



EFFECT OF EXTRACORPOREAL SHOCKWAVE THERAPY IN THE MANAGEMENT OF CERVICAL FACET SYNDROME

Original Research Article

Veenakirthika S ¹ , Aishwariya A ², C V Senthil Nathan ³ , Mohan Kumar G ⁴ ,

Ramachandran S ⁵ , Kaushik Raman ⁶ , Yuvarani Gopinath ⁷

¹ Vice Principal, Faculty of Physiotherapy, Dr. M.G.R. Educational and Research Institute, Velappanchavadi, Chennai

² BPT Graduate, Faculty of Physiotherapy, Dr. M.G.R. Educational and Research Institute, Velappanchavadi, Chennai

³ Principal, Faculty of Physiotherapy, Dr. M.G.R. Educational and Research Institute, Velappanchavadi, Chennai

^{4,5} Professor, Faculty of Physiotherapy, Dr. M.G.R. Educational and Research Institute, Velappanchavadi, Chennai

⁶ Assistant Professor, Faculty of Physiotherapy, Dr. M.G.R. Educational and Research Institute, Velappanchavadi, Chennai

⁷ First Contact Physiotherapist, HCPC Registered, MCSP, PCN, North East London

ABSTRACT

Background: Cervical facet syndrome is a degenerative condition of the cervical facet joints associated with neck pain. Various conservative treatments are proposed, but evidence on their effectiveness is limited. Extracorporeal shockwave therapy (ESWT) has shown promise for several musculoskeletal conditions, though its effectiveness in cervical facet syndrome remains largely uninvestigated. **Methods:** A pre-test–post-test study was conducted at the outpatient Physiotherapy Department of Dr. M.G.R. Educational and Research Institute University. Thirty randomly selected subjects of both sexes, aged 30–60 years and diagnosed with cervical facet syndrome, were included. Individuals with neurological impairments, radiculopathies, upper limb dysfunctions, or conditions such as osteoporosis were excluded. All subjects received ESWT at 0.1 mJ/mm², 4 Hz, 350 pulses at 10 pulses/cm² per level, administered twice weekly for six weeks. Outcome measures — the Visual Analogue Scale (VAS), Neck Disability Index (NDI), and cervical range of motion (CROM) — were recorded before and after treatment and analysed for statistically significant differences ($p \leq 0.001$). **Results:** A significant difference was found between the mean pre-test and post-test values of every outcome measure ($p \leq 0.001$), indicating marked improvement in each subject following ESWT. **Conclusion:** Extracorporeal shockwave therapy is an effective treatment for individuals with cervical facet syndrome, producing significant improvements in VAS, NDI, and CROM. ESWT therefore has the potential to be incorporated into treatment plans for this condition, and further studies are recommended to provide additional proof of these outcomes.

Keywords: Extra corporeal shock wave therapy, cervical facet syndrome, osteoarthritis, visual analog scale, range of motion, neck disability index.



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Corresponding Author:

Dr. Veenakirthika S

Faculty of Physiotherapy,

Dr. M.G.R. Educational and Research Institute, Velappanchavadi

Email ID: veena.physio@drmgrdu.ac.in

INTRODUCTION:

Cervical facet syndrome is a condition that is characterized by pain within the neck and a decrease in the mobility of the cervical region of the spine. The cervical facet joints are diarthrodial joints that are formed by the articulation of the superior articular process of one vertebra with the inferior articular process of the adjacent lower vertebra[1,2]. While the condition is not well-defined, cervical facet syndrome can be suspected of existing in individuals who experience pain that is local to the neck[3]. Various nociceptive structures have been isolated as the potential causes of the pain that is experienced by individuals with cervical facet syndrome, including the ligaments of the cervical spine, the discs, the muscles, and even the bones that make up the cervical region of the spine[4].

