

## REVIEW ARTICLE

# A Literature Review of Osteopathic Manipulative Techniques for Otolgia

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## KEYWORDS:

Eustachian Tube

Non-Opioid Pain Management

Osteopathic Manipulative Medicine

Osteopathic Manipulative Technique

Otolgia

**ABSTRACT:** Otolgia is a common painful condition of the ear that can stem from multiple etiologies, including, but not limited to infectious, mechanical or inflammatory conditions. The intricate anatomy of the ear and eustachian tube offer numerous avenues for pathophysiology to manifest. While the precise mechanism of otalgia has not been entirely elucidated, it is widely accepted that pressure is one common denominator. A potential source of pressure variations within the middle ear relies on pathology of the eustachian tube, making it a target for treatment with Osteopathic manipulative techniques (OMT). OMT offers mechanical solutions to mechanical problems within this complex anatomic system. With this literature review we have three goals: first, to provide an in-depth review of the existing Osteopathic manipulative techniques to treat otalgia; second, to present a case report of a novel Osteopathic manipulative technique for otalgia; and lastly, to encourage further data driven research for the use of OMT for otalgia.

Otolgia is a painful condition related to pathology of the ear or surrounding structures. The differential diagnoses for otalgia include categories such as infectious, inflammatory, and mechanical etiologies. Common diagnoses that are often associated with ear pain include: acute otitis media, serous otitis media, eustachian tube dysfunction, and post-tonsillectomy. Theories exist that otalgia may be directly related to pressure in the eustachian tube or referred pain from inflammation/inflexion of the surrounding tissues. Osteopathic manipulative techniques offer a treatment of otalgia without the need for potential side effects of medical management, including unnecessary exposure to narcotic pain medication. This article is a review of the scientific literature involving manipulative treatment of otalgia, including historical references. In this article, we will describe the anatomy of the region and discuss the potential mechanisms of otalgia. In addition, we will delineate the various Osteopathic and other

manipulative treatments of otalgia and detail their data driven outcomes. Finally, we will report a novel Osteopathic manipulative treatment and encourage further studies to evaluate the manipulative treatment of otalgia.

## METHODS

A thorough review of the literature was conducted using standard procedures<sup>1</sup> and the following databases and journals: *PubMed*, *MEDLINE*, *Osteopathic Medical Digital Repository*, *Journal of the American Medical Association*, and *Journal of the American Osteopathic Association*. A standard protocol for searching each of the databases was followed, which included using a universal set of terms to be searched listed in *Figure 1*. There were no date boundaries set for the searches conducted. In total, seven studies/case reports were selected for inclusion based on relevance to the osteopathic treatment of otalgia or otitis media. The types of literature included are either case reports, pilot studies or peer-reviewed journal articles.

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FIGURE 1 :

Universal set of terms to be searched

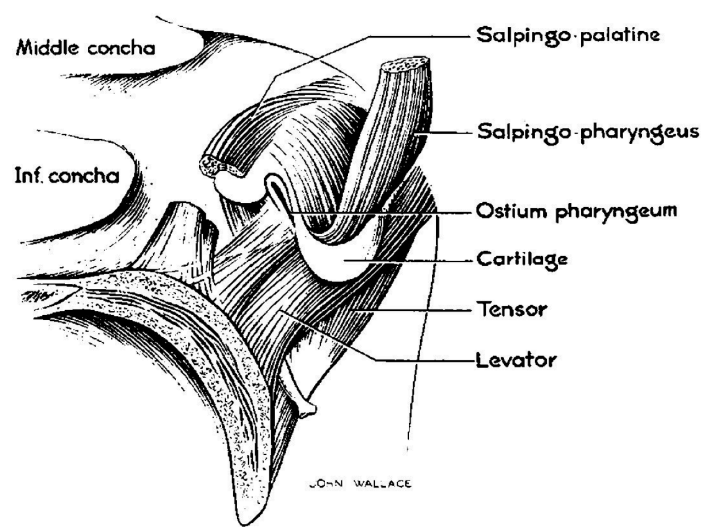
Terms Searched			
Osteopathic treatment of ear pain	Osteopathic treatment of otalgia	Manual ear therapy	Osteopathic treatment of eustachian tube
Osteopathic treatment of otitis media	Galbreath technique	Muncie technique	Modified Muncie technique
Treatment of otalgia	Otagia	Ear pain	Osteopathic manipulative medicine (OMM)
High velocity low amplitude treatment of ear	Alternative treatment of otalgia	Eustachian tube treatment	Eustachian tube dysfunction

