythmic impulse, and it can be

palpated all around the body <sup>[4]</sup>. **Figure 1** illustrates cranial movements while the dysfunctions of the spheno-basillar synchondrosis (SBS) is portrayed in **Figure 2**.

Dental treatment may have a significant effect on the cranosacral cycle; for instance, the patient might have a restriction and distortion in centric occlusion caused by cranial mechanism, but at rest, he will have normal physiological cranial movement. Consequent to compressive closure, the temporal bones rotate internally and extend the sphenobasilar junction in response to the mandibular condyle, so the mandibular acrylic appliance has to be appropriately fitted to allow the cranial mechanism to function freely on closure. The dental practitioner has to know that dentistry is associated with the cranosacral mechanism because without knowing, he might create craniomandibular symptoms.

A tight-fitting maxillary night-guard, a tight maxillary denture and other dental appliances can restrict the maxillary bones movement. Besides, it might have the ability to distort and restrict the whole central nervous system since the cranosacral mechanism act as one biomechanical unit. So, the rotation of the maxillary bones internally and externally has to be preserved <sup>[4]</sup>.

Interdisciplinary cooperation between dentists and osteopaths is needed, as mentioned previously <sup>[5]</sup>. The purpose of this paper is to provide an update of current status of OMT, to shed light on potential areas of dentistry where application of OMT is effective and to supplement the Literature Review with a list of available centers that deliver OMT in the Kingdom of Saudi Arabia.

The following problems and the potential role of OMT in resolving them will be covered:

**1. Pain following dental treatment:**

- RCT
- Extraction
- Orthodontic treatment

**TMDs**

A

**3. Malocclusion**

B

**4. Tongue Thrust**

**5. Centric relation - Centric occlusion Discrepancy**

**6. Re-establishing speech function after long edentulous span**

## **7. Neck, hand and wrist pain encountered by dentists**

### **1. Pain following dental treatment:**

- RCT:

The necessity of endodontic treatment was explained by the American Association of Endodontists “Endodontic treatment is necessary when the pulp, the soft tissue inside the root canal, becomes inflamed or infected. The inflammation or infection can have a variety of causes: deep decay, repeated dental procedures on the tooth, or a crack or chip in the tooth.”

Any pain level that will happen after the endodontic treatment will be considered as postoperative pain, which will compromise the patient’s life quality.

Cranial osteopathy of the jaw and head can be useful in treating somatic dysfunction after endodontic treatment that originated from the prolonged protrusion of the mandible, in addition to the inferior force induced by the clinician during RCT.

A case report was published in 2019 by Fong and Rummel<sup>[6]</sup> of a 47 years old woman who presented with a sharp and throbbing pain in the neck radiated to the right side of the face and jaw with occasional muscle spasm. The symptoms started after root canal treatment of her lower right premolars.

Two years before, she did endodontic re-treatment of her lower right first premolar due to constant pain, the intensity of the pain was 6/10 and it was aggravated by eating, stress and menstruation.

She was diagnosed with sphenobasilar synchondrosis (SBS) compression, inferior alveolar nerve contraction, compression of multiple teeth and somatic dysfunction of the head. Osteopathic manipulative treatment was performed to the cranial SBS compression one week after the first visit to permit a good articulation around the bone and improve cranial rhythmic impulse.

At the end of the treatment, the pain intensity was diminished from 6/10 to 2/10 and she could eat solid food without complications.

In conclusion, dental-osteopathic collaboration is needed to diagnose and treat any unjustified pain induced after dental treatment <sup>[6]</sup>.

- Extraction:

Tooth extraction is the combination of the principles of surgery and elementary physical mechanics; once these principles are applied correctly, the tooth can usually be removed from the alveolar process. The indications of extractions are several, including caries, impacted teeth and teeth associated with pathologic lesions. Patients sometimes experience post-extraction complications like Hemorrhage, Pain and Discomfort, Edema and Trismus <sup>[7]</sup>. The pain usually lasts less than a week and it can be controlled by analgesics. The pain characteristics: length, type and severity vary among patients because of multiple reasons, such as the difficulty of the extraction procedure, patient health status and attitude. Extraction is considered a traumatic procedure.

