

## Role of Cryotherapy in Reducing Postoperative Pain In Patients With Irreversible Pulpitis; An In-Vivo Study

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### ABSTRACT

#### Purpose

To compare and evaluate the role of cryotherapy in reducing post-operative pain after biomechanical preparation in symptomatic irreversible pulpitis with normal periodicals tissue, asymptomatic or symptomatic apical periodontitis.

#### Procedure

60 patients to undergo endodontic treatment in mandibular first molar were selected, on the basis of predetermined criteria. Mesial canals were prepared till No 30 K file and distal canals till No 35 K file, using step back technique. Final irrigation was carried out with either 2.5°C cold saline or saline at room temperature. Patients were given a questionnaire to record their post-operative pain at 6, 24 & 48 hours.

#### Findings

In all the subgroups, there was a reduction in post-operative pain at 6 hours, 24 hours and 48 hours in the cryotherapy group, compared to control group.

**Conclusion** Intra canal cryotherapy is effective in reducing post-operative pain in patient with irreversible pulpitis with apical periodontitis

**Keywords:** Asymptomatic apical periodontitis, Cryotherapy, Normal periapical tissue, Symptomatic apical periodontitis, Symptomatic irreversible pulpitis

### Background

In the endodontic clinical practice, one of the most damaging experiences for both patient and clinician is precipitation of pain, during or after the treatment. Cryotherapy can be employed to control post-operative pain.

## I. INTRODUCTION

In the endodontic clinical practice, one of the most damaging and unnerving experience for both patient and clinician is precipitation of pain, during or after the treatment. The situation turns more complex, when initially there was no pain, to start with. Even in the conditions where pain was present, post treatment exacerbation could arise.<sup>1</sup> In any of these situations, pain could be precipitated due to a multitude of involved factors. Some of the common factors being - the passage of irritants (microorganisms, toxin etc) into the periapical area or conduction of pressure.<sup>2</sup>

One of the primary reasons for initiating endodontic treatment is to rid the patient of the excruciating pain, present pre-operatively. In order to control this pain as well as the potential pain precipitated as a result of endodontic treatment, various strategies have been devised and suggested. One of the latest additions to these is the use of 'cryotherapy'. Cryotherapy means cold therapy, which was widely used by Greeks. It is based on the principle of extracting heat from the applied area rather than implementing cold. In this process, the incidence of pain is either prevented or diminished.<sup>3</sup>

The use of cryotherapy during endodontic treatment is gradually becoming pervasive. This study was planned and carried out so as to test the effectiveness of cryotherapy, in reducing post-operative pain after biomechanical preparation, in symptomatic irreversible pulpitis with normal periapical tissue and asymptomatic / symptomatic apical periodontitis.

## **II. METHODOLOGY**

Amongst the patients, undergoing endodontic treatment in the Department of Conservative Dentistry and Endodontics, 60 patients with Symptomatic Irreversible pulpitis in mandibular 1st molar were selected. Clearance for this study was taken from the RKDF Institutional Ethical Committee. Patients were explained about the procedure & consent was taken. The selection criteria for patients were -

### 1.1. Inclusion criteria

- Patients diagnosed with symptomatic irreversible pulpitis
- Patients free of any diseases
- Patients aged 18-25 years
- Teeth with mature apex
- Teeth free of any defects

### 1.2. Exclusion criteria

- Patients with other pulpal diagnosis
- Medically compromised patients
- Patients on / taken analgesics, antibiotics or any other medication within last 4 weeks
- Presences of any defect in the root – caries, restoration, previously endodontically treated, root resorption, craze lines, fracture or extreme root curvature.

Selected 60 patients were randomly, equally divided into two groups – control and experimental, without any discrimination of gender. Both these groups were further subdivided into 3 subgroups comprising of patient with symptomatic irreversible pulpitis. In subgroups 1,2,3, patients with symptomatic apical periodontitis, asymptomatic apical periodontitis and normal periradicular tissues were placed, respectively. In all the patients, after anaesthetising the tooth with inferior alveolar nerve block and application of rubber dam, access cavity was prepared with No 3 round bur placed in high speed, airtor handpiece, under air-water spray. After checking patency of canals, working length was determined with the help of apex locator and confirmed radiographically. All the root canals were prepared by step back technique, apically till No 35 and coronally till 50. During the preparation canals were irrigated with 2.5% sodium hypochlorite solution. The penultimate irrigation was carried out with 17% EDTA for a minute. The final irrigation in the control group was carried out with saline at room temperature, whereas in the experimental group saline at 2.5°C was used. For irrigation of root canals, 5 ml syringe with side vented, 28 gaugeneedle was used and final irrigation was carried out for a minute.