**ANATOMY AND EMBRYOLOGY**

“The pharyngotympanic tube serves to ventilate the middle ear, exchanging nasopharyngeal air with the air in the middle ear, which has been altered in its composition via transmucosal gas exchange with the hemoglobin in the blood vessels of the mucosa. The tube also carries mucus from the middle ear cleft to the nasopharynx as a result of ciliary transport.”<sup>2</sup> Measuring, on average, 36mm in adults and 18mm in children, the tube has two distinct components: the lateral bony portion and the medial fibrocartilaginous portion.<sup>3</sup> In addition to the differences in length, the eustachian tube of a child is more horizontal with an angle of only 10 degrees with respect to the horizontal plane, compared to 45 degrees in adults, which increases the likelihood of otitis media due to inadequate clearance of secretions.<sup>4</sup> Embryologically the eustachian tube is derived from the proximal portion of the 1st pharyngeal pouch and is therefore endodermal in origin.<sup>5</sup> The cartilage and muscles associated with the eustachian tube are derived from mesoderm.<sup>5</sup> There are four muscles that are associated with the function of the eustachian tube: tensor veli palatini, levator veli palatini, salpingopharyngeus, and tensor tympani (Figure 2).<sup>6</sup> According to Ars<sup>6</sup>, the tensor veli palatini muscles plays the most significant role in the open and closure of the eustachian tube by tensing the anterolateral membranous wall during chewing, yawning or swallowing. Throughout the literature the levator veli palatini muscle has disputed function in opening or closing of the eustachian tube. Lastly, the salpingopharyngeus muscle is considered to serve an anchoring role as opposed to actively opening or closing the eustachian tube.<sup>6</sup> The innervation of the eustachian tube is complex and includes maxillary and mandibular branch of the trigeminal nerve as well as the tympanic plexus derived from the glossopharyngeal nerve. Arterial blood supply is derived from the ascending pharyngeal and middle meningeal arteries respectively.<sup>7</sup> Venous drainage passes through the pterygoid plexus, while lymphatic drainage flows to the deep cervical lymph nodes.<sup>7</sup> With an adequate understanding of the structure of function of the eustachian tube the mechanism of otalgia is more clear.

FIGURE 2 :

Four muscles that are associated with the function of the eustachian tube



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**MECHANISM OF OTALGIA**

There are multiple theories about the exact mechanism of otalgia in the literature. According to *Stanford Ear Institute*, blockage of the eustachian tube isolates the middle ear and traps air within this confined space.<sup>8</sup> Subsequently the mucosa of the middle ear absorbs the air, creating a negative pressure in the middle ear, which applies inward traction to the tympanic membrane.<sup>8</sup> Due to the dense innervation of the tympanic membrane the sensation of pain will occur. The sensory fibers for the inner surface of the tympanic membrane will be carried on the glossopharyngeal nerve.<sup>3</sup> Long term blockage of the eustachian tube will lead to a transudation of fluid into the middle ear space creating a situation known as serous otitis media.<sup>9</sup> There are numerous mechanisms by which the eustachian tube becomes obstructed, leading to the pathogenesis of otalgia described above. Inflammation of the nasopharynx, allergic rhinitis, influenza, cigarette smoke, post-tonsillectomy inflammation are examples of potential precipitating factors in eustachian tube obstruction.<sup>8</sup> According to Kujawski et al,<sup>10</sup> in a study of 200 patients, post-tonsillectomy otalgia was reported in 41%-69% of patients depending on the technique utilized.