The forces required to extract usually exceed forces that the body can accommodate without any harmful consequence. Instead of causing fracture or tears, a strain can be caused to the cranial muscles and sutures, leading to misalignment of the cranial bone articulations known as the cranial somatic dysfunction. Somatic dysfunction is defined as the "impaired or altered function of related components of the somatic (body framework) system: skeletal, arthrodiagonal and myofascial structures, and related vascular, lymphatic and neural elements." Osteopathic physicians can apply the appropriate OMT to resolve this dysfunction. The cranium can be altered by somatic dysfunction. Sutherland <sup>[8]</sup> proposed a mechanism for the induction of cranial strain through dental extraction. His theory was that the side-to-side leverage the dentist uses while extracting with forceps combined with posterior occiput compression caused by the V-shaped headrest will lead to somatic dysfunction of the mandible, maxilla, sphenoid and temporal bones. However, the V-shaped headrest is not used commonly in dentistry nowadays; the forces used to extract did not change. The side-to-side leverage will disrupt the cranial bones' alignment resulting in abnormal function of the muscles of mastication and the strain in the dura mater causing painful stimuli. The cranial dysfunction will differ whether an upper or lower molar was extracted. In upper molar extraction, the maxilla is pulled inferiorly and laterally, resulting in impingement of the coronoid process of the mandible. The

temporomandibular joint's alignment will be disrupted as well, which leads to the temporal bone becoming compressed into the occiput at the occipitomastoid suture. The temporomandibular joint's misalignment results in restriction of motion, malocclusion, alteration of the tension of the masticatory muscles, and after that, head and neck pain. However, in lower molar extraction, it will lead to compression of the temporal bone at the mandibular articulation on the same side of the extraction. During the side-to-side leverage, the opposite mandibular articulation is pulled inferiorly; the sphenoid bone is pulled inferiorly and laterally on the side opposite the extraction. This will increase the strain in the sphenomandibular ligament.

In a case report, a 52-year-old male presented with neck pain, headache and low back pain that began two weeks after right upper tooth extraction and after he had overstretched his neck while pushing a car. He was previously diagnosed with cervical strain and lumbar strain. The patient did not follow up as scheduled but followed up two months because of continued symptoms. The neck pain was described as radiating to the top of his head and behind his eyes and down into the posterior area of his right arm. His head pain was rated as a constant 5/10. The pain would ease with exercise, hot showers and use of muscle relaxant. The back pain was described as stiffness and tightness with motion. Cranial somatic dysfunction was present, with decreased cranial rhythmic impulse amplitude and frequency on the right side and with a right restricted occipitomastoid suture. OMT was performed at the 2-month follow-up visit. The patient reported substantial improvement in his symptoms on a follow-up visit one week after receiving OMT. The patient was again treated with OMT at this visit, with complete resolution of his symptoms. Palpating and evaluating the critical areas of restriction, including the occipitomastoid suture, the occipitoatlantal joint and the temporal bones, can provide the treatment plan basis. Managing these critical areas with OMT could significantly improve the patients' motion and symptoms <sup>[8]</sup>.

- Pain after orthodontic treatment:

According to the definition proposed by the International Association for the Study of Pain, pain is “an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage.” <sup>[9]</sup>. Orthodontics is

defined as “the branch of dentistry concerned with facial growth, with development of the dentition and occlusion, and with the diagnosis, interception, and treatment of occlusal anomalies.”<sup>[10]</sup> Pain with orthodontic treatment can occur at different stages. The pain can be caused by the placement of the separator, arch wire, activations, orthopedic forces, and debonding. This pain can be managed by transcutaneous electrical nerve stimulation (TENS) to control the pain from separator placement and during debonding of brackets, soft laser irradiation in the periodontal tissues, and Vibratory stimulation of the periodontal ligament using a small battery-operated vibrating motor, biting off a plastic wafer or a chewing gum after application of arch wires. Doctors can also prescribe analgesics to relieve the pain. Ibuprofen was found to be the best to reduce pain, but it would reduce the rate of tooth movement<sup>[9]</sup>. On the other hand, Acetaminophen does not affect tooth movement that much; that is why it was the recommended analgesic to relieve orthodontic discomfort<sup>[9]</sup>. The effectiveness of OMT in reducing pain following RCT promotes its use in reducing pain following orthodontic treatment, however, this claim is not supported yet by the existing literature.