After the irrigation, a closed dressing without any intracanal medicament was given by placing a cotton pellet in pulp chamber and sealing with temporary filling material. Patients were given a questionnaire to fill and report the post-operative pain at the duration of 6 hours, 24 hours, and 48 hours. Visual analogue scale was used for evaluating the intensity of pain experienced by the patients, on a scale of 0-10.

Data was collected, tabulated and statistically analysed.

Data was entered in Microsoft excel 2016 for Windows. Mean, standard deviation (SD), and percentages of variables in various groups of patients with irreversible pulpitis were calculated. Shapiro-Wilk test showed that VAS scores did not follow normal distribution, hence non-parametric test Mann-Whitney U test was applied for comparison of VAS scores between cryotherapy and normal saline groups. For comparison of pain perception between cryotherapy and normal saline group at different time intervals, Chi-square test was applied. When expected frequency in any cell was less than 5, with Chi-square test with Yates's correction was applied. P value <0.05 was considered statistically significant. Data analyses were performed using version 21.0 of the Statistical Package for Social Sciences (IBM Corporation, Armonk, New York, USA).

## **III. RESULTS**

In all the subgroups, there was a reduction in post-operative pain at 6 hours, 24 hours and 48 hours in the experimental group, compared to control group.

In cases with symptomatic irreversible pulpitis with symptomatic apical periodontitis, in experimental group, six patients complained of pain of intensity 1, and four patients of 4, 6 hours post-operatively. Whereas in control group 8 patients complained of pain intensity 3-5, and two patients of intensity 1, 6 hours post-operatively.

At 24 hours post-operatively, eight patients complained of pain intensity 1 and two patients of 4-5, in experimental group. Whereas in control group, four patients complained of 3, six patients of 0-2.

At 48 hours post-operatively, four patients complained of pain intensity 1, in the experimental group. Whereas in control group, 6 patients complained of pain intensity 1-2.

A statistically significant reduction in pain was found when comparing pain level in patients with symptomatic irreversible pulpitis with symptomatic apical periodontitis, in experimental group compared to control group at 6 hours, 24 hours and 48 hours.

In cases with symptomatic irreversible pulpitis with asymptomatic apical periodontitis, at 6 hours post-operatively, four patients complained of pain intensity 2, four patients of 1, in experimental group. Whereas in control group, four patients complained of pain intensity 3, six patients of intensity 2.

At 24 hours post-operatively, six patients complained of pain intensity 1, two patients of intensity 2, in the experimental group. Whereas in control group, two patients complained of pain intensity 3, four patients of 1-2.

At 48 hours post-operatively, four patients complained of pain intensity 1 the experimental group. Whereas, in control group, six patients complained of pain intensity 1.

At 6 hours post-operatively, there was a statistically significant reduction in pain in experimental group compared to control group.

At 24 and 48 hours post-operatively, there was no statistically significant reduction in pain in experimental group compared to control group.

In cases with symptomatic irreversible pulpitis with normal periapical tissue, at 6 hours post-operatively, four patients complained of pain intensity 1, in experimental group. Whereas in control group, six patients complained of intensity 1, and two patients of 2.

At 24 hours post-operatively, four patients experienced pain of intensity 1, in experimental group. Whereas in control group, four patients complained of pain intensity 1, and two patients of 2.

At 48 hours post-operatively, none of the patients experienced pain in the experimental group, whereas in control group, 2 patients complained of intensity 1.

A statistically significant reduction in pain was not found at all the time intervals post-operatively

### 3.1. Irreversible pulpitis with symptomatic apical periodontitis:

At 6 hours, mean  $\pm$  SD of VAS scores in cryotherapy and normal saline groups were  $2.25 \pm 2.17$  and  $4.35 \pm 2.18$ , respectively. Mann-Whitney U test showed that VAS scores at 6 hours in normal saline group were significantly higher than cryotherapy group (MW = 106.500, P <0.05).

At 24 hours, mean  $\pm$  SD of VAS scores in cryotherapy and normal saline groups were  $1.15 \pm 1.73$  and  $2.80 \pm 2.17$ , respectively. Mann-Whitney U test showed that VAS scores at 24 hours in normal saline group were significantly higher than cryotherapy group (MW = 114.500, P <0.05).

