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## **Article History**

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| Submission        | : 08 April 2020 |
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| Published         | : 24 Juli 2020  |



hendrik setia budi <hendrik-s-b@fkg.unair.ac.id>

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## EJD-2020-4-15 - (186) Manuscript submission confirmation

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**European Journal of Dentistry** <ejd@manuscriptmanager.net>  
Reply-To: Aditi Painuly <aditi.painuly@thieme.in>  
To: hendrik-s-b@fkg.unair.ac.id

Wed, Apr 8, 2020 at 10:25 AM

Submission: EJD-2020-4-15 - (186) - Determine the effectivity of infrared distance to eliminate dental pain due to pulpitis and periodontitis

Attention: Dr. Setia Budi

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## EJD-2020-4-15 - (186) Revise (major revisions)

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Thu, May 14, 2020 at 3:29 AM

Reply-To: Nejdeth Adanir <necdethan@gmail.com>

To: hendrik-s-b@fkg.unair.ac.id

Manuscript: EJD-2020-4-15 - (186) - Determine the effectivity of infrared distance to eliminate dental pain due to pulpitis and periodontitis

Date submitted: 2020-04-08

Dear Dr. Setia Budi

Thank you very much for submitting the above manuscript to European Journal of Dentistry.

Your manuscript has now been evaluated by external reviewers and members of the editorial board. While we certainly find merit in your paper, a number of major points of criticism were raised and we therefore regret to inform you that your manuscript is not acceptable for publication in its present form. If you feel that you can adequately address the criticisms outlined in the reviewer reports below, we would be willing to reconsider a thoroughly revised version of your manuscript.

If you decide to resubmit your manuscript, please provide point-by-point answers to the reviewer criticisms in the text field provided during the online resubmission process and highlight any revisions made in your manuscript document.

We look forward to receiving the revised version and thank you, again, for submitting your manuscript to European Journal of Dentistry.

Sincerely,

Dr. Nejdeth Adanir, DDS, PhD.  
Editor-in-Chief, European Journal of Dentistry  
Associate Professor, Department of Restorative Dentistry  
School of Dentistry, King Faisal University  
Al Ahsa, KSA, 31982  
[necdethan@gmail.com](mailto:necdethan@gmail.com)

-----  
Reviewer 1 report:

The article was clearly and accurately presented. The study design, statistical analysis, and its interpretation is appropriate with the methods to allow replication by other researchers.

-----  
Reviewer 2 report:

Due the article with the title Determine the effectivity of infrared distance to eliminate dental pain due to pulpitis and periodontitis. This article need some revision.

1. Authors should show novelty and define why don't distinguish dental pain subject between pulpitis dan periodontitis, as we know that dental pain in Periodontitis may cause mild, episodic or persistent dull pain due to inflammation or low-grade infection. In contrast, in pulpitis cause sharp pain, it might take effect to effectivity of infrared and mechanism in A&#948; and C fibers which transmit sensations of pain and pressure.
2. In Method section, Authors should complete with more explanation about :
  - a. how periodontitis and pulpitis were diagnosed
  - b. pain assessment that been used in this research, and
  - c. state the inclusion and exclusion criteria, in example patients were excluded from the study whether the sample refused to participate, pregnancy condition diagnosed, using immunosuppressant or long-term anti-inflammatory medication, or took antibiotics during the last 3 weeks or initiated treatment of their pain.
3. Authors should attach the pain assessment data using Wong-Baker Scale in pre treatment and post-treatment from patients that used in this study.
4. In discussion still not clear yet about the mechanism of application of infrared rays with 800 nm wavelength at 55 cm distance to change of the pain perception in treatment specifically. The explanation just clarify effect of infrared rays mechanism generally.

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5/25/22, 10:11 AM

Airlangga University Mail - EJD-2020-4-15 - (186) Revise (major revisions)

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## Response to Reviewers

1. Authors should show novelty and define why don't distinguish dental pain subject between pulpitis and periodontitis, as we know that dental pain in Periodontitis may cause mild, episodic or persistent dull pain due to inflammation or low-grade infection. In contrast, in pulpitis cause sharp pain, it might take effect to effectivity of infrared and mechanism in A&#948; and C fibers which transmit sensations of pain and pressure.

Response:

Thank you for this suggestion. In this study, we found that 55 cm distance was an effective distance between infrared rays and the patients wherever it could reduce the dental pain due to pulpitis and periodontitis significantly. Besides it, our study distinguished pulpitis and periodontitis diagnosed clearly because our participants diagnose were pulpitis or periodontitis (See in our raw data file).

