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## THE EFFECT OF ULTRASONIC THERAPY IN ACUTE NEURITIS IN LEPROSY PATIENT

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### **Abstract:**

**Objective:** To study the effectiveness of ultrasonic therapy in neuritis in leprosy patients, those which are undergoing and also, those which are underwent MDT treatment. Whereas, also to find out cumulative effect of ultrasound and prednisone on these patients.

**Design:** A prospective unicentre interventional study in rural setting of Physiotherapy Department, Sita Ratan Hospital, Anandwan was done after an informed consent. 24 patients diagnosed with Hansen's disease and having symptoms of neuritis were taken for study, out of which two discontinued. Hence, sample size was 22. Number of sessions were 8-10, twice a week for four weeks. Before and after the completion of total sessions assessment had been done.

**Results:** After the completion of therapy tingling was relieved in 67.27% of patients. Tenderness and nerve thickening / edema was remarkably reduced that is upto 91.66% and 95.21% respectively. The muscle power has been regained and improved in 80% of patients. While, sensory impairment is still an issue not resolved very well that is 24.35% only improvement has been found. In patients who were on medication (prednisone) shows complete relief from tenderness and nerve thickening. They also had 26.35% better recovery from tingling.

**Conclusion:** Ultrasonic therapy was effective on symptoms of neuritis such as nerve thickening/swelling > tenderness > Motor impairment > tingling > sensory impairment. Combination of Prednisone (corticosteroid) and ultrasonic therapy shows complete cure from tenderness and nerve thickening.

Keywords: Ultrasonic therapy, Neuritis, leprosy, prednisone, MDT (Multidrug Therapy)

### **Introduction**

Leprosy is a chronic infectious disease caused by *Mycobacterium leprae* or *Mycobacterium lepromatosis* resulting in skin lesions and nerve damage.

Nerve injury is a central feature of the pathogenesis of leprosy, and the basic biological aspects have been reviewed in many textbooks<sup>1</sup>. The first essential step in leprosy neuritis is the localization of *M. leprae* to peripheral nerves. As the techniques of histology and histochemical staining developed over subsequent decades, perineural and intraneural inflammation were observed to be morphological hallmarks of this disease<sup>2,3</sup>. The infection, host response, and functional impairment of cutaneous nerves is a very early feature of leprosy. Sensory abnormalities are already present in the earliest diagnostic clinical lesions, even in small, single lesions<sup>4</sup>.

Due to nerve damage, inflammatory changes occur in nerve leading to neuritis. 'Inflammation of the nerves', neuritis is usually defined as pain and/or tenderness in the nerves, along with the thickening of the nerves.<sup>5</sup> Neuritis produces symptoms such as swelling, tenderness, tingling, motor and sensory loss; leading to hand and foot deformities. It may be observed in all the main types of leprosy and is known to occur in a single nerve or in a multiple form. The nerves, as a rule, are involved at definite anatomical levels. These levels are:

- (1) The Ulnar nerve just above the medial epicondyle of the Humerus.
- (2) The Median nerve proximal to the Carpal tunnel.
- (3) The Radial nerve at the level of the spiral groove.
- (4) The Lateral Popliteal nerve as it winds around the head of the Fibula.
- (5) The Posterior Tibial nerve at the level of the ankle.
- (6) Branches of the Facial nerve especially the Zygomatic branch as it crosses the Zygomatic arch. Rarely is the facial nerve involved as it emerges from the Stylomastoid foramen.

The nerves most commonly involved are the Ulnar, the Median, the Lateral Popliteal and the Posterior Tibial.

#### *Treatment of Neuritis*

As per WHO Model, most neuritis cases can be treated successfully under field conditions with the standard 12 weeks oral prednisone treatment. But, prolonged use of Prednisone results in hypercorticism (Cushing Syndrome), including moon face, acne, bruising, abdominal striae, central obesity, muscle wasting, amenorrhea and hirsutism in female, even sometimes lead to myopathy and Psoriasis<sup>6</sup>. Also, the 12 months of MDT may be insufficient for complete bacterial killing<sup>7</sup>.

Whereas, if not interrupted by treatment or spontaneous healing, the end results of *M. leprae* infection and the host response in nerves causes demyelination, nerve fibre degeneration, and fibrosis<sup>8,9</sup>. Hence, treatment of leprosy neuritis is of prime importance.