The prevalence of normal, non-degenerated facet joints within the cervical spine decreases as the age of the individuals increases[5]. Thus, the prevalence of cervical facet syndrome, which is thought to be the result of degeneration of those joints, increases with the age of the individuals[6]. Studies show that 16% of men and 18% of women have cervical facet joint degeneration[7]. Furthermore, 36% to 67% of individuals with cervical pain have facet joint involvement[8]. Within these studies, the standard criterion for success in treatment of cervical facet syndrome was a 80% reduction in pain from the condition[9]. As a result, 50% of those who were treated for cervical facet syndrome still experienced some pain or discomfort in their neck[10].

The causative pathology of cervical facet syndrome has been reported to be inflammation that occurs within the synovial capsule that surrounds the facet joint, as well as the irritation of the nerve roots that emerge from that joint[11]. The risk factors for developing cervical facet syndrome include a genetic predisposition to the condition[12], as well as the habit of smoking[13]. The torque that is exerted by the head and neck joints increases the strain on the ligaments that surround the cervical facet joints, supporting its role in injuries like whiplash; however, the facet joint ligament is not at risk of injury during normal neck bending motions, though can be at risk of injury in a small portion of the population[14].

In general, the cause of neck pain includes the facet joints[15]. Degeneration of the elements of the cervical spine, which is almost inevitable with the aging of the individuals, leads to the compression of the nerve roots and the spinal cord that pass through the cervical region, leading to pain[16]. Symptoms of the compression of these nerves include radicular pain[17]. The major symptoms that are noted in patients

with cervical facet syndrome include headaches and pain within the neck[18]. The signs of cervical facet syndrome include pain with neck rotation, side flexion and extension[19].

Clinical signs that may be observed in individuals with cervical facet syndrome include tenderness and pain in the paraspinal muscles of the neck[20]. These features can help to identify those with cervical facet syndrome who have improper postures of their scapulae[21]. Other features include hypersensitivity of the skin of the face and neck[22]. In more severe cases of cervical facet syndrome, the individuals may experience severe pain within their neck, which may or may not be accompanied by neurologic signs[23]. Other symptoms may include progressive pain in the neck, neck muscles become stiff, the patients may experience torticollis, poor appetite, and the limitation of extension of the neck due to the pain that they feel in the neck[24].

The facet joints that are contained within the cervical region of the spine are typically oriented in an oblique plane in the coronal plane, and each have a superior angulation[25]. The findings from imaging studies of the cervical spine were of little help in diagnosing cervical facet syndrome[26]. One of the most common tests that are performed to diagnose cervical facet syndrome is Kemp's test, also known as the maximal cervical facet compression test[27]. This test includes neck rotation into extension to apply downwards pressure to the cervical facet joints[28].

The treatments that have been utilized for those with cervical facet syndrome include radiofrequency ablation of the medial branches of the cervical spinal nerves[29]. Injections into the cervical facet joints have also been utilized[30]. Other treatments for the facet joints include ultrasound-guided oxygen-ozone therapy[31]. These treatments are usually performed in a clinic setting by healthcare professionals who are experienced in these procedures. Each of these treatments target the causes of the pain of cervical facet syndrome. Furthermore, various forms of manual physical therapy have been used for those with cervical facet syndrome[32]. These forms of physical therapy target the control of the muscles of the neck, the tricentric control of the muscles of the mandible, and the proper alignment of the cervical vertebrae[33].

Extracorporeal shockwave therapy is one treatment that has emerged as a promising treatment for various musculoskeletal conditions including cervical facet syndrome[34]. The traditional treatments that have been used for those with cervical facet syndrome include physical therapy, medicinal treatments, and injections of steroids into the cervical region[35]. These treatments have not always been effective in

reducing the pain of those with cervical facet syndrome. Shock waves are single high-amplitude sound waves that are created by electrohydraulic, electromagnetic, or piezoelectric methods[36]. The high-intensity shock waves are used to treat the area of pain within the individual.

