

## EFFECT OF THERAPEUTIC ULTRASOUND FOR NECK PAIN : A SYSTEMATIC REVIEW

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### ABSTRACT

**Background:** The fourth most common cause of disability is neck discomfort, which affects more than 30% of people annually. The majority of acute neck pain episodes will go away with or without therapy, but about 50% of people will still have discomfort or recurrences on a regular basis.

**Aims :** This systematic review is to review the effect of therapy with ultrasound for neck pain.

**Methods:** This study demonstrated compliance with all requirements by means of a comparison with the standards established by the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020. Thus, the specialists were able to guarantee that the research was as current as feasible. Publications released between 2014 and 2024 were considered for this search strategy. This was accomplished by utilizing a number of distinct online reference sites, including Pubmed, ScienceDirect, and SagePub. It was determined that reviews, previously published works, and partially completed works would not be included.

**Result:** In the PubMed database, the results of our search brought up 5375 articles, whereas the results of our search on SAGEPUB brought up 7781 articles, our search on SCIENCE DIRECT brought up 30045 articles. The results of the search conducted for the last year of 2014 yielded a total 2864 articles for PubMed, 3376 articles for SAGEPUB and 13342 articles for SCIENCE DIRECT. In the end, we compiled a total of 7 papers, 5 of which came from PubMed, 1 of which came from SAGEPUB and 1 of which came from SCIENCE DIRECT. We included seven research that met the criteria.

**Conclusion:** In summary, therapeutic ultrasonography is a safe treatment that has the potential to lessen pain intensity more than sham or no treatment at all. It is unclear if using therapeutic ultrasonography in addition to other traditional therapies reduced pain, increased disability, or improved quality of life.

**Keyword:** Ultrasound therapy, neck pain

## INTRODUCTION

A complex illness, neck discomfort is a significant issue in contemporary life. Even though it might not be the most prevalent musculoskeletal condition, neck discomfort is nonetheless a serious concern. The financial toll that neck discomfort takes is astounding and includes issues with employment, lower productivity, and treatment expenses. With an estimated \$134.5 billion in medical costs in 2016, low back and neck pain accounted for the largest portion of all ailments among the 154 that were treated in the US. An average of 11.4 days of work absence was attributed to neck discomfort among 25.5 million Americans in 2012. The incidence rate and age-standardized prevalence of neck discomfort worldwide in 2017 were 806.6 and 3551.1 per 100,000, respectively.<sup>1-3</sup>

Most people—roughly two thirds—will at some point experience neck pain. Women are more likely than males to be afflicted, and the prevalence is highest in middle age. With a mean lifetime prevalence of 48.5% (range 14.2–71.0%) and a mean point prevalence of 7.6% (range 5.9–38.7%), the prevalence of neck discomfort varies greatly between research. Neck discomfort accounts for about 15% of hospital-based physiotherapy referrals in the UK and 30% of chiropractic referrals in Canada. In the Netherlands, up to 2% of appointments with general practitioners are related to neck discomfort.<sup>4</sup>

It's unknown what causes simple neck ache. The majority of cases of simple neck discomfort are linked to poor posture, anxiety and depression, neck strain, injuries sustained at work, or injuries sustained while sports. Degenerative and mechanical causes (often called cervical spondylosis) are more common in chronic pain. Whiplash injuries are the most common soft-tissue damage that causes some neck discomfort. In rare cases, cervical spine disorders such as disc prolapse and inflammatory, infectious, or malignant diseases can cause neck discomfort with or without neurological symptoms.<sup>4</sup>

Ultrasound (US) increases blood flow and metabolic activity, applying both mechanical and thermal effects. US effects are also caused by non-thermal processes like as mechanical stress and ultrasonic cavitation, in addition to heat.<sup>5</sup> In the clinical and physiotherapy domains, ultrasound (US) has gained widespread acceptance and recognition as a non-invasive therapeutic modality. US is made up of piezoelectric crystals that convert electrical energy into mechanical oscillation energy by use of a high-frequency alternate current. US's heat and non-thermal actions would momentarily improve the tendons, ligaments, and joint capsules' pliability, which would reduce joint stiffness, discomfort, and related muscular spasms while also momentarily increasing blood flow. The evidence on the impact of the United States on MPS remains contentious. While some research shows that using US for MPS significantly reduces pain intensity in the upper trapezius muscles (uTMs), other studies do not find any discernible improvement in pain relief or superiority over placebo.<sup>6</sup>

## METHODS

### Protocol

The author of this study ensured that it complied with the standards by adhering to Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020 guidelines. This is done to guarantee the accuracy of the results that are derived from the investigation. Thus, the specialists were able to guarantee that the research was as current as feasible. Publications released between 2014 and 2024 were considered for this search strategy. This was accomplished by utilizing a number of distinct online reference sites, including Pubmed, ScienceDirect, and SagePub. It was determined that reviews, previously published works, and partially completed works would not be included.