2. In Method section, Authors should complete with more explanation about :
  - a. how periodontitis and pulpitis were diagnosed
  - b. pain assessment that been used in this research, and
  - c. state the inclusion and exclusion criteria, in example patients were excluded from the study whether the sample refused to participate, pregnancy condition diagnosed, using immunosuppressant or long-term anti-inflammatory medication, or took antibiotics during the last 3 weeks or initiated treatment of their pain.

Response:

Thank you for this suggestion.

A. This criteria of Pulpitis and Periodontitis diagnose

Pulpitis (Bender, 2000):

- a. Intense, lingering pain to temperature changes
- b. Spontaneous pain
- c. Diffuse or referred pain
- d. Pain from cold test lingers more than 30s

- e. May get pain from heat test
- f. May have spontaneous pain
- g. May be percussion sensitive
- h. Radiographic or clinically visible deep caries
- i. Periodontitis (Barrington, 1990):
- j. Usually inflammation in the apical periodontium
- k. A painful response to biting, percussion or palpation.

May or may not be accompanied by radiographic change (i.e. depending upon the stage of the disease, there may be normal width of the periodontal ligament or there may be a periapical radiolucency).

**B. This study used Wong-Baker Faces Rating Pain Scale (17)**

| <b>Scale</b> | <b>Face expression</b> | <b>Description</b> |
|--------------|------------------------|--------------------|
| <b>5</b>     | Happy                  | No hurts           |
| <b>4</b>     | Little bit smile       | Hurts little bit   |
| <b>3</b>     | Neutral                | Hurts little more  |
| <b>2</b>     | Little bit sullen      | Hurts even more    |
| <b>1</b>     | Sullen                 | Hurts whole lot    |
| <b>0</b>     | Crying                 | Hurts worst        |

C. Patients who fulfilled the following criteria were included in the study:(1) No photosensitive drugs;(2) No family history of porphyria; (3) No using immunosuppressive drugs; (4) No long-term anti-inflammatory drugs (Ibuprofen); (5) No using diuretics (Furosemide); (6) No using some antibiotics ( Ciprofloxacin, Ofloxacin, Levofloxacin); (7) No pregnant; (8)Age > 18 years.

- 3. Authors should attach the pain assessment data using Wong-Baker Scale in pre-treatment and post-treatment from patients that used in this study

Response:

Thank you for this suggestion. Please see in raw data file.

4. In discussion still not clear yet about the mechanism of application of infrared rays with 800 nm wavelength at 55 cm distance to change of the pain perception in treatment specifically. The explanation just clarify effect of infrared rays mechanism generally.

Response:

Thank you for this suggestion. We have revised in discussion section.



hendrik setia budi <hendrik-s-b@fkg.unair.ac.id>

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## EJD-2020-4-15/R1 RESUBMISSION - (186) Manuscript submission confirmation

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Tue, May 26, 2020 at 11:49 AM

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To: hendrik-s-b@fkg.unair.ac.id

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Attention: Dr. Setia Budi

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**EJD-2020-4-15/R1 RESUBMISSION - (186) Accept manuscript**

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Thu, May 28, 2020 at 2:24 PM

Reply-To: Nejdethan Adanir <necdethan@gmail.com>

To: hendrik-s-b@fkg.unair.ac.id

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Date submitted: 2020-05-26

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Thank you,

Sincerely,

Dr. Nejdethan Adanir, DDS, PhD.  
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Associate Professor, Department of Restorative Dentistry  
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Sun, Jul 5, 2020 at 7:10 PM

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Answer:

Q1 : Correct

Q2 : Correct

Q3 : Silvia Anitasari:

<sup>1</sup>Department of Dental Material and Devices, Dentistry Program, Faculty of Medicine, Universitas Mulawarman, Samarinda, Indonesia

<sup>2</sup>Department of Microbiology, Faculty of Medicine, Universitas Mulawarman, Samarinda, Indonesia

Deasy E Wahab

<sup>3</sup>Department of Health, Samarinda City Government, Samarinda-Indonesia

Q4: [hendrik-s-b@fkg.unair.ac.id](mailto:hendrik-s-b@fkg.unair.ac.id)

Q5-Q6: There were influenced of the infrared rays to reduce the dental pain as follow, distance 45 cm ( $p = 0.007$ ), distance 55 cm ( $p = 0.026$ ), and distance 65 cm ( $p = 0.007$ ). The average scale reduction for distance 45 cm was  $2.22 \pm 0.83$ , the distance 55 cm was  $3.44 \pm 0.82$ , and the distance 65 cm was ( $1.78 \pm 0.83$ ). Therefore, according to Kruskal–Wallis test with  $p = 0.004$  ( $p < 0.05$ ) showed the significant difference between the scale to decrease of dental pain was the distance of 55.

