



## Calcific tendinitis of the supraspinatus tendon treated with iontophoresis: a case report

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### Abstract

**Introduction:** In particular, calcium hydroxyapatite crystals that are frequently deposited within the supraspinatus and infraspinatus tendons are the cause of calcific tendinitis of the shoulder, an acute or chronic painful condition brought on by calcific deposits inside or around the rotator cuff tendons.

**Case presentation:** A 46-year-old patient arrived at the clinic complaining of excruciating pain and significant movement impairment. Calcific tendonitis was diagnosed during a clinical assessment. Iontophoresis using a 5% acetic acid solution was applied three times a week for ten sessions as part of the treatment.

**Discussion:** Various studies have identified 5% acetic acid iontophoresis as an effective intervention for calcific tendinitis-associated pain. Additionally, this treatment modality was partially responsible for the reduction in calcific deposits.

**Conclusion:** Ten sessions of iontophoresis therapy using a 5% acetic acid solution were conducted. Following completion, there was a full recovery of shoulder range of motion, a complete clearance of calcific deposits, and no pain.

**Keywords:** Calcific tendinitis, Iontophoresis, Acetic acid, Shoulder

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## Key findings

1. The pre-intervention VAS for pain was 10/10; it decreased to 0/10 after the iontophoresis therapy using a 5% acetic acid solution.
2. The pre-treatment range of motion was limited in all directions; the full range was regained post-intervention.
3. Complete resolution of the calcific deposit that had been visible before treatment occurred after iontophoresis therapy using a 5% acetic acid solution.

## Introduction

The self-limiting condition known as calcific tendinitis of the shoulder, or enthesopathy, is typified by the accumulation of calcium phosphate crystals in the rotator cuff tendons (1). It is uncommon in people over 70 and most frequently happens in those between the ages of 30 and 50 (2). It affects both shoulders in 10% of patients, is more prevalent in the right shoulder than the left, and is roughly twice as likely to occur in women as in males (3). The most frequent location is 1.5–2 cm from the greater tuberosity's supraspinatus tendon insertion point. It has been reported in the literature that calcific tendinitis is more common in the supraspinatus tendon than in other tendons (4).

The way calcific tendinitis is treated varies, and a patient's level of pain is a key consideration. The conventional treatment for calcific tendinitis often starts with conservative management. If initial conservative measures prove ineffective or under specific circumstances, surgical intervention may be considered (5, 6). Recently, various noninvasive and conservative treatment options have demonstrated effectiveness. These include oral anti-inflammatory drugs, therapeutic exercises, a combination of ultrasound therapy with therapeutic exercises, Iontophoresis with acetic acid, ultrasound therapy paired with mesotherapy, and ultrasound-guided needling (UGN) and extracorporeal shock wave therapy (ESWT) (7-9). These methods have shown potential in reducing calcium deposit size, relieving pain, and improving shoulder functionality (10).

Acetic acid iontophoresis was first performed for the treatment of calcifying tendinitis of the shoulder back in 1955. The physiological mechanism behind this treatment is based on a transdermal drug delivery method wherein most ionizable substances are transdermally delivered through the hair follicle and sweat gland channels because of the polar action of direct-galvanic-current motives. The resulting current, therefore, induces the translational motion of ionized molecules positioned under the electrode of identical polarity toward the electrode of opposite charge. In this specific arrangement, acetic acid-an inorganic anion-was provided under the cathode or the negatively charged electrode and was subjected to migration toward the positively charged electrode-the anode-by the action of galvanic current. Since calcifications consist mainly of hydroxyapatite crystals that are water-insoluble but acid-soluble, there is a reasonable expectation of the reduction of calcification with this method (1). The effectiveness of 10 sessions of 5% acetic acid iontophoresis in treating calcific tendinitis with a clinical diagnosis is examined in this case report.

## Case presentation

A 46-year-old female working in the accounts section in a children's hospital was referred for complaints of pain and stiff right shoulder to the physiotherapy clinic. The patient reported that the shoulder pain had gradually begun two months ago, leading to progressive limitation of all shoulder movements. Activities of daily living, such as dressing and eating, were notably affected.

Initial postural assessment during the course of the examination revealed kyphotic posture with rounded shoulders and forward head posture. On palpation, tenderness and pain on the shoulder were located over the supraspinatus tendon, the deltoid, and subscapularis muscles. It was impossible to perform a complete physical examination of the patient, including active and passive range of motion assessments (The range of motion for abduction and flexion was recorded at 20 degrees, with no observable extension or rotational movement.) and specialized tests, in view of the patient's severe pain, which he described as VAS scores of 10/10. Imaging finding [X-ray] revealed calcification within the subacromial space (Figure 1).



**Figure 1.** Anteroposterior external rotation radiograph of the right shoulder, demonstrating marked soft tissue calcifications identified at the insertion site of the supraspinatus tendon.

So, following the diagnosis, the selected modality of treatment was acetic acid iontophoresis. Acetic acid, being negatively charged, was transferred into the body using the cathode. Iontophoresis treatment was administered in sessions of 10 series, three times a week on alternate days for 15 minutes each.