#### *Ultrasonic therapy as a remedy for neuritis in leprosy*

Ultrasound is a deep heating modality which is effective up to periosteum level. It has a transducer head with quartz crystal within. This Quartz crystal on application of high frequency current produces compression and rarefaction resulting in production of Ultrasonic waves. When applied over skin it penetrates through the tissues deep up to periosteum as per the frequency of ultrasound<sup>10</sup>.

As the ultrasonic waves are absorbed they are converted to thermal energy (heat) the reflection of these waves occurs at tissue level producing a concentrated heating effect at that point. Thus, because of its thermal effect and stimulation of mechanoreceptor, pain is relieved. Ultrasound also gives micro massage effect which leads to reduction of oedema<sup>10</sup>. Hence it can be used in Neuritis.

This provokes an idea to study Ultrasonic therapy instead of Prednisone (Corticosteroid Therapy) to prevent such conditions with minimal side effect.

#### **Review of literature:**

**M. Becx-Bleumink et al**, in their research "**The management of nerve damage in the leprosy control services**" a review. 1990, says how to control the nerve further damage and to promote self-care through health education.

**J.M Pearson, W F Ross** in their study "**Nerve involvement in leprosy – Pathology differential diagnosis and principles of management**" 1996 summarize about the differential diagnosis of nerve damage and the principles of management to the nerve damage due to leprosy

**Richardus JH, et al** "**Treatment with corticosteroids of long-standing nerve function impairment in leprosy: a randomized controlled trial (TRIPOD 3)**", in his review on 1998 proved spontaneous recovery of nerve function appears to be a common phenomenon in leprosy

**Davis KE**, in his review "**Physical therapy in leprosy for paramedicals**" 1998 has achieved the objectives of preventive rehabilitation of leprosy patients is feasible and successfully maintainable.

#### **Methodology**

##### Study Design

A Prospective Unicentre interventional study

Name of the institution where the work was undertaken:

MSS (Maharogi Sewa Samiti) Sita Ratan Hospital,

Anandwan, Warora, District: Chandrapur

State: Maharashtra, India.

**Sample size:**

24 patients affected with leprosy and having minimum 2 nerve involvement, two people drop out due to non-involvement of nerve, 22 leprosy patients are only considered as sample size

**Inclusion criteria:****Source and method of selection of Patient:**

The subject of the study was chosen from patient undergoing or underwent MDT, living in MSS, Anandwan after an informant consent. For the study, 24 patients were selected having typical signs of neuritis. There were 2 dropouts. Hence, 22 have been included in the study. Out of them 8 were already on corticosteroid therapy (Prednisone), thus a combination of corticosteroid and ultrasonic therapy was administered.

**Assessment was done using the following methods:**

- A. Tingling: For tingling, tap test / distal tingling on percussion.
- B. Tenderness: By palpation with tip of finger.
- C. Swelling: On nerve palpation.
- D. Sensory impairment: Testing for skin sensitivity by Ball Point pen test.
- E. Motor power: By SRMP Scale.

- A. Tingling: For tingling, tap test/ distal tingling on percussion.

The affected area overlying bone was tapped with the knuckles to elicit tingling sensation. The patients perception of intensity of pain sensation was compared with the corresponding site on the contralateral side of the same patient. They were requested to say whether pain sensation upon tapping was greater, less, or the same. Tap Sign was considered to be positive when the deep pain sensation was greater over the lesional area. This indicates that contralateral non-lesional bony prominences are suitable sites for direct comparison. This test had been used as other laboratory facilities were not available in the rural setting.<sup>11</sup>

- B. Tenderness: By nerve palpation,<sup>12</sup>

- For nerve palpation, use the 'finger pulp' not the fingertip/nail.
- Palpate the size (small/large).
- Palpate the shape.
- Palpate the tenderness.

- C. Swelling / Nerve thickness:

Following the same procedure, especially the last one.

- D. Sensory impairment:

Testing for skin sensitivity by Ball Point pen test.

Various methods have been developed to test the different aspects of sensory function. The most commonly used are those based on nylon monofilaments test or on a ball-point pen.<sup>13,14</sup> Though the later method is less standardized, many authors prefer to use it, especially in the field, because of its simplicity and low cost, in contrast to the nylon monofilaments which are more complicated to use and more expensive. Hence, the ball point pen method has been preferred.

- E. Motor power: By SRMP Scale.