### Criteria for Eligibility

In order to complete this literature evaluation, we looked at published research that discusses the effect of therapy with ultrasound for neck pain. This is done to enhance the patient's therapy management and to offer an explanation. This paper's primary goal is to demonstrate the applicability of the issues that have been noted overall.

To be eligible to participate in the study, researchers had to meet the following requirements: 1) English must be used to write the paper. The manuscript must fulfill both of these conditions in order to be considered for publication. 2) A few of the examined studies were released after 2013 but prior to the time frame considered relevant by this systematic review. Editorials, submissions without a DOI, already published review articles, and entries that are nearly exact replicas of journal papers that have already been published are a few examples of research that are prohibited.

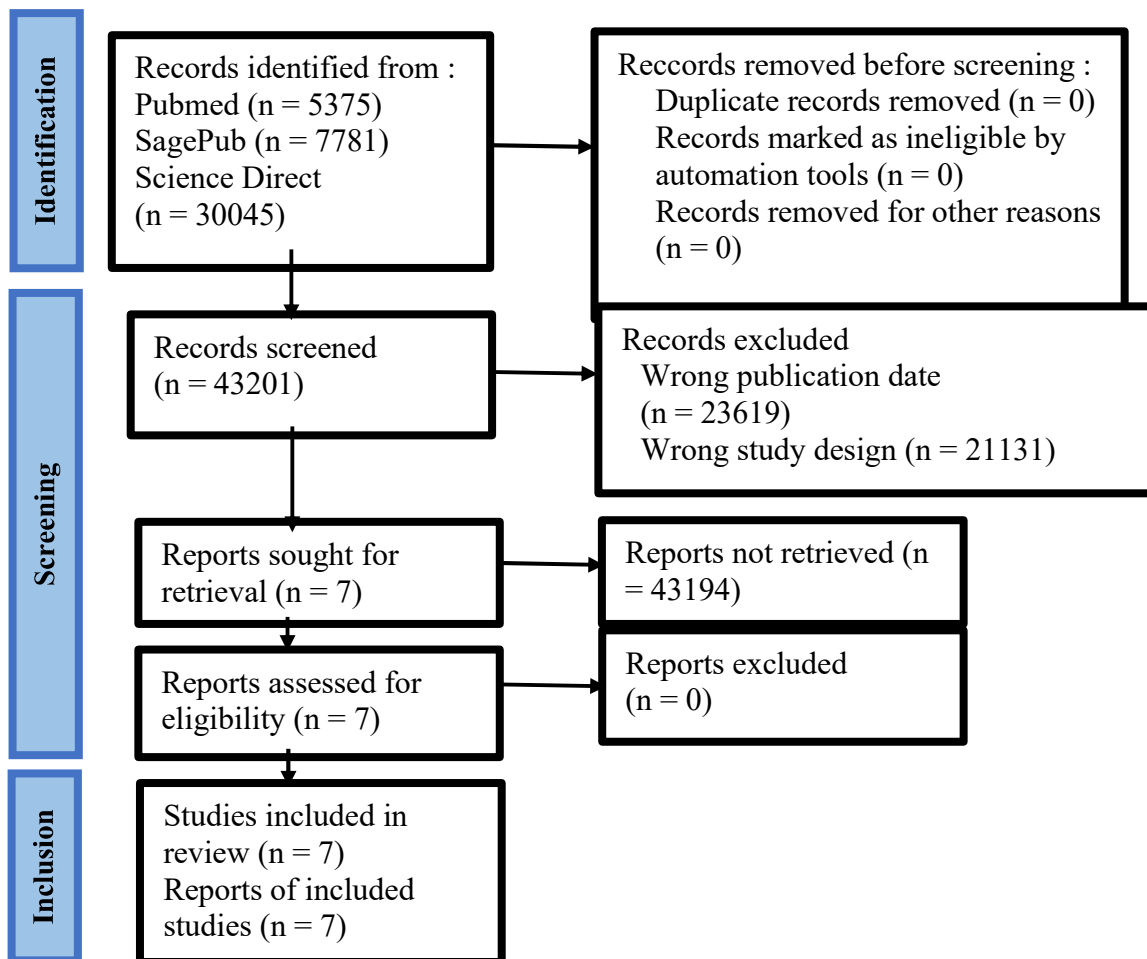
### Search Strategy

We used "ultrasound therapy" and "neck pain" out using the PubMed and SAGEPUB databases by inputting the words: ("diagnostic imaging"[MeSH Subheading] OR ("diagnostic"[All Fields] AND "imaging"[All Fields]) OR "diagnostic imaging"[All Fields] OR "ultrasound"[All Fields] OR "ultrasonography"[MeSH Terms] OR "ultrasonography"[All Fields] OR "ultrasonics"[MeSH Terms] OR "ultrasonics"[All Fields] OR "ultrasounds"[All Fields] OR "ultrasound s"[All Fields]) AND ("therapeutics"[MeSH Terms] OR "therapeutics"[All Fields] OR "therapies"[All Fields] OR "therapy"[MeSH Subheading] OR "therapy"[All Fields] OR "therapy s"[All Fields] OR "therapys"[All Fields]) AND

("neck pain"[MeSH Terms] OR ("neck"[All Fields] AND "pain"[All Fields]) OR "neck pain"[All Fields])) AND ((clinicalstudy[Filter]) AND (2014:2024[pdat])) used in searching the literature.

**Data retrieval**

After reading the abstract and the title of each study, the writers performed an examination to determine whether or not the study satisfied the inclusion criteria. The writers then decided which previous research they wanted to utilise as sources for their article and selected those studies. After looking at a number of different research, which all seemed to point to the same trend, this conclusion was drawn. All submissions need to be written in English and can't have been seen anywhere else.



**Figure 1. Prisma Flow Diagram**

Only those papers that were able to satisfy all of the inclusion criteria were taken into consideration for the systematic review. This reduces the number of results to only those that are pertinent to the search. We do not take into consideration the conclusions of any study that does not satisfy our requirements. After this, the findings of the research will be analysed in great detail. The following pieces of information were uncovered as a result of the inquiry that was carried out for the purpose of this study: names, authors, publication dates, location, study activities, and parameters.