The cathode was then soaked in a solution made of 0.05% acetic acid and placed over the proximal attachment of the supraspinatus tendon (This region, situated near the insertion of the superior rotator cuff, is characterized by reduced vascularity(2)). It was to be wrapped in place with an elastic bandage. The anode electrode was wet with water only and positioned on the distal portion of the same hand over the bony region on the dorsal side of the wrist. A galvanic current was delivered to using an Electrotherapy stimulator.

The size of the cathode and anode pads used for the treatment was each 20 cm<sup>2</sup>. The position, according to Modalities for Therapeutic Intervention (11) is that the maximum current density for the cathode is 0.5 mA/cm<sup>2</sup> and for the anode is 1 mA/cm<sup>2</sup>. With the size of the pad being 20 cm<sup>2</sup>, the maximum allowable current calculated to 10 mA. The current amplitude was calculated using the following formulas (11):

$$\text{current density (CD)} = \frac{\text{current amplitude (mA)}}{\text{conductive surface area of the electrode (cm}^2\text{)}}$$

The current amplitude in first two sessions was 6 mA, increasing in the third session to 8 mA and further increased in subsequent sessions to 10 mA. During the first four sessions, manual release techniques were also

applied on the subscapularis and pectoralis minor muscles. By the end of the fourth session, there was already a significant decrease in the intensity of his pain, and he already had a VAS score of 2/10.

Starting with the fifth session, exercise teachings related to kinesitherapy for kyphotic posture have been introduced in order to further improve therapeutic results. At the end of the sessions, he had full shoulder range in all movements and only felt pain at the end of the range of motion. In the radiographic image, the calcific deposit from the supraspinatus tendon insertion was gone (Figure 2).



**Figure 2.** Anteroposterior external rotation radiograph of the right shoulder, demonstrates marked improvement in the previously noted soft tissue calcifications identified at the insertion site of the supraspinatus tendon.

## Discussion

The major treatment objectives for calcific tendinopathy include pain, limitation of movement, and size of calcification (12). In the current study, all three variables were measured as treatment outcomes. All three parameters showed dramatic changes after iontophoresis with 5% acetic acid. In particular, the patient's pain score reached zero by the end of ten sessions, the shoulder range of motion became fully restored, and the calcification resolved completely.

Acetic acid iontophoresis has emerged as a promising conservative treatment for calcifying tendinitis, particularly in the context of various tendons, including the Achilles and shoulder (1). This technique utilizes a direct electric current to enhance the transdermal

delivery of acetic acid, which is believed to facilitate the resorption of calcific deposits (13). While acetic acid iontophoresis shows promise as an effective treatment for calcifying tendinitis, some studies indicate that its efficacy may vary based on individual patient factors and the specific tendon affected (1, 4, 14).

Iontophoresis with 5% acetic acid has been shown in numerous studies to be effective in lowering calcific tendinitis pain, it has been demonstrated that iontophoresis with acetic acid not only lessens pain but also shrinks calcific deposits (15). In addition, in a case report, 3% acetic acid was tested for its effect in calcific tendinopathy of the shoulder for a period of 16 weeks. The results presented an agreement with the present study; that also showed inadequate explanation for the effectiveness of iontophoresis (12).

Although interim analyses were promising, one cannot exclude that acetic acid does not effectively penetrate into the skin barrier. Previous investigations carried out on iontophoretic drug delivery did show the transdermal penetration of some anti-inflammatory drugs and a poor passage of cortisone in humans; however, no confirmation of transdermal absorption has been evidenced so far referring to acetic acid itself (16, 17). Animal and human studies using radioactive tracers, along with techniques such as fluorescein dye tracking and scanning electrochemical microscopy, have explained the electrophoretic processes: diffusion, migration, and electro-osmosis (18). None of these, however, have actually researched resorptive capabilities of acetic acid through the skin influenced by galvanic current (1). The lack of long-term follow-up and the absence of comparisons with other therapeutic methods were among the limitations of the present study.

## Conclusion

While galvanic stimulation chemical burns can be considered as some of the important complications of iontophoresis, no such complication was observed in this case. From the literature today, Extracorporeal shockwave therapy, Ultrasound-guided needle lavage, and surgical intervention are the mainstream treatment for shoulder calcium deposits (2). Only two clinical trials, so far, have involved the use of 5% acetic acid

iontophoresis for this condition. Both used the primary outcomes as pain reduction and improvement in shoulder function. By contrast, the therapeutic approach presented in the current study brought about complete pain relief, full recovery of the range of motion of the shoulder, normal function, and even complete disappearance of calcium deposits that were confirmed with imaging after only ten sessions of treatment. Future study could involve investigating the effects of acetic acid on skin permeability and conducting clinical trial studies. And also, the comparison of iontophoresis, shockwave therapy, and dry needling treatments could be explored in future studies.

## Author contribution

**SK-GA** performed Conceptualization, Software, Methodology, Writing – Original, performed Formal analysis. **AR** data collection.

## Conflict of interest

There is no Conflicts of interest/competing interests.

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