Q7: Correct

Q8: *Wong-Baker faces pain rating scale*:<sup>17</sup>

| Scale | Expression of Face | Description       |
|-------|--------------------|-------------------|
| 5     | Happy              | No hurts          |
| 4     | Little bit smile   | Hurts little bit  |
| 3     | Neutral            | Hurts little more |
| 2     | Little bit sullen  | Hurts even more   |
| 1     | Sullen             | Hurts whole lot   |
| 0     | Crying             | Hurts worst       |

Q9: No citation. It's trial flow

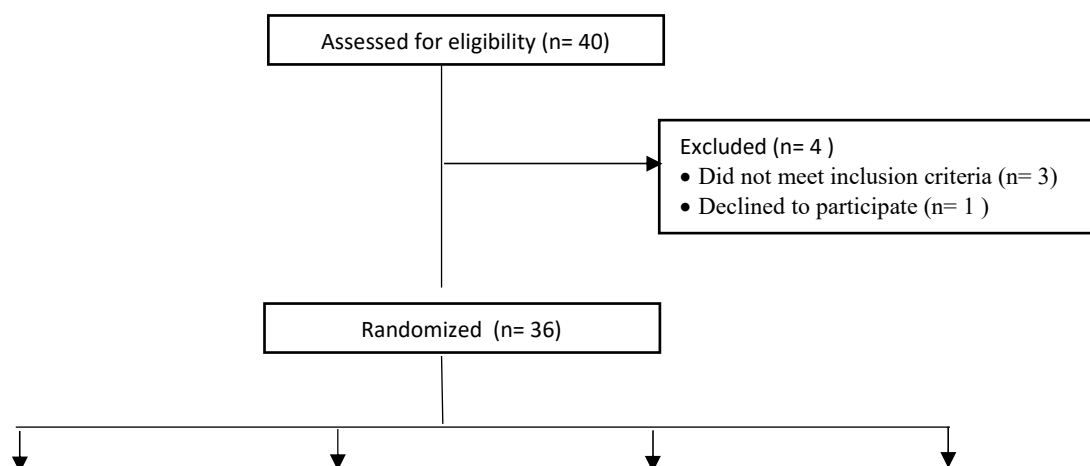
Q10: The Statistical Package for the Social Sciences (SPSS version 23.0 Inc, Chicago, IL) software.

Q11: Our assumption was based on the following scientific information that infrared treatment near the stellate ganglion results in the increase of blood flow velocity similar to that caused by stellate ganglion block and the infrared induces warmth in the treated areas.<sup>17-19</sup>

Q12: Correct

Q13: *Trial Flow*

After anamnesis and diagnosed, all subjects got the therapy based on their groups.