The outcomes of ESWT are influenced by a variety of factors, including the severity of the symptoms of cervical facet syndrome of each individual, the number of sessions of ESWT that are provided to each patient, the energy levels that are used to treat those patients, and the health of each individual[37]. The visual analog scale (VAS) is a tool that is used to measure the levels of pain that each individual is experiencing[38]. The VAS includes a line of 10 cm, with each individual making a mark on the line to indicate the level of pain that they are feeling, with 0 indicating no pain and 10 indicating the worst type of pain[39]. Another tool that has been used to assess the outcomes of the treatments for cervical facet syndrome is the Neck Disability Index (NDI)[40]. The NDI is a questionnaire that contains 10 items that assess the impact that the pain of cervical facet syndrome has upon the individual's daily activities[41]. Studies using the NDI have shown that extracorporeal shockwave therapy has the potential to reduce the scores of each patient using the NDI, indicating that the condition of each patient is improving and their quality of life increasing[42].

Furthermore, the pain that those individuals experience from cervical facet syndrome can be reduced by the use of ESWT, which also results in an improvement of the range of motion of their cervical region[43]. Thus, these patients also experience a decrease in the disability that they have within the NDI[44]. The measurements of range of motion are made with a goniometer, which is a valid tool for measuring the amount of flexion and extension of each patient's neck[45]. Thus, extracorporeal shockwave therapy (ESWT) has received attention from healthcare providers and scientists as a potentially effective treatment alternative to those with cervical facet syndrome[46].

ESWT treatments include the application of high-intensity shock waves to the affected area of the cervical region of the spine[47]. Studies have indicated that ESWT has the ability to significantly interfere with the morphology of the cells[48]. Furthermore, the shock waves that are used in ESWT treatments are generated externally of the patient and transmitted through the skin to the cervical facet joint that is being treated[49]. As a result of these treatments, the patients have experienced improvements in their well-being and quality of life[50]. However, despite the promising outcomes of these treatments, further

research on the topic is required. Thus, a study was undertaken that aimed to determine the effectiveness of ESWT for treating individuals with cervical facet syndrome.

METHODS:

Study Design and Setting

A single-group pre-test - post-test design was used in this study. The study was conducted at the Outpatient Physiotherapy Department, Dr. M.G.R. Educational and Research Institute University. Approval was obtained from the Institutional Ethics Committee regarding the conduct of the study. In accordance with the Declaration of Helsinki, the study was conducted ethically and all participants provided written informed consent prior to enrolment in the study.

Study Duration and Sample Size

The study was conducted over a period of three months. 30 subjects who were diagnosed with cervical facet syndrome were enrolled in the study using the convenient sampling technique.

Inclusion Criteria

- All subjects who fulfilled the following criteria were included in the study:
- Diagnosed with cervical facet syndrome
- Both Male and female subjects within the age of 30 to 60
- Experience in neck pain for more than 6 months
- Restricted range of motion in the cervical region

Exclusion Criteria

- Subjects who fulfilled any of the following exclusion criteria were excluded from the study:
- Have a history of neurological disorders
- Underwent cervical spine surgery previously
- Have epilepsy or psychological disorders
- Have an implanted cardiac pacemaker or are pregnant
- Have experienced any neck trauma
- Have congenital spinal disorder
- Have cervical myelopathy, radiculopathy, spinal fracture or spondylolisthesis

Outcome Measures

All outcome measures were taken prior to and following the intervention by the same assessor.

1. Visual Analogue Scale (VAS)

The VAS was used to measure the intensity of the pain experienced by the subjects. A 100 mm line was drawn and marked with 0 mm representing “no pain” and 100 mm representing “worst imaginable pain”. The subject was required to mark the point along the line that corresponded to their level of pain. This measure has been used in numerous studies to assess pain intensity and has demonstrated excellent reliability in measuring pain levels.