**Quality Assessment and Data Synthesis**

Each author did their own study on the research that was included in the publication's title and abstract before making a decision about which publications to explore further. The next step will be to evaluate all of the articles that are suitable for inclusion in the review because they match the criteria set forth for that purpose in the review. After that, we'll determine which articles to include in the review depending on the findings that we've uncovered. This criteria is utilised in the process of selecting papers for further assessment. In order to simplify the process as much as feasible when selecting papers to evaluate. Which earlier investigations were carried out, and what elements of those studies made it appropriate to include them in the review, are being discussed here.

**RESULT**

In the PubMed database, the results of our search brought up 5375 articles, whereas the results of our search on SAGEPUB brought up 7781 articles, our search on SCIENCE DIRECT brought up 30045 articles. The results of the search conducted for the last year of 2014 yielded a total 2864 articles for PubMed, 3376 articles for SAGEPUB and 13342 articles for SCIENCE DIRECT. In the end, we compiled a total of 7 papers, 5 of which came from PubMed, 1 of which came from SAGEPUB and 1 of which came from SCIENCE DIRECT. We included seven research that met the criteria.

Benatto, et al<sup>7</sup> (2022) showed that craniocervical muscle-strengthening exercise (CMSE) were not enough to improve cervical muscle function, lessen migraine frequency and severity, or lessen impairments associated to neck discomfort and migraines. This was discovered in spite of the cervical muscles' reduced electromyographic activity in the final phases of the craniocervical flexion test (CCFT) and their elevated median frequency in the endurance test.

Dibai-Filho, et al<sup>8</sup> (2017) showed that in conjunction with a manual treatment program, the application of static ultrasonography or diadynamic currents to myofascial trigger points in the upper trapezius did not produce any more advantages than manual therapy by itself.

Petterson, et al<sup>9</sup> (2020) showed that patients with upper trapezius myofascial pain in the neck and shoulder saw a considerable reduction in pain with low-intensity continuous ultrasound therapy. Patients' GROG ratings improved in a way that was clinically significant after receiving LICUS therapy. The clinical trial's findings suggest that upper trapezius myofascial pain can be successfully treated with 18,720 Joules as part of the LICUS therapy.