At 48 hours, mean  $\pm$  SD of VAS scores in cryotherapy and normal saline groups were  $0.55 \pm 1.36$  and  $1.75 \pm 1.94$ , respectively. Mann-Whitney U test showed that VAS scores at 48 hours in normal saline group were significantly higher than cryotherapy group (MW = 131.500, P <0.05).

### 3.2. Irreversible pulpitis with asymptomatic apical periodontitis:

At 6 hours, Mann-Whitney U test showed that VAS scores at 6 hours in normal saline group were significantly higher than cryotherapy group (MW = 117.000, P <0.05).

At 24 hours, Mann-Whitney U test showed no significant difference for VAS scores at 24 hours between cryotherapy and normal saline groups.

At 48 hours, Mann-Whitney U test showed no significant difference for VAS scores at 48 hours between cryotherapy and normal saline groups.

### 3.3. Irreversible pulpitis with normal periapical tissue:

At 6 hours, Mann-Whitney U test showed no significant difference for VAS scores at 6 hours between cryotherapy and normal saline groups.

At 24 hours Mann-Whitney U test showed no significant difference for VAS scores at 24 hours between cryotherapy and normal saline groups.

At 48 hours, Mann-Whitney U test showed no significant difference for VAS scores at 48 hours between cryotherapy and normal saline groups.

## IV. DISCUSSION

During the endodontic treatment, pain can be precipitated at any stage due to various factors. They could be mechanical, chemical or microbiological.<sup>2</sup> Once these factors pass through the root into the periapical region, inflammation is initiated, resulting in pain. This condition could be complicated further, resulting in flare up.<sup>4</sup> The necrotic debris present within the root canal, the microorganisms, and/ their byproducts, and various chemicals and medicament used during endodontic treatment could be pushed into the periapical region during the treatment<sup>5</sup>. Even the higher mechanical pressure used during the endodontic treatment could lead to or accelerate the movement of these products into the periapical region, precipitating pain.<sup>6</sup>

In spite of all the precautions observed during biomechanical preparation, pain can be precipitated. In such situation, the treatment option is decompression of the periradicular area, followed by resolution of inflammation.<sup>7</sup> Towards this end, various strategies have been employed.<sup>8</sup> Cryotherapy is one of the latest

modalities in these sequence. The response to this treatment could be variable in different pre-existing periapical conditions.<sup>9</sup> Hence to gauge the effect of cryotherapy in symptomatic irreversible pulpitis cases with different periapical presentation, this study was conducted.

In this study, Cryotherapy was found to diminish the incidence of post-operative pain in both normal and inflamed periapical tissue. A statistically significant difference was found when comparing pain level in patients with symptomatic irreversible pulpitis with symptomatic apical periodontitis in between cryotherapy and non-cryotherapy group. This can be explained by the effect of cold saline in reducing edema and inflammation. It worked as anti-inflammatory in periapical area<sup>10</sup>. It has been found that intracanal cryotherapy reduces root surface temperature.<sup>11</sup> Lowering the body temperature decreases peripheral nerve conduction, and especially, when it reaches about 7°C, there is complete deactivation of myelinated A-delta fibres, whereas deactivation of non-myelinated C-fibre occurs at lower temperature.<sup>12</sup> In our study, 2.5°C saline was used for cryotherapy, which proves the effectiveness of lower temperature in reducing pain.

In cases with symptomatic irreversible pulpitis with asymptomatic apical periodontitis, statistically significant difference in pain incidence was found during 6 hours in between cryotherapy and non-cryotherapy groups, and no statistically significant difference was found at 24 and 48 hours. Studies show that symptomatic cases are more likely to produce flare up than asymptomatic cases.<sup>13</sup> Studies show that, 47-60% of patients having asymptomatic irreversible pulpitis experience pain of medium to acute during first 24 hours post-operatively.<sup>14</sup> Sundquist in his study concluded that in all flare up cases, *Bacterioides melanninogenicus*, a gram negative anaerobic rod was present,<sup>15</sup> which was also endorsed by Grifee et al saying that, symptomless infected teeth did not contain *bacterioides melanninogenicus*.<sup>16</sup> This gram negative rod produces fibrinolytic, collagenolytic enzymes and endotoxins which activates Hageman factors which releases bradykinin, a potent pain mediator.<sup>17</sup> In patients with symptomatic irreversible pulpitis with normal periapical tissue, no statistically significant difference in pain was found in between the cryotherapy and non cryotherapy groups.