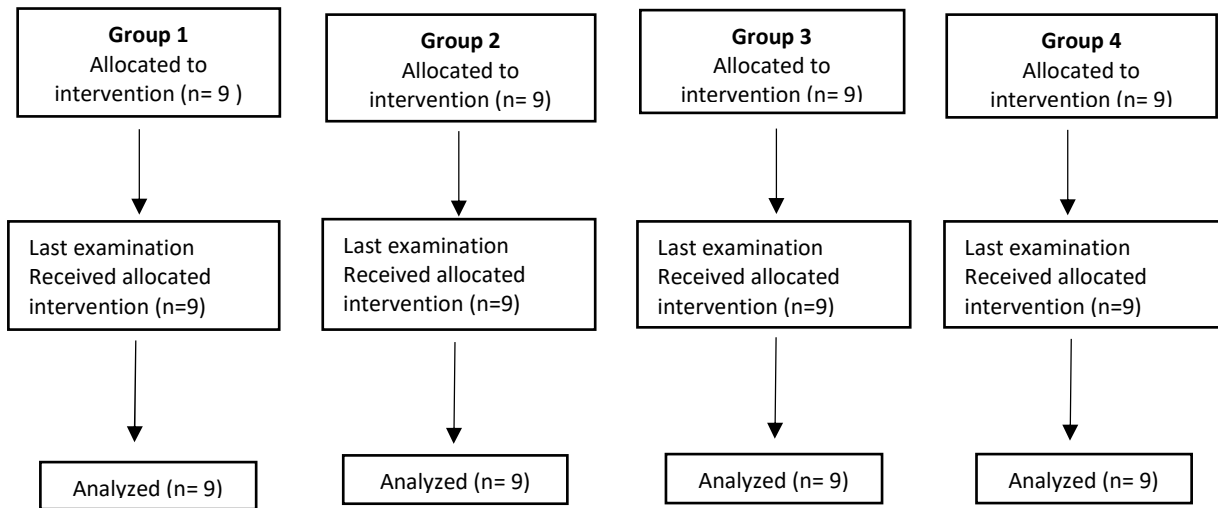


Figure 2. Flow of study phases

Q14: No citation. It's trial flow of this study

Q15: We have no conflif of interest. Herewith I sent you again of conflict of Interest form

# Determining the Effectivity of Infrared Distance to Eliminate Dental Pain Due to Pulpitis and Periodontitis

Silvia Anitasari<sup>1,2</sup> Deasy E. Wahab<sup>3</sup> Barlianta Barlianta<sup>4</sup> Hendrik S. Budi<sup>5,6</sup>

<sup>1</sup>Department of Dental Material and Devices, Dentistry Program, Faculty of Medicine, Universitas Mulawarman, Samarinda, Indonesia

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<sup>3</sup>Department of Health, Samarinda City Government, Samarinda, Indonesia

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<sup>6</sup>Research Center, Faculty of Dental Medicine, Universitas Airlangga, Surabaya, Indonesia

**Address for correspondence** Hendrik S. Budi, DDS, MDS, PhD, Department of Oral Biology, Faculty of Dental Medicine, Universitas Airlangga, Jl. Mayjend. Prof. Dr. Moestopo No. 47 Surabaya, 60132, Indonesia (e-mail: hendrik-s-b@fkg.unair.ac.id).

Eur J Dent:2020;14:360–365

## Abstract

**Objective** The infrared rays is one of the treatments to relief of dental pain due to pulpitis or periodontitis. The ability of infrared to increase the pain threshold which make eliminating P substance on the inflammation area and inducing  $A\beta$  and  $A\delta$  fibers to activate  $\gamma$ -aminobutyrate (GABA) and neuropeptides to decrease the pain. Hence, reducing or eliminating dental pain. This study to get information about effectively distance between patients and infrared rays which can reduce or eliminate dental pain.

**Materials and Methods** The explorative experimental research to determine the effectivity of the infrared rays' distance: 45, 55, and 55 cm in reducing or eliminating dental pain. The material of infrared was tungsten with luminous light and the time for the lighting was 15 minutes.

**Statistical Analysis** The data were obtained and analyzed using Wilcoxon's signed rank test and Kruskal–Wallis test ( $\alpha = 0.05$ ).

**Results** There were influenced of the infrared rays to reduce the dental pain as follow, distance 45 cm ( $p = 0.007$ ), distance 55 cm ( $p = 0.026$ ), and distance 65 cm ( $p = 0.007$ ). The average scale reduction for distance 45 cm was  $2.23 \pm 0.83$ , the distance 55 cm was  $3.33 \pm 0.87$ , and the distance 65 cm was ( $1.78 \pm 0.83$ ). Therefore, according to Kruskal–Wallis test with  $p = 0.004$  ( $p < 0.05$ ) showed the significant difference between the scale to decrease of dental pain was the distance of 55.

**Conclusion** Infrared rays located at a distance of 55 cm from patients might be more effective in relieving dental pain, compared with other distances tested.