Kenareh, et al<sup>10</sup> (2021) showed that the results of this study demonstrated that both photobiomodulation and physical therapy can lessen the various components of chronic neck pain, with laser treatment having a far greater impact than physical therapy.

Yilmaz, et al<sup>11</sup> (2020) showed that by lowering discomfort, it was discovered that the HILT plus exercise program and the transcutaneous nerve stimulation/ultrasound (TENS / US) plus exercise program both improved cervical range of motion and quality of life. These two treatment plans can be used interchangeably in clinical settings and have comparable results when treating cervical pain brought on by cervical disc herniation (CDH). The principles of applying high intensity laser therapy (HILT) to painful areas or tissues (amount of area applied, dose applied, energy delivered, number of pulses, session duration, frequency of sessions) must be further investigated, and the effects of exercise treatment on the outcomes of both treatment groups must be ruled out.

**Table 1. The literature include in this study**

Author	Origin	Method	Sample	Result
Benatto et al, 2022 <sup>7</sup>	Brazil	Randomized controlled trial	42 patients	After eight weeks and at the three-month follow-up, there were no differences seen in the changes shown in the primary outcomes ( $p > 0.05$ ). In terms of the secondary outcomes, craniocervical workouts led to a decrease in the amplitude of muscular activity of the upper trapezius and anterior scalene in the latter phases of CCFT ( $p < 0.010$ ) and an improvement in the sensitivity of the frontal muscle ( $p = 0.040$ ). Additionally, surface electromyography revealed decreased muscle activity in the splenius capitis and anterior scalene throughout the endurance test ( $p < 0.045$ ).
Dibai-Filho et al, 2017 <sup>8</sup>	Brazil	Randomized clinical trial	60 patients	The following measures showed no group-versus-time interaction: skin temperature, cervical range of motion, pressure pain threshold, Neck Disability Index, Numeric

				Rating Scale, and Pain-Related Self-Statement Scale (F-value range, 0.089-1.961; P-value range, 0.106-0.977). Additionally, we did not find any variations in electromyographic activity across the groups ( $P > 0.05$ ).
<b>Petterson et al, 2020<sup>9</sup></b>	USA	Randomized clinical trial	33 patients	Every person who signed up for the trial completed it, and there were no notable variations in baseline outcome measures or demographic characteristics across the groups. Active therapy participants reported a significant mean pain reduction from baseline of 2.61 points ( $p < 0.001$ ), whereas the placebo group saw a 1.58 point decline from baseline ( $p = 0.087$ ). This translated into a significant 1.03 point decrease in the active group over the placebo group ( $p = 0.003$ ). The active group's total GROC was 2.84 points, considerably greater than the placebo group's 0.46 points ( $p < 0.001$ ).
<b>Kenareh et al, 2021<sup>10</sup></b>	Iran	Randomized controlled trial	60 patients	In physiotherapy, the participants' mean age was $37.53 \pm 9.52$ , whereas in laser therapy, it was $41.16 \pm 7.85$ years. Following both types of therapies, the VAS and NDI ratings dropped, with photobiomodulation having a considerably greater impact than physiotherapy ( $P < 0.001$ ). According to NDPS and BQN questionnaires, both treatment methods had a considerable impact on several elements of chronic neck pain; photobiomodulation's effect was more pronounced than physiotherapy's.
<b>Yilmaz et al, 2020<sup>11</sup></b>	Turkey	Randomized trial	40 patients	At baseline, there was no difference in the groups' cervical ROM, VAS, or NPADS values ( $p > 0.05$ ). Following the intervention, there was a substantial improvement in both groups' cervical ROM, VAS, and NPADS values ( $p < 0.05$ ). Upon comparing the groups' post-treatment VAS, NPADS, and ROM values, no statistically significant difference was seen between