## 2. TMDs:

The temporomandibular joint is one of the most used joints in the body, and because of this, it can have some disorders. According to the American Academy of Orofacial Pain, Temporomandibular joint disorders (TMD) are defined as "It is a collective term embracing several clinical problems that involve the masticatory muscles, the Temporomandibular Joint and the associated structures, or both"<sup>[11]</sup>. TMD is a broad topic for different types of disorders, including the TMJ, masticatory muscles and associated structures. Also, the jaws, cervical spine and the teeth's alignment can play a role in this because they are all related to each other, and a dysfunction in one of them may affect it. TMD is usually presented with either one or multiple symptoms such as pain in the preauricular and other areas in the face, joint sounds, muscle, facial tenderness and restricted movement of the mandible. Maximum opening restriction and deviation or deflection while the opening is reported as classical signs of TMD<sup>[3]</sup>. Till now, the pathogenesis of TMD is unclear; it could be physical such as trauma, muscle spasms, chronic malocclusion, bruxism causing grinding or clenching of teeth or biochemical



such as vitamin inadequacy and physiological factors such as anxiety, stress and depression. TMD can affect the quality of life, but it is not a life-threatening disease. Different specialties have tried to reach a treatment for TMD like dentists, orthodontists, psychologists, physical therapists and physicians <sup>[11]</sup>. They have suggested numerous treatments in the literature to treat these conditions; they are divided into invasive and non-invasive therapies. Non-invasive therapy should be attempted before seeking invasive temporary or persistent treatment like orthodontic or surgery that can produce irreversible damage. They include oral appliances, home care procedures, cognitive-behavioral information program, acupuncture, dry needling, chiropractic, physical therapy, osteopathy, relaxation and meditation and pharmacological treatment such as non-steroidal anti-inflammatory drugs, muscle relaxants, antidepressants and corticosteroids <sup>[3]</sup>. Physical therapy interventions are likely to be effective in managing TMD. It includes electrophysical modalities such as shortwave diathermy, ultrasound, biofeedback, microwave, laser therapy and transcutaneous electrical nerve stimulation. Therapeutic exercises for the masticatory or cervical muscles and manual therapy techniques. These are commonly used to reduce pain and improve the mandibular range of motion <sup>[11]</sup>. There are three different manipulative techniques for the jaw.

- 1- Manipulation of the condyle into the anteriorly displaced disc.
  - 2- Manipulating the anteriorly displaced articular disc posteriorly.
  - 3- Manipulating the condyle in a lateromedial direction.
- 1- Manipulation of the condyle into the anteriorly displaced disc can be done unilaterally or bilaterally by contacting the lower molars with the thumbs intraorally and thrusting or distracting the mandible anteroinferiorly. It is usually used for acute closed or open lock and reduces the condyle back onto an anteriorly displaced disc. This technique can be used with or without anesthetic.

No published studies supported the effect of the last two techniques <sup>[12]</sup>.

A randomized controlled trial study was made to study the effect of OMT in patients with TMD compared to conventional conservative therapy (CCT). They collected 50 patients and divided them into two groups, 25 each. For the first group, they applied OMT. The

other 25 patients had CCT. The results were that both groups showed improvement during the six months of treatment. Even though they showed similarities in the results, The OMT group used less medication (non-steroidal medication and muscle relaxants) than the CCT group <sup>[13]</sup>.

### 3. Malocclusion:

Edward H. Angle <sup>[14]</sup> classified the malocclusion based on the upper and lower molars, which should be related in a way that the mesiobuccal cusp of the upper first molar occluding in the mesiobuccal groove of the lower first molar, and any deviation from this scheme will be considered a malocclusion.

Angle defined three types of malocclusion as displayed in **Figure 3**:

Class I: normal molar relationship with marked malposition or rotation.

Class II: the mesiobuccal cusp of the upper molar occludes mesial to the buccal grooves of the lower molar.

Class III: the mesiobuccal cusp of the upper molar occludes distal to the buccal grooves of the lower molar <sup>[14]</sup>.