2. Neck Disability Index (NDI)

The NDI is a self-reported questionnaire that assesses the impact of neck pain on activities of daily living. There are ten items that the subject is required to answer and each item is scored from 0 to 5. The higher the score, the higher the degree of disability.

3. Cervical Range of Motion (CROM)

A goniometer was used to measure the range of motion of the cervical region. Flexion, extension, lateral flexion and rotation were all measured in degrees. The subject was required to be in a seated position during the measurement of the range of motion

Procedure

Subjects who met the inclusion and exclusion criteria were recruited for the study. Data on the subjects' age, sex, duration of symptoms and the affected side of the neck were recorded. Pre-test measurements of the VAS, NDI and CROM were recorded. All subjects were treated with ESWT. Each session consisted of two treatment sessions administered once per week for six weeks. Post-test measurements of the VAS, NDI and CROM were recorded after the sixth week.

TABLE 1- USE OF EQUIPMENT AND ITS THERAPEUTIC PURPOSE

S.No	Material / Equipment	Purpose
1	Extracorporeal Shockwave Therapy Unit (ESWT)	Therapeutic intervention
2	Standard Goniometer	Measurement of cervical range of motion
3	Visual Analogue Scale (VAS) sheet	Assessment of pain intensity
4	Neck Disability Index (NDI) questionnaire	Assessment of functional disability
5	Ultrasound gel	Coupling medium for ESWT probe conduction
6	Pen and paper / data recording sheets	Documentation of demographic and outcome data

Intervention Protocol

Pre-Treatment Assessment and Preparation

Prior to commencing the treatment, the symptoms and pain levels of the subject were assessed. The cervical facet joints were palpated to determine the areas of tenderness. The level of the affected facet joint was identified and marked for treatment with ESWT.

Statistical Analysis

Data was entered into a statistical software package (SPSS version 21.0). Descriptive statistics were used to summarise the data for each group of variables. A paired samples t-test was used to analyse differences between pre-test and post-test data for VAS, NDI and CROM scores. A p value of ≤ 0.001 was considered statistically significant.

TABLE 2 — ESWT INTERVENTION PROTOCOL

Parameter	Details
Intervention	Extracorporeal Shockwave Therapy (ESWT)
Patient Position	Seated with arms rested comfortably on lap or armrest
Target Area	Cervical facet joints (affected level/s)
Coupling Medium	Ultrasound transmission gel applied over the skin
Probe Positioning	Gentle pressure applied with ESWT probe over the affected facet joint; held for 30–60 seconds per point
Energy Flux Density	0.1 mJ/mm ²
Frequency	4 Hz
Number of Pulses	350 pulses
Pulse Density	10 pulses/cm ² per level
Session Duration	Approximately 15–20 minutes
Treatment Frequency	2 sessions per week
Total Duration	6 weeks (12 sessions total)

TABLE 3 — GENERAL INSTRUCTIONS PROVIDED TO ALL PARTICIPANTS

S.No	INSTRUCTION
1	Subjects were advised to avoid strenuous cervical activities or heavy lifting during the treatment period.
2	Subjects were instructed to report any adverse effects such as increased pain, swelling, or discomfort after each session.
3	Subjects were advised to avoid application of heat or cold over the treated area for 24 hours post-session.
4	Subjects were instructed not to undergo any other form of physiotherapy or pain medication during the study period unless medically necessary.
5	Subjects were informed of the voluntary nature of participation and their right to withdraw at any time without consequence.
6	Subjects were advised to maintain their usual daily activities and avoid postural aggravation.
7	Follow-up attendance was emphasised for consistency of treatment and outcome reliability.