## Keywords

- dental pain
- infrared rays
- distance of light
- pulpitis
- periodontitis

## Introduction

Dental pain is a condition that can be felt by all people and always be found in patients who visit the dentists. The pain involve uncomfortable emotion and sensory condition on the past due to pulpitis and periodontitis. It occurs when a

stimuli penetrate into the teeth, as a thermal, chemical, or mechanic stimuli, but sometimes this pain can spontaneously occur without stimuli.<sup>1,2</sup>

Dental pain is sharp, localized, and short of duration. The hydrodynamic theory proposed by Brannstron and Astrom in 1964 is still currently accepted to explain the relationship



between pain of dentinal origin and the displacement of odontoblast in the dentinal tubules.<sup>3</sup> Thermal, physical, and chemical stimuli will cause the displacement of the pulp-dentinal fluid, thus stimulating the pulp nervous terminations.<sup>4</sup>

Type A $\beta$  and A $\delta$  fibers are responsible for dental pain and are probably activated by hydrodynamic mechanism. Therefore, their activation is directly associated to the presence of opened or occluded tubules and nerve activation may result in the release of neuropeptides from the activated nervous terminations and, consequently, induce neurogenic inflammation.<sup>5</sup>

Treatment for dental pain was influenced by subjectivity of every person.<sup>6,7</sup> Basically, we decided to eliminate causative pathologic which responsibility by conservative, surgery therapy, or both of them. One of the conservative therapies to relief acute or chronic dental pain is infrared or heat therapy.<sup>8</sup> Infrared is commonly used by physiotherapy and medical rehabilitation to reduce local and segmental inflammation based on gate control theory and a counter irritant method that intended to lessening discomfort condition or inflammation.<sup>9</sup>

The ongoing researches about infrared are developing rapidly since the invention of infrared laser technology and its growing utilization in dentistry, an additional therapeutic option is available for the treatment of dentinal pain. The laser, by interacting with the tissue, causes different tissue reactions, according to wavelength and distance between infrared laser and the target tissue.<sup>10,11</sup>

The laser photobiomodulation action in the dental pulp was reported with histological studies of dental pulp of mice after irradiation with laser, in teeth previously eroded with high rotation to expose the dentine. The profiling of the odontoblasts was observed, showing evidence of a large quantity of tertiary dentine production, causing the physiological obliteration of the dentinal tubules. The nonirradiated control teeth showed intense inflammatory process, and in some cases, evolved to necrosis.<sup>12,13</sup>

Infrared usually use tungsten material to the lamp with luminous light. The distance between patients and device are 45 to 60 cm. The wavelength is 800 nm and perpendicular to the area of pain. The process of therapy takes time between 10 and 15 minutes and can be done repeatedly depending on the cases.<sup>8,9,14</sup>

There should be effective distance between device and the area of therapy but information found in the literature regarding the most effective distance can give the best result for it. Hence, this study aimed to determine the effective distance which yields the effective result.

## Materials and Methods

### Ethical Procedures and Informed Consent

This research obtained the ethical clearance of the Medical and Health research Ethics Commission, Faculty of Medicine, Mulawarman University (No.53/KEPK-FK/VI/2017). All patients signed the informed consent form for agreeing to participation before enrolling in the study.

### Study Design and Participants

This research was conducted in a private dental clinic from January to July 2017, as double blind, randomized controlled trial and 36 patients were included of both the genders (age between 19 and 52 years) who were diagnosed as pulpitis and periodontitis patients. Patients who fulfilled the following criteria were included in the study<sup>1</sup>: no photosensitive drugs<sup>2</sup>; no family history of porphyria<sup>3</sup>; no using immunosuppressive drugs<sup>4</sup>; no long-term anti-inflammatory drugs (ibuprofen)<sup>5</sup>; no using diuretics (furosemide)<sup>6</sup>; no using some antibiotics (ciprofloxacin, ofloxacin, and levofloxacin)<sup>7</sup>; no pregnant<sup>8</sup>; age >18 years. After screening, block randomization was used, and the patients were randomly allocated to four groups through selection using sequentially numbered,<sup>1-4</sup> opaque sealed envelopes at ratio of 1:1:1:1. The purpose of the study, the protocol, possible side effect, risks, and benefits of participation, all were informed to them.

### Preparation of Infrared Irradiation and Face Rating Pain Scale

Each potentially eligible patient who visited the dental clinic during the treatment was examined by dentist responsible for the treatment. The patients were divided randomly into three groups and one control group as follow: group 1 received treatment with distance 45 cm, group 2 received treatment with distance 55 cm, group 3 received treatment with distance 65 cm, and group 4 as a control no received treatment. All patients had one treatment used the infrared (Nesco SN 51;.Nesco Meblab;. Taiwan) with 800 nm wavelength and perpendicular to the area of pain for 15 minutes (**-Fig. 1**). They were analyzed pretreatment and posttreatment by Wong-Baker faces rating pain scale (**-Table 1**). The following are the diagnostic criteria for the pulpitis and periodontitis.

