Meta-Analysis the Effect of a Potassium Nitrate Desensitizing Agent and Casein Phosphopeptide Amorphous Calcium Phosphate on Tooth Sensitivity after Office Bleaching Treatment

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ABSTRACT

Background: Office bleaching is a treatment used to treat tooth discoloration, but it often results in tooth sensitivity. The desensitizing agent potassium nitrate and casein phosphopeptide amorphous calcium phosphate (CPP-ACP) can reduce tooth sensitivity because they work to inhibit nerve transmission, thereby preventing the sensation of pain. This study aimed to investigate the effect of potassium nitrate desensitization agents and CPP-ACP on tooth sensitivity after bleaching treatment.

Subjects and Method: This was a meta-analysis with the following PICO format. Population= Patients who have undergone office bleaching treatment. Intervention= desensitizing agents potassium nitrate and CPP-ACP. Comparison: without desensitizing agent. Outcome: tooth sensitivity. Keywords used "Office bleaching" AND "Tooth sensitivity" OR "Dentine hypersensitivity" AND "Potassium nitrate" AND Casein Phosphopeptide Amorphous Calcium Phosphate" OR "CPP-ACP" AND "Randomized Controlled Trial" OR "RCT". Studies published at PubMed, Springerlink, Cochrane Database, Hindawi, Elsevier, Google Scholar and Wiley Online Library databases, from 2013 to 2023. The selected articles were critically reviewed using the PRISMA checklist and analyzed using the Review Manager 5.4.1. The effect size used is the Standardized Mean Difference (SMD).

Results: A total of 13 RCTs from Brazil, Spain, India, Pakistan, Turkey, Jordan, Iran, and the United States was selected for meta-analysis. Meta-analysis of 7 articles shows that the use of potassium nitrate desensitization agents can reduce tooth sensitivity by 0.20 units lower than without the use of desensitization agents (SMD = -0.20; 95% CI = -0.37 to -0.03; p=0.020). Meanwhile, 7 articles show that the use of CPP-ACP desensitization agents can reduce tooth sensitivity by 0.46 units lower than without the use of desensitization agents (SMD = -0.46; 95% CI = -0.67 to -0.24; p<0.001).

Conclusion: The use of potassium nitrate desensitization agents and CPP-ACP reduces tooth sensitivity compared to without the use of potassium nitrate desensitization agents and CPP-ACP and is statistically significant.

Keywords: desensitizing agent, potassium nitrat, casein phosphopeptide amorphous calcium phosphate, tooth sensitivity, office bleaching

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BACKGROUND

The appearance of teeth is an important aspect that plays a role in human social interaction. Teeth that change color can affect a person's self-confidence and the beauty of their appearance (Lumuhu et al., 2016). Tooth discoloration can be treated by teeth whitening or bleaching. Bleaching is a process used to whiten discolored teeth until they are close to the desired tooth color (Pary et al., 2015).

Office bleaching is a teeth whitening procedure using high concentrations of hydrogen peroxide and has several advantages, such as the treatment process being very fast and carried out directly by the dentist so that the results can be seen in one visit (Apriliyani et al., 2021). The effectiveness of office bleaching has been reported in the majority of cases of tooth discoloration with good results. However, patient-reported tooth sensitivity is the most common side effect associated with office bleaching procedures, especially when high concentrations of bleaching agents are used (Rodrigues et al., 2018). Office bleaching treatments using agents with higher concentrations can cause greater tooth sensitivity than bleaching treatments carried out at home because the concentration of the agent used is lower (Martin et al., 2013).

According to Mehta and Sasaki’s (2018), the large amount of tooth sensitivity experienced by patients with bleaching treatment at dentist clinics caused some patients to stop bleaching treatment so that to overcome this problem a desensitization agent was needed which could induce tooth remineralization (Mehta et al., 2018). A study conducted by Rezende et al. (2020) stated that the application of a desensitizing agent before or after bleaching treatment at the dentist’s clinic (office bleaching) showed results in a significant reduction in tooth sensitivity in several clinical trials (Rezende et al., 2020).

SUBJECTS AND METHOD

1. Study Design

This was a systematic review and meta-analysis between 2013 and 2023. Search for this research article through databases, including: PubMed, Springerlink, Cochrane Database, Hindawi, Elsevier, Google Scholar and Wiley Online Library using the search keyword “Office bleaching” OR “Tooth sensitivity” OR “Dentine hypersensitivity” OR “Potassium nitrate” OR “Casein Phosphopeptide Amorphous Calcium Phosphate” OR “CPP-ACP” OR “Randomized Controlled Trial” OR –RCT”.