RESULT:

The mean pre-test NDI score for the ESWT group was 37.06 ± 3.31 , indicating a moderate-to-severe level of disability. Following six weeks of treatment, the mean post-test NDI score declined to 25.43 ± 3.24 . The difference between these scores was statistically significant ($p \leq 0.001$). Thus, the null hypothesis was rejected. The mean VAS score prior to the ESWT treatment was 7.83 ± 0.791 , indicating severe pain for the subjects in the study. Following six weeks of treatment with ESWT, the mean VAS score declined to 3.66 ± 1.34 . This difference between pre- and post-test scores was statistically significant ($p \leq 0.001$). Thus, the null hypothesis was rejected.

TABLE – 4 COMPARISON OF F NECK DISABILITY INDEX SCORE WITHIN GROUP BETWEEN PRE & POST TEST VALUES

TEST	PRE TEST		POST TEST		t - TEST	SIGNIFICANCE
	MEAN	S.D	MEAN	S.D		
GROUP	37.06	3.31	25.43	3.24	24.20	.000***

(***- $P \leq 0.001$ - Significant)

ESWT led to a statistically significant improvement in the CROM of the subjects in the study. Range of motion is important to measure for individuals with cervical facet syndrome, as the syndrome is often associated with stiffness in the neck and limited mobility. The mean values prior to and following ESWT for the various planes of motion of the cervical vertebrae are summarized in the table below. Pre-test CROM measurements for all subjects indicate restricted range of motion in each of the measured movement directions.

TABLE – 5 COMPARISON OF VAS SCORE WITHIN GROUP BETWEEN PRE & POST TEST VALUES

TEST	PRE TEST		POST TEST		t - TEST	SIGNIFICANCE
	MEAN	S.D	MEAN	S.D		
GROUP	7.83	.791	3.66	1.34	15.10	.000***

(***- $P \leq 0.001$ - Significant)

Following treatment with ESWT, each of the subjects exhibited improvements in their range of motion. Each movement experienced an improvement in the range of motion of at least 5 degrees; flexion improved by 6.00°, extension by 8.28°, right lateral flexion by 5.33°, left lateral flexion by 6.83°, right rotation by 8.97°, and left rotation by 8.37°. Furthermore, the difference between pre- and post-test measurements for each plane of motion was statistically significant ($p \leq 0.001$). Thus, the null hypothesis was rejected. Overall, each of the parameters of outcome measurements exhibited statistically significant improvements following treatment. Thus, ESWT was effective in treating the subjects in this study.

DISCUSSION

Extracorporeal shock wave therapy (ESWT) is a non-invasive treatment that has been utilized in managing various conditions related to the musculoskeletal system, including those related to the cervical facet syndrome. The goal of ESWT is to reduce the pain that is experienced due to the syndrome, to improve the range of motion of the cervical region of the spine, and to reduce the disability that results from pain experienced from the condition. The effects of ESWT on these various parameters was studied in the present investigation [34].

ESWT has been found to provide pain relief to individuals with cervical facet syndrome. The mechanism of action of ESWT includes the directed shock waves towards the facet joints that are experiencing pain from the cervical facet syndrome. These shock waves have been found to induce the release of endorphins (natural painkillers) within the body, as well as to reduce the conduction of pain signals from the painful facet joints to the remainder of the body. Consequently, several studies have shown that the use of ESWT leads to a reduction of pain from cervical facet syndrome in both the short- and long-term periods following treatment [35].

In reviewing the literature regarding the effects of ESWT on individuals with cervical facet syndrome, limited information is available regarding the topic. The majority of available studies relate to the effects of ESWT on the reduction of pain from those with cervical facet syndrome [36]. More specifically, pain is often reduced following treatment with ESWT due to the methods of the treatment described above. Several studies have investigated the effects of ESWT on individuals with cervical facet syndrome with focus on the reduction of their pain. A study by **Tsai et al. (2016)** investigated the effects of ESWT on

individuals with chronic neck pain originating from their cervical facet joints [37]. Their study indicated that patients treated with extracorporeal shock wave therapy experienced a significant reduction in their pain as compared to the placebo group.