#### Pulpitis:<sup>15</sup>

1. Intense, lingering pain to temperature changes.
2. Spontaneous pain.
3. Diffuse or referred pain.
4. Pain from cold test lingers more than 30 seconds.
5. May get pain from heat test.
6. May have spontaneous pain.
7. May be percussion sensitive.
8. Radiographic or clinically visible deep caries.

#### Periodontitis:<sup>16</sup>

1. Usually inflammation in the apical periodontium.
2. A painful response to biting, percussion, or palpation.
3. May or may not be accompanied by radiographic change (i.e., depending upon the stage of the disease, there may be normal width of the periodontal ligament or there may be a periapical radiolucency).

### Trial Flow

After anamnesis and diagnosed, all patients got the therapy based on their groups (**-Fig. 2**).

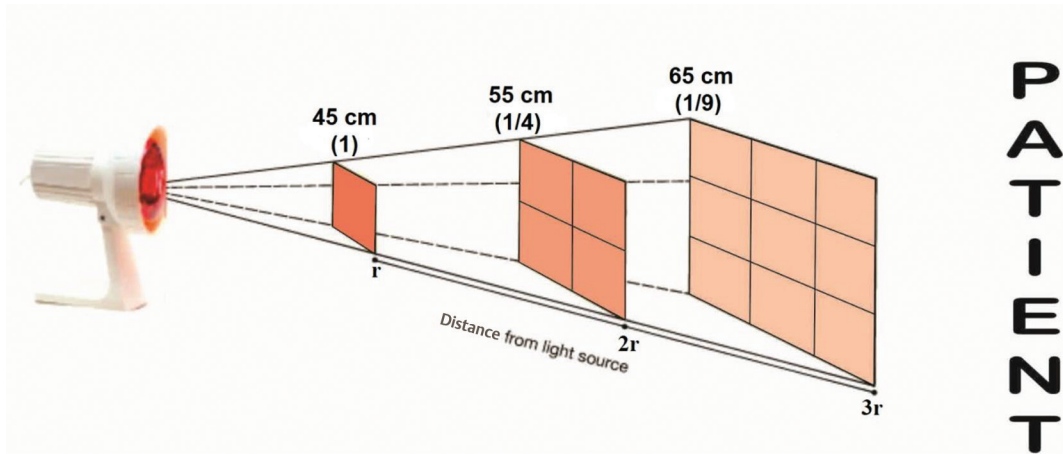


Fig. 1 The position and distance between infrared device and patients.

Table 1 Wong–Baker faces rating pain scale<sup>17</sup>

| Scale | Expression of Face | Description       |
|-------|--------------------|-------------------|
| 5     | Happy              | No hurts          |
| 4     | Little bit smile   | Hurts little bit  |
| 3     | Neutral            | Hurts little more |
| 2     | Little bit sullen  | Hurts even more   |
| 1     | Sullen             | Hurts whole lot   |
| 0     | Crying             | Hurts worst       |

### Statistical Analysis

The difference between four groups were performed based on nonparametric statistics according to the Statistical Package for the Social Sciences (version 23.0; SPSS, Inc., Chicago, IL, United States) software. Data of pain scale were tabulated and analyzed in Wilcoxon’s signed-rank test. The effectivity of distance of infrared therapy were analyzed using the Kruskal–Wallis test. For all analyses, the significance level was set at 0.05 ( $\alpha = 0.05$ ).