2. Steps of Meta-Analysis

Meta-analysis was carried out in the following five steps:

a. Formulate research questions in the PICO format (Population, Intervention, Comparison, Outcome).

b. Search for primary study articles from various electronic databases including PubMed, Springerlink, Elsevier, Google Scholar and Wiley Online Library.

c. Conduct screening and critical appraisal of primary research articles.

d. Extract data and synthesize effect estimates into RevMan 5.4

e. Interpret and conclude the results.

3. Inclusion Criteria dan Exclusion Criteria

The inclusion criteria used in this study were full-text articles using a Randomized Controlled Trial (RCT) design. The analysis used was multivariate with Standardized Mean Difference (SMD). The exclusion criteria in this study were articles published before 2013 and articles that did not include a mean SD.

4. Operational Definition of Variables

The articles included in this study were adapted to PICO. The article search was
carried out by considering the eligibility criteria using the PICO model as follows: Population = Patients who have had office bleaching treatment. Intervention= desensitizing agent potassium nitrate and casein phosphopeptide amorphous calcium phosphate (CPP-ACP). Comparison= No desensitizing agent. Outcome= Tooth sensitivity.

The potassium nitrate desensitization agent is the chemical compound KNO$_3$ which consists of potassium ions (K$^+$) and nitrate ions (NO$_3^-$). The mechanism of action of potassium nitrate is to inhibit nerve transmission, thereby preventing the sensation of pain.

CPP-ACP desensitizing agent is an active ingredient formed by the combination of casein phosphopeptide and calcium phosphate. The mechanism of action of CPP-ACP is by blocking the flow of tubular fluid thereby closing the open dentinal tubules.

Tooth sensitivity is pain or aching in the teeth which causes the pulp to respond excessively to various stimuli.

3. Study Instrument
This research is guided by the PRISMA flow diagram and assessing the quality of research articles using the Critical Appraisal Checklist for Randomized Controlled Trial (RCT) tool). The following are the 12 questions used in the checklist (Tables 3 and 4):

1. Does this research address a clear research focus?
2. Is the Randomized Controlled Trial research method suitable for answering the research questions?
3. Were there enough subjects in the study to determine that the findings did not occur by chance?
4. Were subjects randomly allocated to experimental and control groups?
5. Are inclusion/exclusion criteria used?
6. Were the two groups comparable at the start of the study?
7. Are objective and unbiased outcome criteria used?
8. Are objective and validated measurement methods used to measure the results?
9. Is the effect size practically relevant?
10. How precise are the effect estimates?
11. Could there be confounding factors that have not been taken into account?
12. Can the results be applied to your research?

6. Data Analysis
The collected articles were processed using the Review Manager application (RevMan 5.4). Data processing is carried out by calculating effect sizes and heterogeneity values to determine the research combination model and form the final results of the meta analysis which are presented in the form of forest plots and funnel plots.

RESULTS
Research related to the effect of applying the desensitizing agent potassium nitrate and casein phosphopeptide amorphous calcium phosphate on tooth sensitivity after office bleaching treatment consists of 13 articles originating from the Asian continent 6 articles, the United States 5 articles, the North American continent 1 article, and the European continent 1 article can be seen in Figure 2.

The total number of primary studies included in this meta-analysis synthesis was 13 articles originating from Brazil, Spain, India, Pakistan, Turkey, Jordan, Iran, and the United States. Primary research for the use of potassium nitrate desensitization agents used 7 Randomized Controlled Trial (RCT) studies from Brazil, India, and Spain. Meanwhile, the use of the casein phosphopeptide amorphous calcium phosphate desensitization agent used 7...
Randomized Controlled Trial (RCT) studies from Pakistan, Turkey, Jordan, India, the United States and Iran.