The fundamental distortions in the cranium that contribute to the malocclusions are:

Hyper-extension, Hyper-flexion, Inferior vertical strain and Superior vertical strain <sup>[15]</sup>.

Hyper-extension and Superior vertical strains both result in Class III malocclusion. Still, the difference is in the Frankfort mandibular plane angle, so, Hyper-extension results in Class III with a high Frankfort mandibular plane angle. In contrast, Superior vertical strain results in Class III with a low Frankfort mandibular plane angle. To differentiate between them, you need to examine the sphenobasilar synchondrosis (SBS) portrayed in **Figure 4**, which forms the occiput and the sphenoid junction at the cranial base.

In hyper-extension, the occiput will be displaced in a clockwise rotation while the sphenoid will be displaced in a counter-clockwise rotation as shown in **Figure 5a**.

In Superior vertical strain, both the occiput and the sphenoid are displaced in clockwise rotation as shown in **Figure 5b**. Dentally, there is a unilateral crossbite with functional shift and high narrow palate, in addition to reduced overbite with lingual inclination of the mandibular teeth in hyper-extension, whereas in Superior vertical strain, there will be crowding in the maxillary central incisors and canine as a result to the reduced premaxilla that led to partial or complete block out of the lateral incisors <sup>[16]</sup>.

In inferior vertical strain, the occiput and sphenoid will move downwards, and forwards and it will be displaced in anti-clockwise rotation, and it will usually result in Class II Division 1 malocclusion<sup>[17]</sup> as illustrated in *Figure 5c*.

In Hyper-flexion, there is an anteroposterior shortening of the cranium with upward bending of the SBS. Dentally as the cranium shortens, the premaxilla deflects palatally; thus, it will result in Class II Division 2 malocclusion<sup>[18]</sup> as illustrated in *Figure 5d*.

In the last century, Grozat was not familiar with the physiological cranial movement. However, he supports the idea of light force. He thinks that “only mild processes are needed to create change as long as they are applied in a proper direction.” Moreover, his goal was to perform a skeletal change through an extended period using a light force system that improves the rhythmic cranial function, like the Advanced Lightwire Functional Appliance (ALF) which was developed by Dr. Darick Nordstrom<sup>[19]</sup>, the primary purpose for it is to aid in relieving multiple cranial strains addressed by an osteopath and then correcting the malocclusion<sup>[20]</sup>.

At the end, examining patients both from frontal and profile view, you come to understand the most frequent patterns and correlations. Although it takes time and effort to develop this ability, but it is gratifying<sup>[19]</sup>.

#### **4. Tongue thrust:**

Tongue thrust is defined as the forward movement of the tongue tip between the teeth to meet the lower lip and contact any teeth anterior to the molars during swallowing while deglutition and in sounds of speech, so that the tongue becomes interdental<sup>[21-22]</sup>. The etiology of tongue thrust could be either genetic, learned behaviour, infectious or feeding practices. There are four types of tongue thrust: physiological, habitual, functional, and anatomical. The Intraoral features for these patients include: proclined and flared upper incisors, retroclined or proclined lower incisors, increased overjet, anterior open bite and posterior crossbite while their extraoral features comprise: dolichocephalic face, increased lower anterior facial height, incompetent lips and speech problems like lisping and sibilant distortions.

On 2005, the American Academy of Pediatric Dentistry revealed multiple management options including “myofunctional therapy, simple habit control, habit-breaking appliances, orthodontics and possible surgery” [22].

The concept of OMT indicates that it can be effective in managing tongue thrust cases however no available literature was found to support that claim.

### **5. Centric relation - Centric occlusion Discrepancy:**

Centric occlusion (CO) is:” The occlusion of opposing teeth when the mandible is in centric relation. This may or may not coincide with the maximal intercuspal position.” In contrast, centric relation (CR) is “the maxillo- mandibular relationship in which the condyles articulate with the thinnest avascular portion of their respective disks with the complex in the anterior-superior position against the shapes of the articular eminences. This position is independent of tooth contact” [23].

Multiple methods can be used to detect the discrepancy between CO and CR: intra-oral examination, radiographic detection and measures condyle displacement (MCD) or condyle position indicator (CPI) too, which is considered to be the easiest way for the evaluation of the discrepancy [24]. Crawford in his study on 1999 [24], concluded that the discrepancy between the CO-CR has a solid correlation with the presence of TMD symptoms [24].