**REVIEW OF TECHNIQUES FOR OTALGIA**

Find below the description of four specific techniques<sup>(1-4)</sup>, followed by three studies with their supporting data<sup>(5-7)</sup>.

**Muncie Technique**

The Muncie technique was developed by *Curtis H. Muncie, DO*, in the 1920's to address eustachian tube dysfunction. The technique is performed as follows: “the osteopathic physician should insert a gloved right index finger into the patient's mouth, placing the finger against the inferior part of the posterior pillar of the palatine tonsil. Moving the finger tip cephalad and slightly lateral to the

Rosenmüller fossa, posterior to the opening of the eustachian tube, the osteopathic physician should apply a pumping motion with the finger pad to lyse any adhesions and, ultimately, restore the eustachian tube opening.<sup>7</sup> The major disadvantage of this procedure is the lack of patient tolerance secondary to gagging. This technique was taught in osteopathic medical schools through the 1960's, however the procedure was seldom used in clinical practice due to limitations previously mentioned.<sup>11</sup> No studies measuring the effectiveness of the Muncie technique were discovered during the literature review.

### Modified Muncie Technique

The Modified Muncie technique was introduced in the literature for the first time in 2008 via a case report of a patient with vertigo. One of the modifications to the original Muncie technique, is the patient is laid supine or reclined to increase head stabilization.<sup>7</sup> The technique is performed as follows: "First insert the index finger, gloved, into the patient's mouth. Place the finger against the posterior pillar of the palatine tonsil. Lastly, apply lateral pressure while making a circular motion into the soft tissue."<sup>7</sup> Channell notes that applying the motion to this specific point exerts traction to the ostium of the eustachian tube allowing it to open. Opening of the eustachian tube allows for equalization of pressure and drainage of fluid. The patient in the case study was a 37-year-old female presenting with difficulty hearing out of the right ear and subjective vertigo symptoms. On exam, she had a mildly retracted right tympanic membrane with serous fluid noted. Pressure measurements were not documented due to lack of instrumentation. She was diagnosed with serous otitis media secondary to seasonal allergies. The patient was subsequently treated with the Modified Muncie technique and tolerated the procedure well. The patient returned two weeks later with complaints of recurrent symptoms for approximately one week after initial treatment. The patient was treated with the Modified Muncie technique again with complete resolution of her symptoms. No studies measuring the effectiveness of the Modified Muncie technique were discovered during the literature review.

### Galbreath Technique

The Galbreath Technique was first described by *William Otis Galbreath, DO* in 1929 and has been taught in osteopathic medical schools for the treatment of otitis media and otalgia. The technique was well described by *Dale Pratt-Harrington, DO* in a review article published in the *JAOA* in October of 2000. The technique is performed as follows: "The physician can perform this technique by either placing the child in the supine position (as originally described) or in the physician's or parent's lap). The physician then turns the child's head so that the affected ear faces away; with the operator's hand that is opposite of the affected ear (that is, if the child has otitis media on the right side, the operator uses the left hand), the operator contacts the child's mandible on the affected side and applies a downward and transverse mild force on the mandible that crosses the face. This is repeated in a slow rhythmic application of force (about 3 to 5 seconds per round) for 30 to 60 seconds. Drainage resulting from this technique provides relief of pain and of the infection."<sup>11,12</sup> No studies measuring the effectiveness of the Galbreath Technique were discovered during the literature review.

### Manual Therapy (HVLA)

A high-velocity, low-amplitude (HVLA) technique was described by *Donald R. Murphy, DC* in *The Journal of the Canadian Chiropractic Association* in March of 2011. The article described the treatment of four cases of idiopathic otalgia. The technique is performed as follows: "The technique used in the cases reported here was one in which the thumb is placed just inside the intertragic notch, with the proximal interphalangeal joint of the index finger contacting just inside the lobule. A gentle lateral movement is applied and the patient is asked whether this produces pain. The practitioner also attempts to assess the degree of resistance to the movement (the reliability and validity of this assessment is unknown). If manipulation is deemed indicated, a high-velocity, low-amplitude thrust is performed in a straight lateral direction. An audible release typically occurs. The patient can then be taught self-mobilization in the same direction, applying low-velocity, low-amplitude oscillatory maneuvers."<sup>13</sup> No studies measuring the effectiveness of the Manual Therapy (HVLA) were discovered during the literature review.