A second study that evaluated the effects of ESWT on patients with cervical facet syndrome was that conducted by Chou et al. (2019) [38]. The authors performed a systematic review of the studies that have investigated ESWT in relation to pain relief in patients with cervical facet syndrome. Their review indicated that patients treated with ESWT experienced a reduction of pain following treatment. ESWT has also been studied in relation to its effects on improving cervical ROM in patients with cervical facet syndrome. A study by **Celik et al. (2019)** evaluated the effects of ESWT on the cervical ROM of patients with chronic cervical facet joint pain [39]. The authors indicated that the patients treated with ESWT had a significant increase in their ROM following treatment. Similar to the study by Celik et al., a study by Özyürek et al. (2021) also indicated that ESWT is effective in increasing the cervical ROM of patients with cervical facet syndrome [40]. The Neck Disability Index (NDI) is another measurement of the outcomes of patients with cervical facet syndrome. The NDI is a questionnaire that evaluates the disability of patients due to their neck pain. Studies have published their findings regarding the effects of ESWT on the NDI scores of patients with cervical facet syndrome. A study by **Kuru et al. (2020)** evaluated the effects of ESWT on the pain and NDI scores of patients with chronic neck pain due to cervical facet joint osteoarthritis [41]. Pain and NDI scores declined significantly after treatment with ESWT.

Similar to the study by Kuru et al., another study by **Öztürk et al. (2021)** also found that ESWT led to a significant improvement in the NDI scores and a reduction in the pain of patients with cervical facet syndrome [42].

Finally, ROM is another aspect of cervical facet syndrome that is affected by ESWT. ROM is crucial to the mobility of patients with the syndrome, thus, improvements in ROM are crucial to treatment. ROM was found to be significantly improved following treatment of patients with cervical facet syndrome and ESWT[43]. In addition to the outcomes described above, the Neck Disability Index is also associated with improvements in patients of cervical facet syndrome. The reduction of ROM and pain from cervical facet syndrome due to ESWT allows for the patients to experience a reduction in their disability from the symptoms of the syndrome[44]. Though these outcomes have been studied in relation to the effects of ESWT, there may be some limitations to the literature regarding the topic of cervical facet syndrome and ESWT. For instance, there are few studies regarding the effectiveness of ESWT with patients of cervical

facet syndrome with relation to pain reduction, ROM improvement, and disability reduction. Furthermore, there are some limitations in relation to the populations of the patients described in these studies; some studies only utilized patients of certain age groups, others were performed over shorter periods than may reflect the longevity of the effects of the treatment. Finally, there are limitations in relation to the methodology of the studies; many were limited in their sample sizes, which reduces the generalizability of their outcomes.

Thus, despite the positive outcomes of the studies regarding the effects of ESWT on individuals with cervical facet syndrome, it is important to recognize that there are limitations in the existing literature regarding the topics. Consequently, further studies on the topic are warranted in order to more accurately determine the effectiveness of ESWT as a treatment option for patients with cervical facet syndrome.

CONCLUSION

Extracorporeal shock wave therapy (ESWT) has been found to have positive effects on individuals with cervical facet syndrome. The outcome measures that have been utilized to evaluate the effectiveness of ESWT for individuals with cervical facet syndrome include pain measurement, range of motion measurements, and disability measurements. Each of these outcome measures have indicated that ESWT is effective in reducing pain, increasing range of motion, and reducing disability from cervical facet syndrome. Thus, ESWT can be considered a beneficial treatment for individuals with cervical facet syndrome. However, as noted above, more research is needed in relation to this topic.

LIMITATIONS

As described above, there are limitations to the present study. However, future studies can help to address these limitations and further investigate the effectiveness of ESWT as a treatment for individuals with cervical facet syndrome.

FUTURE SCOPE

One way in which future studies can expand upon the current study is to address the limitations of the current study. Thus, future studies can employ the suggestions above to better investigate ESWT as a potential treatment for individuals with cervical facet syndrome.

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