To keep the operator variability factor under control, only one endodontics performed the root canal treatment. The results point towards effectiveness of cryotherapy in situations where periapical inflammation is present. In both symptomatic and asymptomatic apical periodontitis, cryotherapy proved to be more effective than non-cryotherapy group. In case with normal periapical tissue cryotherapy was not found to be statistically effective thus pointing towards the fact that inflammation is controlled by cryotherapy. In cases with pre-existing periapical inflammation there is a higher possibility of exacerbation of pre-existing periapical inflammation during root canal treatment, since the passage of minor quantity of irritants into the periapical region can aggravate the inflammation.<sup>18</sup>

Cryotherapy aids in reducing pain by decreasing the blood flow in the periapical region along with metabolic activity.<sup>19</sup> It also inhibits the neural receptor in the periapical region<sup>20</sup>. The number of inflammatory cells is diminished in the periapical area, since cryotherapy reduces the adhesion of these cells to the walls of the capillaries.<sup>21</sup> Furthermore it decreases the release and activity of bradykinin, the pain causing agent.<sup>22</sup> Cryotherapy has been found to be of help in reducing pain along with inflammation and hastening healing.<sup>23</sup> Not just for endodontic treatment, but cryotherapy has been suggested and used in various other body parts.<sup>24</sup> Similar to our finding Bazaid et al also found intracanal cryotherapy to be of help in reducing pain in symptomatic irreversible pulpitis with apical periodontitis patients.<sup>2</sup> Keskin et al, in their study on irreversible pulpitis also found intracanal cryotherapy to reduce post-operative pain.<sup>9</sup> Jorge vera et al found intracanal cryotherapy to reduce root surface temperature.<sup>1</sup> In another study, Jorge vera et al, in symptomatic apical periodontitis situations found intracanal cryotherapy to reduce post-operative pain.<sup>11</sup>

## V. CONCLUSION

On the basis of results obtained in our study, it can be concluded that, intracanal cryotherapy is effective in reducing pain during and after endodontic treatment in symptomatic irreversible pulpitis with apical periodontitis. In normal periapical tissue, it does not appear to offer much help. Therefore its use during endodontic treatment is recommended in symptomatic irreversible pulpitis with apical periodontitis.

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Table 1: Comparison of pain VAS scores between cryotherapy and normal saline groups at different time intervals in various groups of patients with irreversible pulpitis.

Groups		Mean ± SD of VAS scores		
		At 6 hours	At 24 hours	At 48 hours
Irreversible pulpitis with symptomatic apical periodontitis	Cryotherapy group	2.25 ± 2.17	1.15 ± 1.73	0.55 ± 1.36
	Normal saline group	4.35 ± 2.18	2.80 ± 2.17	1.75 ± 1.94
	Mann-Whitney U test	MW = 106.500, P = 0.10 (<0.05), S	MW = 114.500, P = 0.014 (<0.05), S	MW = 131.500, P = 0.026 (<0.05), S
Irreversible pulpitis with asymptomatic apical periodontitis	Cryotherapy group	1.90 ± 1.74	0.80 ± 1.47	0.40 ± 1.00
	Normal saline group	3.45 ± 2.04	1.75 ± 1.59	1.20 ± 1.74
	Mann-Whitney U test	MW = 117.000, P = 0.022 (<0.05), S	MW = 135.500, P = 0.051 (>0.05), NS	MW = 154.000, P = 0.101 (>0.05), NS
Irreversible pulpitis with normal periapical tissue	Cryotherapy group	1.40 ± 1.50	0.45 ± 1.15	0.10 ± 0.45
	Normal saline group	2.50 ± 1.93	1.30 ± 1.53	0.50 ± 1.05
	Mann-Whitney U test	MW = 133.000, P = 0.058 (>0.05), NS	MW = 136.000, P = 0.51 (>0.05), NS	MW = 169.000, P = 0.144 (>0.05), NS