It is the authors’ belief that OMT could be beneficial in correcting CR—CO Discrepancy, however, its role has to be investigated on scientific basis.

### **6. Re-establishing speech function after long period of being edentulous:**

Losing speech function can affect the quality of life, especially for teachers, actors, singers, etc. [25]. Speech can be defined as "the phonation of sounds in connected discourse; the movement and placement during speech of the organs that serve to interrupt or modify the voiced or unvoiced air stream into meaningful sounds". It was divided into six parts: respiration, phonation, resonance, articulation, neural integration, and ability to hear sounds [26]. Speech quality and clarity can be altered by changes in the oral cavity, such as tooth loss and bone resorption. The resonance will decrease when the placement of the tongue with the hard palate and the alveolar ridge has changed [25].

There are two types of edentulism: partial and complete edentulism. Partial edentulous is when one or more natural teeth are lost, while complete edentulousness is losing all the natural teeth in the dental arch <sup>[27]</sup>. Zaigham *et al.* and Abdel Rahman *et al.* <sup>[27]</sup> concluded that the most significant reasons for tooth loss are dental caries and periodontal disease <sup>[27]</sup>. Age, genetics, traumatic events, and neglect can also play a significant role <sup>[27]</sup>. After these events, these patients will need dentures to re-establish the function, aesthetics, and phonetics. Following prosthodontic treatment, completely edentulous patients are often unsatisfied with the difficulty of pronouncing certain words <sup>[26]</sup> so they might need speech therapy and oral exercise. We believe that osteopathic manipulative treatment can be beneficial in improving speech quality, but no evidence has been found to support this claim.

#### **7. Neck, hand and wrist pain encountered by dentists:**

The unique and remarkable work setting in the dental profession has a noticeable effect on the dentist's health, as reported in the literature. Low back pain is widespread among dentists; its prevalence has increased tenfold in the past 20 decades by 60%-90%. Moreover, it is causing one-third of dentists to retire early. Musculoskeletal disorders are a serious occupational hazard in dentistry. Furthermore, it impacts dentists' physical, psychological and social life, affecting their productivity and ultimately reducing their quality of life. Dentists adopting the same static postures all day while working is a risk factor, the fixed or constrained body positions, poor positioning, the recurrent movements and forces centered on small parts of the body like the hand or wrist. The most common regions of pain among dentists are the lower back and neck, with symptoms like swelling, inflammation, pain and lower strength, with pain being the most prevalent symptom. Complementary alternative medicine (CAM) was reported to manage musculoskeletal disorders in the general public successfully. It includes traditional Chinese Medicine, Aromatherapy, Homeopathic medicine, Naturopathic medicine, Herbal medicines, Unani, essential oils, yoga and meditation. In a study done in India, practitioners preferred doing Yogic exercises, massage, meditation and herbal supplements <sup>[28]</sup>.

The National Health Professional Organizations have set guidelines on treating chronic pain conditions. The American College of Physicians and the American Pain Society

issued guidelines to treat back pain and stated that a non-drug approach should be considered for patients who do not get better with self-care. The approaches include exercise therapy, cognitive-behavioral therapy, and acupuncture, massage therapy, spinal manipulation and progressive relaxation, and are complementary <sup>[28]</sup>. Neck pain is a recurrent complaint faced by osteopathic physicians; OMT usually manages the somatic dysfunction related to that complaint. A randomized clinical trial was conducted to study the spinal manipulation therapy, medication and home exercise effect on neck pain patients. 272 patients aged between 18 and 65 years who had a complaint of mechanical and nonspecific pain for 2 to 12 weeks with duration and severity equaling 3/10 or more. They were divided into three intervention groups. The first intervention group had spinal manipulation treatment with or without mobilization or soft tissue procedure. The second group was managed with medications for musculoskeletal pain (nonsteroidal anti-inflammatory drugs, acetaminophen, muscle relaxants and narcotics) as indicated by their history and clinical examination. The last group had a home exercise with advice from therapists; it included individualized instruction in anatomy, stretching, range of motion, and ergonomics and an informational booklet with exercise instruction. The outcome was evaluated using a standardized survey with the home exercise with advice having more relief than the medication group.