				them ( $p>0.05$ ). In individuals with CDH, both therapeutic modalities showed analgesic effectiveness and improved function following 4 weeks of therapy (totaling 20 treatment sessions over 5 days a week).
<b>Rahbar et al, 2021<sup>12</sup></b>	Iran	Randomized clinical trial	72 patients	Both shock wave and ultrasound demonstrated significant improvements at first week examinations, with $P < 0.05$ for both the visual analogue scale ( $7.50 \pm 1.71$ to $5.72 \pm 2.20$ and $6.22 \pm 2.54$ to $4.95 \pm 2.86$ , respectively, $P = 0.083$ ) and disability index ( $54.24 \pm 15.53$ to $39.04 \pm 19.58$ and $50.23 \pm 19.57$ to $32.10 \pm 18.34$ , $P = 0.495$ ). Further improvements were noted in the shock wave ( $-4.00 \pm 2.22$ and $-20.24 \pm 16.56$ ) and ultrasound ( $-2.18 \pm 2.71$ and $-21.79 \pm 10.56$ ) groups with regard to the visual analogue scale and disability index in the week 4 assessments. In contrast, the shock wave group's visual analogue scale improved more than the ultrasound group's throughout the fourth week of assessments ( $P = 0.012$ ).
<b>Overmann et al, 2024<sup>13</sup></b>	Germany	Observational study	217 patients	Significant variations are seen in the deep fascia's rigidity, tone, and fascia thickness. Correlations between these factors and chronic pain and depression are also found.

Rahbar, et al<sup>12</sup> (2021) showed that one month following treatment, extracorporeal shock wave therapy was superior to ultrasonography in managing pain intensity. But at this stage, it was no more effective than ultrasonography in raising the neck disability index.

Overmann, et al<sup>13</sup> (2024) showed that the study emphasizes how depression and chronic pain affect fascial characteristics, underscoring the need for more research in this area to fully understand the complex relationships and their therapeutic implications.

**DISCUSSION**

Despite being one of the top five chronic pain illnesses in terms of prevalence and years lost to incapacity, neck pain places a significant personal and social burden on sufferers, but it only receives a small portion of the cash allocated to low back pain research. Genetics and psychosocial variables are risk factors for persistence; although while the majority of acute episodes end on their own, over one year later, over one-third of those affected still experience low-grade symptoms or recurrences. Benatto, et al did study to verify the effectiveness of therapy for neck pain, they performed 3 month follow up in 21 persons of intervention group and 21 persons with sham ultrasound group.<sup>7</sup>

Dibai-Filho, et al also in their study to asses the effect of static ultrasound for chronic neck pain did a single-blind randomized trial in both men and women between 18 and 45 years old. The subjects devided into 3 groups with group 1 with manualt herapy, group 2 with manual and static ultrasound, and the 3<sup>rd</sup> group with manual and diadynamic. The result showed the ultrasound therapy nor the diadynamic associated with manual therapy did not showed the better benefits.<sup>8</sup>

One new high-dosimetry ultrasound-based therapy that is being used to treat myofascial pain and speed up tissue repair is called low-intensity continuous ultrasound, or LICUS. In the Petterson et al. research, LICUS therapy is clinically assessed in a multi-site, randomized, double-blind, placebo-controlled trial for the treatment of persistent upper neck and shoulder pain. In their study, LICUS showed improvement of GROC scores in patients.<sup>9</sup>

Office workers frequently complain of chronic neck pain. In study by Kenareh, et al with 60 office workers, aged 25 until 55 years, showed the result that physiotherapy and photobiomodulation both help to lessen the various components of persistent neck pain, however laser treatment had a far greater impact than physiotherapy.<sup>10</sup> Yilmaz, et al did study of total 40 patients which is 22 women and 18 men that affected with cervical disc herniation and feel the neck pain showed that by lowering discomfort, it was discovered that the HILT plus exercise program and the TENS / US plus exercise program both improved cervical range of motion and quality of life. These two treatment plans can be used interchangeably in clinical settings and have comparable results when treating cervical pain brought on by CDH.<sup>11</sup>

Rahbar, et al also compare the effect of extracorporeal shock wave therapy and the standard care therapy contains ultrasound, hot pack and self stretch exercises in 72 patients that divided into 3 groups that are shock wave group, standard care and control group contains 24 patients each. The study showed result one month following treatment, extracorporeal shock wave therapy was superior to ultrasonography in managing pain intensity. But at this stage, it was no more effective than ultrasonography in raising the neck disability index.<sup>12</sup>

## CONCLUSION

In summary, therapeutic ultrasonography is a safe treatment that has the potential to lessen pain intensity more than sham or no treatment at all. It is unclear if using therapeutic ultrasonography in addition to other traditional therapies reduced pain, increased disability, or improved quality of life.

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