### Integrated Osteopathic Treatment

In 1989 *Dr. William Pinal, DO*, published a case report in *The Journal of the American Osteopathic Association* detailing an integrated osteopathic treatment plan for otitis media. He utilized Cefaclor dosed appropriately along with the following osteopathic techniques: "deep soft tissue releases at both mandibular angles to increase blood supply and facilitate drainage around the eustachian tubes, hyoid release using direct articulatory approach, with subsequent alternating pressure to the lateral anterior aspect of the neck to stimulate eustachian tube drainage along with generalized lymphatic and venous drainage, bilateral shoulder raising to act as a lymphatic pump, direct muscle energy approach to the cervical spine was used, specifically at the level of C-1 and C-2, myofascial release technique to soft tissues, deep to the angles of the mandible, generalized anterior cervical soft tissue technique to facilitate arterial, venous, and lymphatic circulation in and about the head and neck."<sup>14</sup> The patient was treated for 5 days with this regimen and reported resolution of otalgia by fourth day of treatment. At a 9-month follow up, the patient had no recurrence of symptoms. Outside of *Dr. Pinal's* singular case report, no studies measuring the effectiveness of these specific techniques were discovered during the literature review.

### Steele, DO, et al Pilot study

In May of 2014 *Dr. Karen Steele, DO*, et al published results of a pilot study designed "as a dual-site, prospective, randomized, blinded, controlled clinical trial on the efficacy of a standardized OMM protocol on middle ear effusion (MEE) in young children with acute otitis media (AOM)."<sup>15</sup> The authors set out to improve upon the historical limitations in studies of Osteopathic manipulative treatment such as lack of patient recruitment, insufficient standard treatment protocol, and results based only on subjective features. Treatment plans lasted 15-30 minutes and were based on a combination of osteopathic manipulative techniques including bilateral ligamentous tension, myofascial release, and supoccipital inhibition.<sup>15</sup> In an effort to report more objective data, they collected data using tympanometry and

acoustic reflectometry. Tympanometry reports on a tympanogram the ability of the tympanic membrane to vibrate at different pressures, while acoustic reflectometry reports the likelihood of middle ear effusion. There were 43 participants that completed the study aged 6 months-2 years. There were 2 groups in this study, either standard care (antibiotics) or OMT in addition to standard care. The findings of the study were reported as follows: "standard OMT protocol administered adjunctively with standard care for patients with AOM resulted in faster resolution of MEE at 2 weeks than standard care alone."<sup>15</sup> The evidence behind this assertion is that in the general US pediatric population after acute otitis media, roughly 70% of patients will have persistent MEE by 2 weeks as compared to 18.5% noted in the patients receiving OMT along with standard care.<sup>15,16</sup> Limitations of this study include the small sample size and the lack of a sham OMT group to compare against. Prakash<sup>17</sup> wrote in an article reviewing the study by Steele, DO, et al: "Many manipulation techniques were performed in the study by Steele et al, making interpretation of results difficult—especially considering the possible low enrollment of study participants."