The spinal manipulation treatment and home exercise with advice had unclear responses; however, the spinal manipulation group was more satisfied than the home exercise with the advice group <sup>[29]</sup>. The American Osteopathic Association Guidelines for OMT for patients with low back pain stated that Osteopathic manipulative treatment has a considerable effect on low back pain. They concluded that OMT provides an analgesic effect that can be compared to nonsteroidal anti-inflammatory drugs, including cyclooxygenase-2 inhibitors. However, Seffinger *et al.* <sup>[30]</sup> found that OMT also notably reduced pain during the 3 to 12-months period following randomization. Thus, using OMT for low back pain may eliminate or minimize the need for drugs that can have serious adverse effects <sup>[30]</sup>.

This work was supplemented with a search for OMT providers in the Kingdom of Saudi Arabia which is illustrated in **Table 1**.

### **Findings:**

Centers that deliver OMT in the Kingdom of Saudi Arabia are very few and were all found in the private sector.

### **Recommendations:**

Future studies on the effectiveness of OMT in reducing pain following orthodontic treatment, tongue thrust and CR-CO discrepancy are encouraged. And, as more centers are needed in all areas of the Kingdom and free-access to medical service is hoped especially close to the area where the dental treatment is usually provided to facilitate inter-disciplinary cooperation between dentists and osteopaths and based on the findings of the present study, we recommend that the Ministry of Higher Education encourages the specialty of Osteopathic Physician and equip them with the needed training whether inside or outside the Kingdom.