Articles identified through database searches (n= 2,978) → Removed duplicate data (n= 10)

Filtered articles (n= 2,968) → Excluded articles (n= 2,948)
1. Irrelevant titles = 423
2. Not RCT = 2,505
3. Articles not full text = 20

Full text articles deemed worthy (n= 20) → Full text articles were excluded for the following reasons, with reasons (n= 7)
1. Outcome is not viral load
2. SARS-CoV-2 saliva = 3
3. The study does not meet the criteria inclusion = 4

Articles included in the meta-analysis quantitative synthesis (n= 13)

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**Figure 1. PRISMA flow diagram**

**Figure 2. Map of the research area**
### 1. Research Quality Assessment

**Table 1. Quality assessment of Randomized Controlled Trial (RCT) of the effect of applying potassium nitrate desensitizing agents on tooth sensitivity after office bleaching treatment**

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Criteria</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pale’ et al., 2013</td>
<td>2 2 2 2 2 2 2 2 2 2 3 2</td>
<td>25</td>
</tr>
<tr>
<td>Nanjundasetty and Ashrafulla, 2016</td>
<td>2 2 2 2 2 2 2 2 2 2 3 2</td>
<td>25</td>
</tr>
<tr>
<td>Parreiraes et al., 2020</td>
<td>2 2 2 2 2 2 2 2 2 2 1 2</td>
<td>22</td>
</tr>
<tr>
<td>Martini et al., 2018</td>
<td>2 2 2 2 2 2 2 2 2 2 1 2</td>
<td>23</td>
</tr>
<tr>
<td>Rezende et al., 2020</td>
<td>2 2 3 2 2 2 2 2 2 1 1 1</td>
<td>21</td>
</tr>
<tr>
<td>Maran et al., 2020</td>
<td>2 2 2 2 2 2 2 2 2 2 3 2</td>
<td>25</td>
</tr>
<tr>
<td>Vochikovsk et al., 2021</td>
<td>2 2 2 2 2 2 2 2 2 2 1 2</td>
<td>23</td>
</tr>
</tbody>
</table>

**Table 2. Quality assessment of Randomized Controlled Trial (RCT) of the effect of applying the desensitizing agent casein phosphopeptide-amorphous calcium phosphate on tooth sensitivity after office bleaching treatment**

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Criteria</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maghairah et al., 2014</td>
<td>2 2 2 2 2 2 2 2 2 2 1 2</td>
<td>23</td>
</tr>
<tr>
<td>Najundasetty and Ashrafulla, 2016</td>
<td>2 2 2 2 2 2 2 2 2 2 3 2</td>
<td>25</td>
</tr>
<tr>
<td>Singh et al., 2022</td>
<td>2 2 2 2 2 2 2 2 2 2 3 2</td>
<td>25</td>
</tr>
<tr>
<td>Gumustas and Dikmen, 2021</td>
<td>2 2 2 2 2 2 2 2 2 2 3 2</td>
<td>25</td>
</tr>
<tr>
<td>Rashid and ElSalhy, 2021</td>
<td>2 2 2 2 2 2 2 2 2 1 1 1</td>
<td>20</td>
</tr>
<tr>
<td>Adil et al., 2021</td>
<td>2 2 2 2 2 2 2 2 2 2 3 2</td>
<td>25</td>
</tr>
<tr>
<td>Sadri et al., 2023</td>
<td>2 2 2 2 2 2 2 2 2 2 1 1</td>
<td>22</td>
</tr>
</tbody>
</table>

1 = Does this research address a clear research focus?
2 = Is the Randomized Controlled Trial research method suitable for answering the research questions?
3 = Were there enough subjects in the study to determine that the findings did not occur by chance?
4 = Are subjects randomly allocated to experimental and control groups?
5 = Are inclusion/exclusion criteria used?
6 = Were the two groups comparable at the start of the study?
7 = Are objective and unbiased outcome criteria used?
8 = Are objective and validated measurement methods used to measure the results?
9 = Is effect size practically relevant?
10 = How precise is the effect estimate? Is there a confidence interval?
11 = Could there be confounding factors that have not been taken into account?
12 = Can the results be applied to your research?

**Description of the answer score:**

1 = No
2 = Hesitant
3 = Yes
2. Summary of the article

a. The effect of applying potassium nitrate desensitization agent on tooth sensitivity after office bleaching treatment

Table 3. Description of Primary Studies of Potassium Nitrate Desensitizing Agents Included in the Meta-Analysis