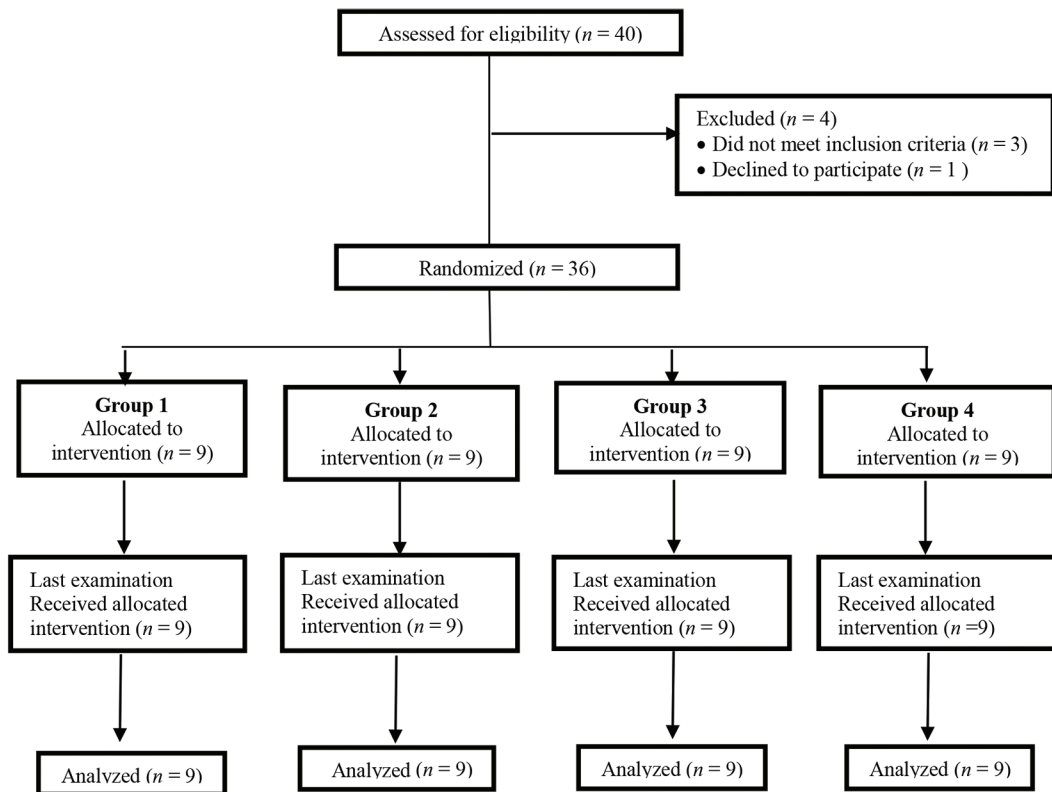


Fig. 2 Flow of study phases.

## Results

The data showed that there were reduced pain for all the patients who had infrared therapy with the distance 45, 55, and 65 cm based on Wong–Baker scale of pre and post-treatment (► **Table 2**). Data were analyzed using Wilcoxon’s signed rank test ( $\alpha = 0.05$ ).

The data (► **Table 3**) showed that two patients experienced a decrease as much as 1: pain scale lower (22%), 2: pain scale lower for three patients (33%), 3: pain scale lower for four patients (45%), and all of them were treated by 45-cm distance. The scale of decline for patients were treated by 55-cm distance, 2 pain scale lower for one (11%), 3 pain scale for four patients (45%), 4 pain scale for three patients (33%), and 5 pain scale for one patient (11%). For the last distance, 65 cm, there were four patients experienced a decrease of 1 level pain scale lower than before (45%), 2 scale pain lower for three patients (33%), and 3 scale pain lower for two patients (22%).

The analysis of data on ► **Table 4** revealed significant difference between subjects who were treated by infrared with distance between 45, 55, and 65 cm, and the effective result was 55-cm distance by Kruskal–Wallis test ( $p < 0.05$ ).

## Discussion

Our study proved that the distance of the infrared might be effective in reducing pain caused by pulpitis or periodontitis. Our assumption was based on the following scientific information that infrared treatment near the stellate ganglion results in the increase of blood flow velocity similar to that caused by stellate ganglion block and the infrared induces warmth in the treated areas.<sup>17-19</sup>

The infrared rays with wavelength of 600 to 1,600 nm are capable of reaching the subcutaneous tissue, following which the energy light is converted to thermal energy and produces warming sensation. Thermal energy can increase vasodilation of blood vessel and elasticity of connective tissue. The mechanisms involved in it may include increasing local blood flow and enhancing mild inflammatory reaction mediated through the release of histamine and prostaglandin, changing enzyme activity and metabolic rate, increasing pain threshold through a direct action of heat upon free nerve endings, or nerve trunk that supply the affected area of pain.<sup>20-22</sup>

The Aβ and Aδ fibers respond to thermal energy and activate inhibitory neurotransmitter, such as γ-aminobutyrate

**Table 2** Mean and standard deviation of dental pain relief pre and postinfrared therapy

| Group             | Pretreatment | Post-treatment | <i>p</i> -Value |
|-------------------|--------------|----------------|-----------------|
| Group 1 (D 45)    | 1.44 ± 1.24  | 3.67 ± 0.87    | 0.007           |
| Group 2 (D 55)    | 1.00 ± 1.80  | 4 ± 0.87       | 0.026           |
| Group 3 (D 65)    | 1.44 ± 1.01  | 3.22 ± 1.30    | 0.007           |
| Group 4 (control) | 1.89 ± 0.78  | 1.89 ± 0.78    | –               |

Abbreviation: D, distance.