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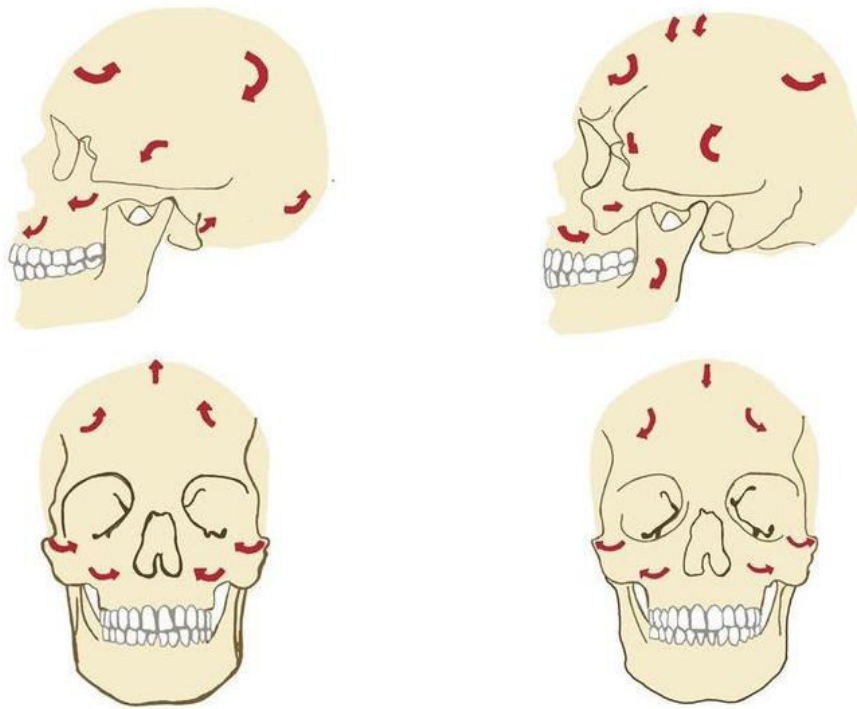
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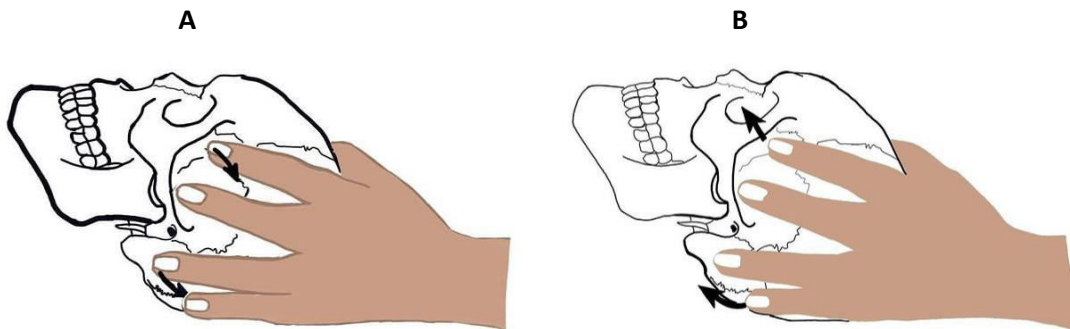
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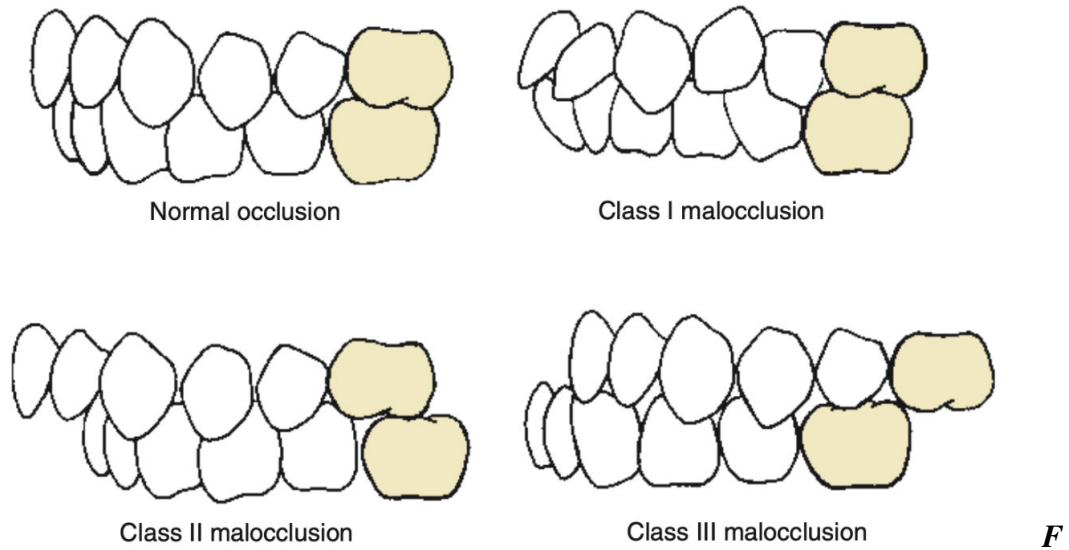
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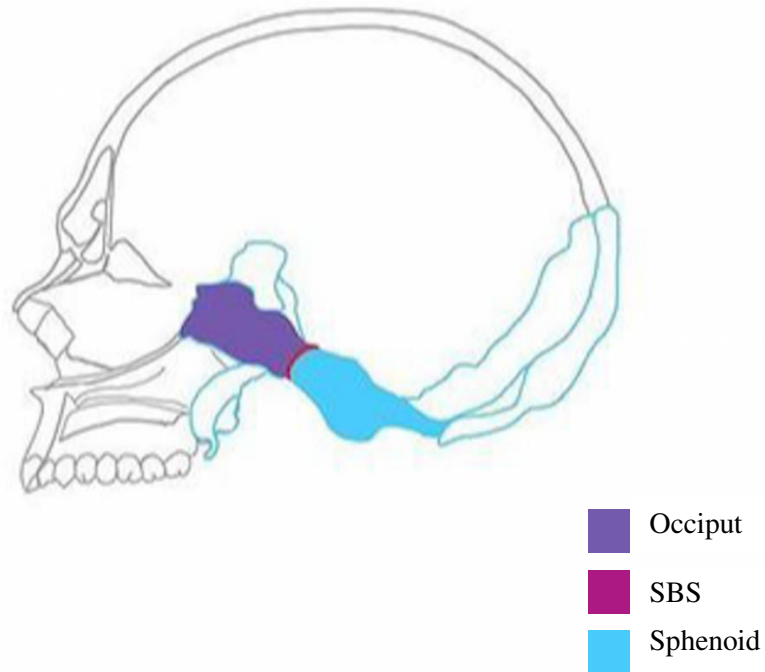
**Figure 1:** i.e. Flexion and Extension lateral and ventral views.