Goodwin developed a voluntary motor test (VMT) for leprosy patients, based on the MRC scale of strength.<sup>15,16</sup> This test was subsequently reviewed by several authors. Although it is the most frequently used scale with 5 point grading, but simpler is the SRMP which is 3-4 point scale so mainly used for field use, hence it is applied in this study.<sup>17</sup>

**Exclusion criteria:**

Severely infected leprosy patients  
 Patient without nerve involvement  
 Patient having other systemic complications  
 Auto- amputated patients

**Treatment and dosage:**

Ultrasound therapy done with the Frequency of 1MHz twice a week for four weeks with gradually increasing the intensity from 0.5 W/cm<sup>2</sup> to 2 W/cm<sup>2</sup>. Number of sessions was 8 to 10.

Total duration of the study is 6 months

Statistics

Total 22 Patients were examined out of which 8 underwent steroid therapy i.e Prednisone. Total of 55 nerves were treated with Ultrasound. Following are the nerves treated:

Median Nerve :- 35

Ulnar Nerve :-09

Radial Nerve :-03

Deep Peroneal Nerve :- 08

Effect of Ultrasonic Therapy in Leprosy Patient for Neuritis:

Total recovery from Tingling: 4

Partial recovery from Tingling: 12

Total recovery from Tenderness: 5

Partial recovery from Tenderness: 6

Total recovery from Swelling: 8

Partial recovery from Swelling: 4

Total recovery from Sensation: 4

Partial recovery from Sensation: 2

Total recovery from Motor power: 1

Partial recovery from Motor power: 4

Results

Ultrasonic therapy for neuritis proved effective for some of the symptoms of neuritis. Simple pre and post treatment percentage score take to analyse the report. Mainly, swelling/ nerve thickness (95.21%) and tenderness (91.66%) almost get completely cured after the treatment. Whereas, it also results in improvement of motor power (80%) followed by significant relief of tingling sensation. Also, comparative of patients on Prednisone (corticosteroid) shows more relief of tingling i.e. 26.35% (82.6-56.25) more than those who were not taking any corticosteroids. Also, in these patients, swelling and tenderness was completely recovered.

Whereas, ultrasonic therapy does not have significant effect on recovery of sensation and muscle power.

In total, cumulative effect of ultrasound and corticosteroid shows better results.

Table 1 showing recovery of patients from tingling and tenderness by ultrasonic therapy.

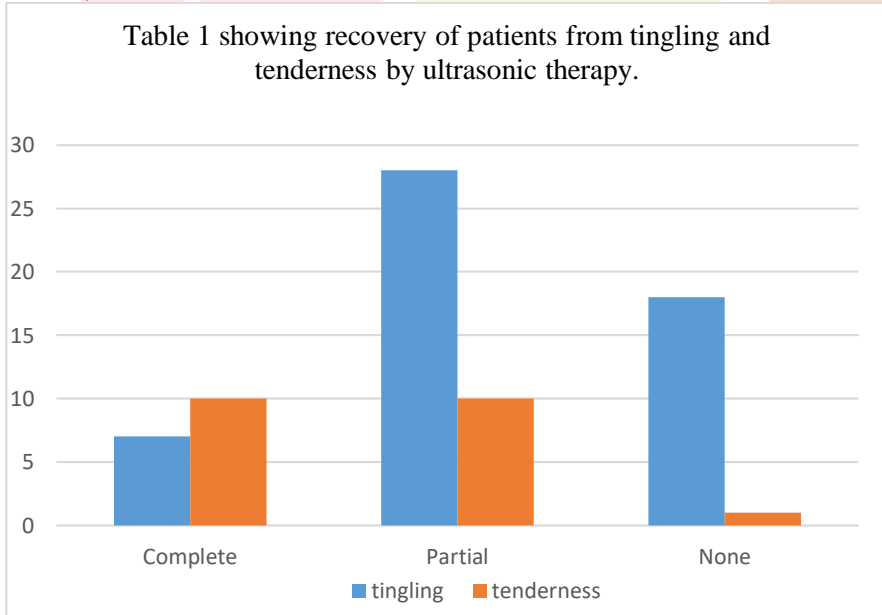
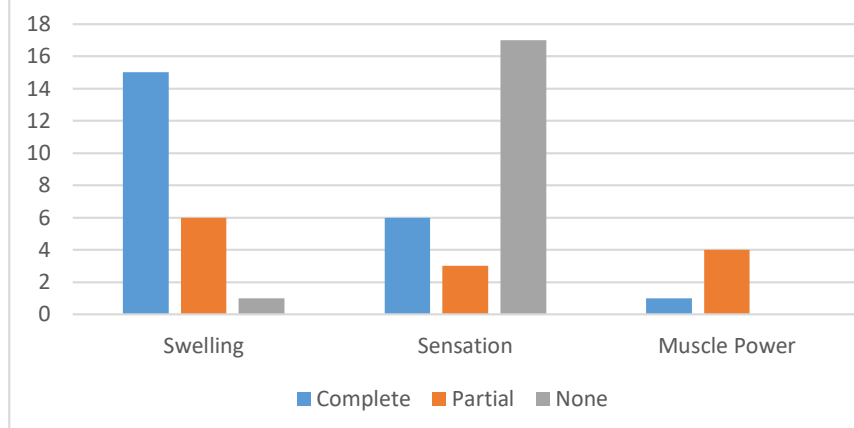