#### Mills, MD, et al OMT study

In September 2003 *Miriam Mills, MD*, published a study in *The Archives of Pediatrics & Adolescent Medicine* investigating the effects on osteopathic manipulative treatment as adjuvant therapy for pediatric patients with recurrent otitis media. Patients for this study were aged 6 months to 6 years old and split into two groups: either routine care or osteopathic manipulative treatment in addition to routine care. "Children in both groups were scheduled for 9 visits during the study: approximately 3 weekly, 3 biweekly, and 3 monthly."<sup>18</sup> This study reports that they followed the designed model of Steele, DO, et al by using tympanometry, however did not use acoustic reflectometry.<sup>18</sup> This study had a total of 57 patients that followed through to completion. The osteopathic treatments described in this study lacked specificity and are listed as follows: "Treatments lasted 15 to 25 minutes, which is usual in most practices. Treatments were gentle techniques on areas of restriction consisting of articulation, myofascial release, balanced membranous tension (according to teachings of William Garner Sutherland, DO, and others), balanced ligamentous tension, facilitated positional release, and/or counterstrain treatments."<sup>18</sup> Results from the study showed that the group receiving adjuvant osteopathic manipulative medicine had fewer episodes of AOM, required fewer prescriptions for antibiotics, and required fewer surgical placement of tubes.<sup>18</sup> This study reported similar limitations to previous studies due to the lack of a sham OMT group. In addition, this study reported a higher dropout rate than Steele, DO, et al. In a review of this study by Hollis King, DO, PhD commented: "My opinion is that we have proven the benefit of OMT in musculoskeletal disorders. Next, we need to develop and fund well-designed studies that demonstrate the benefit of OMT in physiologic functions and systemic disorders such as otitis media."<sup>19</sup>

#### Case report of a novel Osteopathic Manipulative Treatment: Eustachian tube traction technique

A 35-year-old male presented to the urgent care clinic with three-day history of continuous right ear pain. Patient history revealed that he had no trauma, no recent air travel and was a non-smoker. The patient had no past history of surgery. He reported no other symptoms including sore throat, hearing loss or tinnitus. Otoloscopic examination revealed right serous otitis media as evidenced by bulging right tympanic membrane with clear fluid noted. He was diagnosed with otalgia secondary to right serous otitis media. Standard of care for this diagnosis would be a 10-day course of anti-inflammatory medication. In addition to oral anti-inflammatory therapy, the patient was treated with the novel osteopathic manipulative technique titled Eustachian tube traction that has not been documented in osteopathic literature. He experienced immediate relief of his right ear pain and left the clinic pain free. On follow up the next day the patient reported that he remained pain free and was taking oral anti-inflammatory medication as prescribed.

The novel Eustachian tube traction technique was taught to the author during his third year of medical school in 1986 by an osteopathic clinical instructor. The Eustachian tube traction technique has been used for the treatment of idiopathic otalgia, otitis media (serous and infectious), vertigo, and post-tonsillectomy otalgia. The technique is performed as follows: the physician grasps the pinna of the ear with the thumb and index finger of each hand. The fifth metacarpal of the physician's hand is placed against the corner of the mandible of the patient (*Figure 3*). The hand is rotated around a vertical axis to an end-point and then the Eustachian tube is distracted with force along its axis. There is often an audible pop heard by both the patient and the physician. The authors concede that physicians will become more proficient with application of this technique. Often the patient will report immediate relief of their pain and the sensation of fluid draining from the Eustachian tube into the posterior pharynx.

#### FIGURE 3 :

Eustachian tube traction technique



## CONCLUSION

Otalgia is a mechanical problem and as such may be treatable by mechanical means. This literature search was undertaken to determine the full spectrum of manual treatments that exist and their supporting studies. Otalgia itself seems poorly understood, including the etiologies and mechanisms of the pain, despite a detailed understanding of the anatomy of the region. Review of the literature reveals four singular and three combination manual techniques.<sup>7,12,14,16,18</sup> Additionally, we submit a novel Osteopathic manipulative treatment, the Eustachian tube traction technique, into the literature. As a result of the review there is demonstrated a history of manual treatments without studies to support their reported, successful outcomes. These reports of successful management of otalgia with manual therapies are encouraging. A review of the literature on the manual treatment of otalgia leads to two conclusions. There is a need for a better understanding of the etiologies of otalgia and there is a need for further study of Osteopathic manipulative treatment in otalgia, specifically the Eustachian tube traction technique.

## AUTHOR DISCLOSURES:

No relevant financial affiliations

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