**Figure 2:** A: Extension dysfunction of the SBS. B: Flexion dysfunction of the SBS.

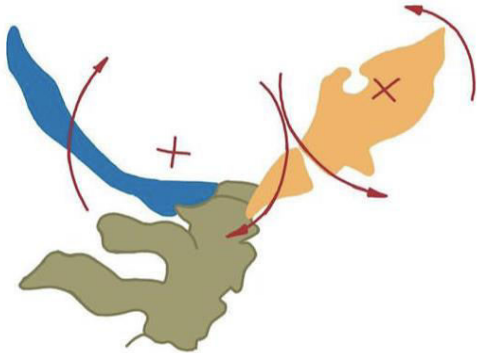


**figure 3:** Normal occlusion and Angle's classes of malocclusion adapted from Proffit et. al. (2013) <sup>[14]</sup>.

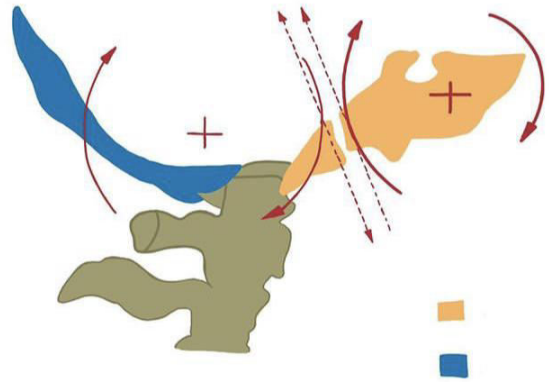


**Figure 4:** Sphenobasilar synchondrosis (SBS).

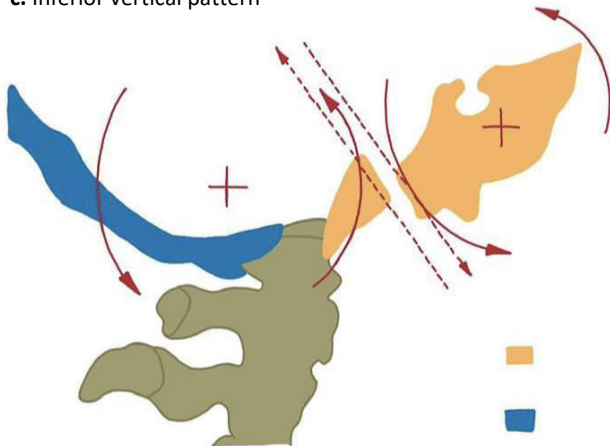
a. Hyper-extension pattern



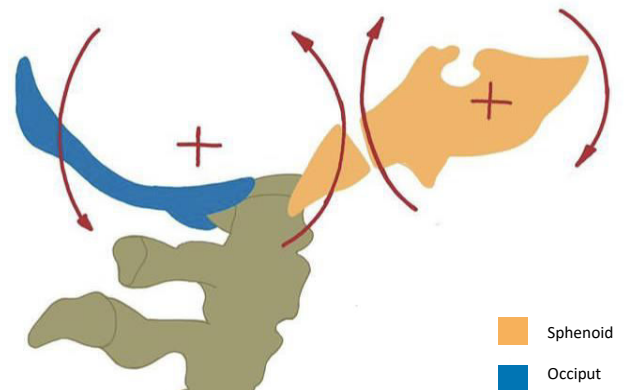
b. Superior vertical pattern



c. Inferior vertical pattern



d. Hyper-flexion pattern



**Figure 5:** Occiput and sphenoid movement in **a.** hyperextension, **b.** superior vertical strain, **c.** inferior vertical strain and **d.** hyper-flexion.

<b>Center</b>	<b>City</b>
Myo Osteopathy Center	Riyadh
Muroona Spine & Joint Clinic	Riyadh
Dr. Sulaiman Alhabib Hospital	Riyadh, <i>Alrayan branch</i>
Integrated Treatment Center	Riyadh
Physio Trio Clinic	Riyadh
Sunrise Center	Jeddah
Relief Clinic	Jeddah

**Table 1:** Centers that deliver OMT in the Kingdom of Saudi Arabia.