Table 2 showing recovery of patients from swelling, sensation and muscle power by ultrasonic therapy.



### Discussion

As per WHO guidelines, three to six or more months of course of oral Prednisone is included as a usual treatment for nerve damage. Since, it is the most effective drug, course of this drug can improve chances of functional recovery<sup>18</sup>. On the contrary, as per the study “the effect of corticosteroids usage on bacterial killing, clearance and nerve damage in leprosy” by M.Prabhakar Shetty and Fatema Abbas Khambati in Leprosy Review, 2010; 12 months of MDT may be insufficient for complete bacterial killing.<sup>6</sup> Hence, the study suggests that combination of prednisone and ultrasonic therapy augment the inflammatory process relieving neuritis.

Advantages of Ultrasonic therapy:

- Ultrasonic therapy is an easy and effective method to bring relief to leprosy patients suffering from acute neuritis.
- The areas to be treated are conveniently located for adequate contact with the sound head of an ultrasonic generator.
- If treated early enough, production of secondary complications such as paralysis and anesthesia can be avoided.
- The deep penetration and long lasting effects of ultrasonic therapy make it an attractive modality for both domiciliary and outpatient use.

### Conclusion

With the Ultrasonic therapy, nerve thickening i.e swelling and tenderness has been remarkably improved. Although its effect on tingling and sensory loss is still not so satisfactory. Reduction in swelling and tenderness gave a great relief to leprosy patients suffering from neuritis, they also recovered from motor loss. Thus, further study can be done by change in the dosage, frequency and intensity of ultrasound.

Patients on corticosteroids (Prednisone) shows more relief of tingling i.e. 26.35 % more compare to those who are not taking any corticosteroids. Tenderness and swelling completely resolved in this group of patients making a difference of 18.19% and 6.67% respectively. Two of the patients from this group, having motor impairment partially cured whereas the other group of patients not on medication two shows partial recovery and one got completely recovered.

From the following results, ultrasonic therapy can be suggested as an alternative or used in combination with prednisone for leprosy neuritis. Further study can be done on cumulative effect of prednisone and Ultrasound i.e. phonophoresis with prednisone.

### Acknowledgement

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## APPENDIX 1

### SCALE USED IN VOLUNTARY MOTOR TESTING

#### MRC Scale:

The examiner first demonstrates the correct movement to the patient, and then asks him to repeat it spontaneously. If the patient is able to perform the full range of the demonstrated movement, he is asked to hold it against resistance. According to the result, the examiner grades the movement as follows:

- Grade 5: full range of movement against resistance.
- Grade 4: full range of movement but less than normal resistance.
- Grade 3: full range of movement without resistance.
- Grade 2: Partial range of movement with no resistance.
- Grade 1: perceptible contraction of the muscle not resulting in joint movement.
- Grade 0: No movement/ complete Paralysis.

#### “SRMP” Scale:

The same procedure applied with the following scale:

- Strong: full range of movement against resistance.
- Resistance reduced: Reduced range of the movement against resistance.
- Movement reduced: Range of spontaneous movement reduced.
- Paralysis: No spontaneous movement.

## APPENDIX 2

### SENSORY TESTING

#### Ball Point pen (Watson 1953)

A ball pen is applied on the specific site of the hands and feet, allowing a denting of 1 mm during 2 sec, while the patient's eyes are closed. He/she is asked to point the stimulated area with the finger. The ball pen is applied 3 times on each site. If the patient responds to at-least 2 out of the 3 applications within 2cm on a specific site, the response is correct and coded 1, otherwise 0.