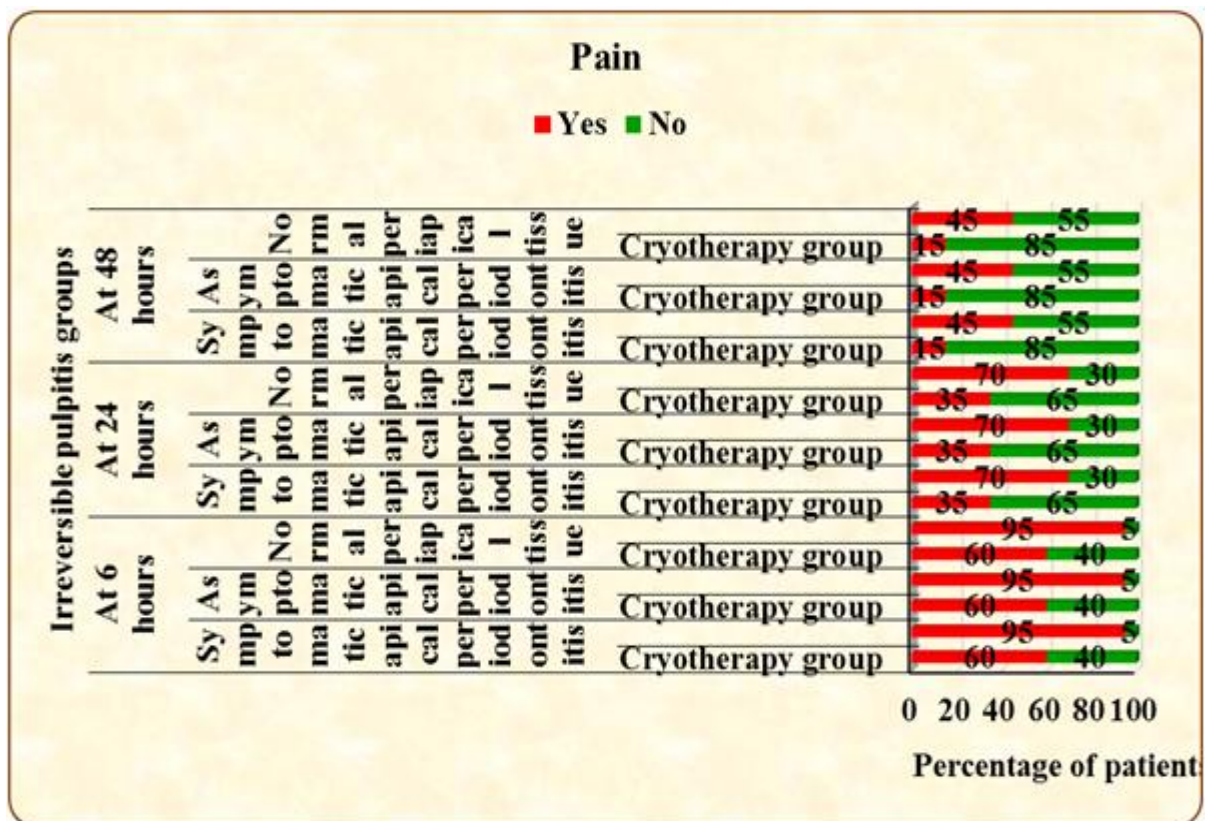


Fig 1: Comparison of pain perception between cryotherapy and normal saline group at different time intervals in various groups of patients with irreversible pulpitis