Note: There were significant differences within group ( $p < 0.05$ ) on Wilcoxon’s signed rank test.

**Table 3** Infrared therapy effectiveness of dental pain

| Relief of pain scale | D 45  |     | D 55  |     | D 65  |     |
|----------------------|-------|-----|-------|-----|-------|-----|
|                      | Total | %   | Total | %   | Total | %   |
| 1                    | 2     | 22  | 0     | 0   | 4     | 45  |
| 2                    | 3     | 33  | 1     | 11  | 3     | 33  |
| 3                    | 4     | 45  | 4     | 45  | 2     | 22  |
| 4                    | 0     | 0   | 3     | 33  | 0     | 0   |
| 5                    | 0     | 0   | 1     | 11  | 0     | 0   |
| Total                | 9     | 100 | 9     | 100 | 9     | 100 |

Abbreviation: D, distance.

Note: Relief of dental pain’s subjects after infrared therapy ( $n = 9$ ).

**Table 4** Mean and standard deviation of decreasing dental pain scale ( $n = 9$ )

| Group             | Relief of pain scale |     |                  | <i>p</i> -Value |
|-------------------|----------------------|-----|------------------|-----------------|
|                   | Min                  | Max | $\bar{X} \pm SD$ |                 |
| Group 1(D 45)     | 1                    | 3   | 2.23 ± 0.83      | 0.004           |
| Group 2 (D 55)    | 2                    | 5   | 3.33 ± 0.87      |                 |
| Group 3 (D 65)    | 3                    | 3   | 1.78 ± 0.83      |                 |
| Group 4 (control) | 0                    | 0   | 0                |                 |

Abbreviations: D, distance; Min, minimal; Max, maximal;  $\bar{X}$ , mean; SD, standard deviation.

Note: There were significant differences among group ( $p < 0.05$ ) on Kruskal–Wallis test.



(GABA) and neuropeptide. All the inhibitory transmitters are conjugated on the neuron fibers and travel to dorsal horn of the spinal cord. The transmitters can decrease or block nociceptive transmission as not all signal are sent by the dorsal to the brain but most of the signals modulates the signal by themselves. Therefore, this condition can decrease the dental pain.<sup>5,22</sup>

Our study represented the effectiveness of distance to relief of dental pain. The radiation with 55-cm distance gives the effective result to decrease the dental pain compared between 45 and 65 cm. It can be happened, because the Inverse Square Law says the intensity of light is proportional to the square of the distance from the light source. Based on this theory, the good distance was 45 cm but the statistical analysis showed the effective distance to be 55 cm. This can happen, because there are many sensitive area on our face and based on a study by Nandraziova et al, the distance between lamp and skin could not be positioned closer to the skin without incurring the risk of a skin burn.<sup>23</sup> Hence, the distance which is near the face cannot reduce the pain but increase it because of the undesirable heating that results from close proximity to the lamp and the erythema in the surface of skin.<sup>24,25</sup> The other reason being, some patients cannot hold down the light.<sup>26</sup>

We illustrated this study, if the intensity of the nearest distance was 45 cm ( $r$ ) that corresponded to a surface  $A$ . At a  $2r$  distance (55 cm), the same amount of energy passed through the surface  $4A$ , making the intensity one-fourth, which indicates to the fact that the greater body surface area exposed to the light (infrared), the faster the pain declines.<sup>27</sup> In this study, the highest intensity was 45-cm distance but the greater body surface area exposed to the infrared was 65-cm distance (→ Fig. 1). Theoretically, the greater body surface area exposed could decline the pain very well. However, our data showed that the 55 cm proximity from the infrared lamp could yield the best result compared to both 45 and 65 cm. It was possible because the irradiation intensity was not influenced by the distance but it influenced the temperature of the area surface and could penetrate to the muscle 15 mm or more deeper.<sup>27-29</sup> Therefore, the effective distance between infrared rays and the patient was 55 cm because this distance could decrease the dental pain, as well as muscle relaxation.

## Conclusion

Application of infrared rays with 800-nm wavelength was effective at 55-cm distance for 15 minutes. This condition could change dental pain perception in its treatment.

### Conflict of Interest

None declared.

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