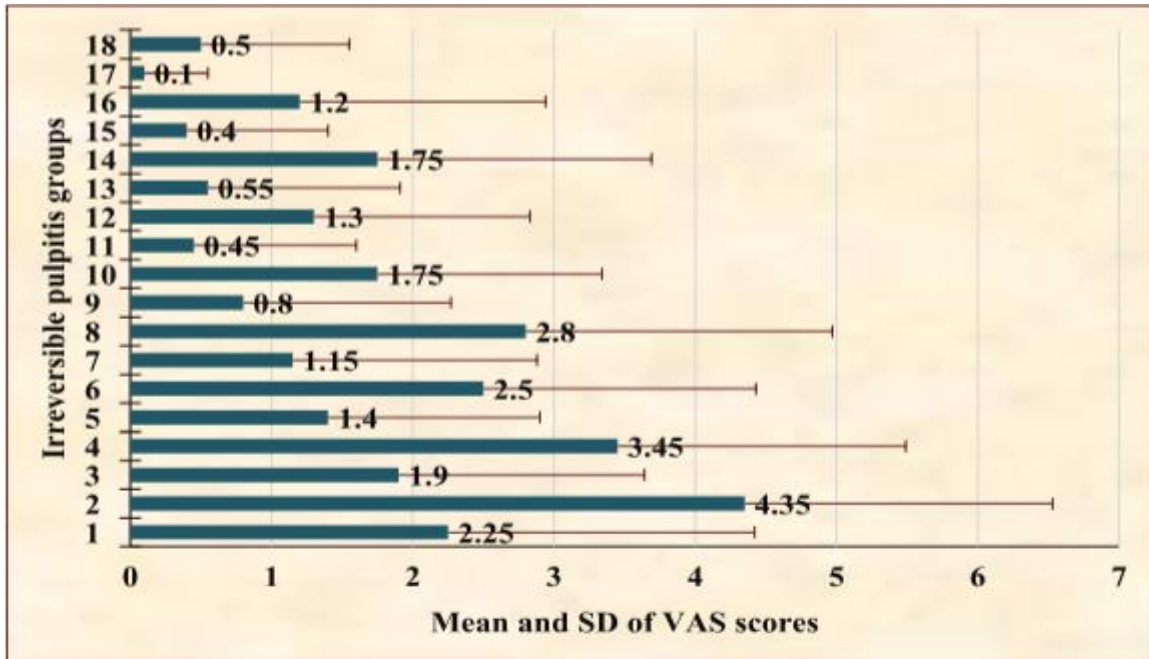


Fig 2: Comparison of VAS scores between cryotherapy and normal saline groups at different time intervals in various groups of patients with irreversible pulpitis

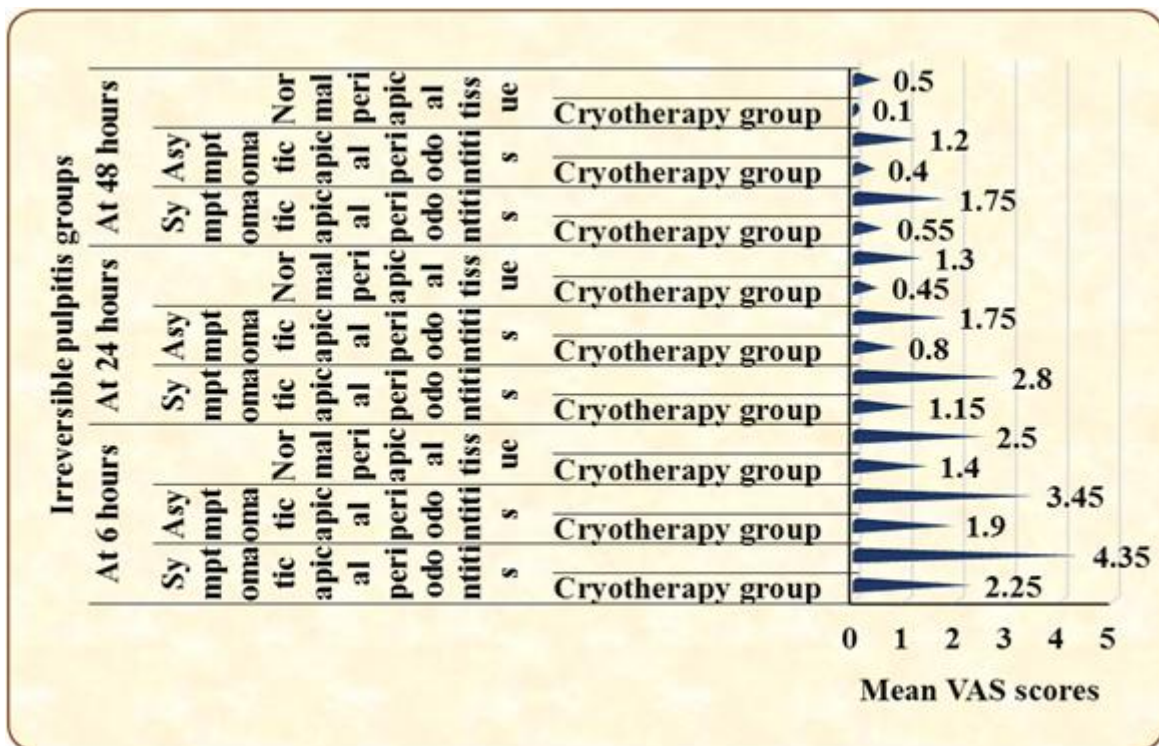


Fig 3: Comparison of VAS scores between cryotherapy and normal saline groups at different time intervals in various groups of patients with irreversible pulpitis.

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