<table>
<thead>
<tr>
<th>Author et al. (Year)</th>
<th>Country</th>
<th>Study Design</th>
<th>Sample</th>
<th>P Population</th>
<th>I Intervention</th>
<th>C Comparison</th>
<th>O Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Martini et al., 2019</td>
<td>Brazil</td>
<td>RCT</td>
<td>Intervention: Patient after office bleaching treatment 90</td>
<td>Potassium nitrate and sodium fluoride desensitizing agents</td>
<td>Placebo</td>
<td>Tooth sensitivity</td>
<td></td>
</tr>
<tr>
<td>Parraires et al., 2022</td>
<td>Brazil</td>
<td>RCT</td>
<td>Intervention: Patient after office bleaching treatment 42</td>
<td>Desensitizing agent Potassium nitrate and glutaraldehyde</td>
<td>Placebo</td>
<td>Tooth sensitivity</td>
<td></td>
</tr>
<tr>
<td>Maran et al., 2022</td>
<td>Brazil</td>
<td>RCT</td>
<td>Intervention: Patient after office bleaching treatment 60</td>
<td>Potassium Nitrate desensitizing agent</td>
<td>Experimental gel without desensitizing agent</td>
<td>Tooth sensitivity</td>
<td></td>
</tr>
<tr>
<td>Rezende et al., 2021</td>
<td>Brazil</td>
<td>RCT</td>
<td>Intervention: Patient after office bleaching treatment 43</td>
<td>Potassium Nitrate desensitizing agent</td>
<td>Placebo</td>
<td>Tooth sensitivity</td>
<td></td>
</tr>
<tr>
<td>Nanjundasety and Ashrafullal, 2021</td>
<td>India</td>
<td>RCT</td>
<td>Intervention: Patient after office bleaching treatment 23</td>
<td>Potassium nitrate desensitizing agent, CPP-ACP</td>
<td>Placebo</td>
<td>Tooth sensitivity</td>
<td></td>
</tr>
<tr>
<td>Vochikovsk et al., 2022</td>
<td>Brazil</td>
<td>RCT</td>
<td>Intervention: Patient after office bleaching treatment 50</td>
<td>Potassium Nitrate desensitizing agent</td>
<td>Placebo</td>
<td>Tooth sensitivity</td>
<td></td>
</tr>
<tr>
<td>Pale’ et al., 2021</td>
<td>Spain</td>
<td>RCT</td>
<td>Intervention: Patient after office bleaching treatment 16</td>
<td>Potassium Nitrate desensitizing agent</td>
<td>Placebo</td>
<td>Tooth sensitivity</td>
<td></td>
</tr>
</tbody>
</table>

b. The effect of applying CPP-ACP desensitization agents on tooth sensitivity after office bleaching treatment

Table 4. Description of Primary Studies of CPP-ACP Desensitizing Agents Included in the Meta-Analysis

<table>
<thead>
<tr>
<th>Author et al. (Year)</th>
<th>Country</th>
<th>Study Design</th>
<th>Sample</th>
<th>P Population</th>
<th>I Intervention</th>
<th>C Comparison</th>
<th>O Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adil et al., 2021</td>
<td>Pakistan</td>
<td>RCT</td>
<td>Intervention: Patient after office bleaching treatment 67</td>
<td>CPP-ACP and PNSMP desensitizing agents</td>
<td>Placebo (without desensitizing agent)</td>
<td>Tooth sensitivity</td>
<td></td>
</tr>
<tr>
<td>Gumustas and Dikmen, 2021</td>
<td>Turkey</td>
<td>RCT</td>
<td>Intervention: Patient after office bleaching treatment 16</td>
<td>Desensitizing agents CPP-ACP neutral sodium fluoride gel (NSF) and nano-hydroxyapatite solution (n-HAP)</td>
<td>Placebo (without desensitizing agent)</td>
<td>Tooth sensitivity</td>
<td></td>
</tr>
<tr>
<td>Maghaire et al., 2014</td>
<td>Jordan</td>
<td>RCT</td>
<td>Intervention: Patient after office bleaching treatment 17</td>
<td>Desensitizing agents sodium fluoride and CPP-ACP</td>
<td>Placebo (without desensitizing agent)</td>
<td>Tooth sensitivity</td>
<td></td>
</tr>
</tbody>
</table>
1. The effect of applying potassium nitrate desensitization agent on tooth sensitivity after office bleaching treatment

a. Forest plot

The forest plot in Figure 3 shows that there is an effect of applying the desensitizing agent potassium nitrate on tooth sensitivity after office bleaching treatment. According to the results of the analysis, the use of potassium nitrate desensitization agents can reduce tooth sensitivity by 0.20 units lower than without the use of desensitization agents, but it is statistically significant (SMD= -0.20; 95% CI= -0.37 to -0.03; p=0.020). The forest plot shows low heterogeneity in effect estimates between studies (I²=10%; p=0.070), therefore the calculation of the average effect estimate was carried out using a fixed effect model approach.

A forest plot is a diagram that shows at a glance information from each study examined in a meta-analysis research, as well as an estimate of the overall results. The forest plot shows the large variation (heterogeneity) between study results visually (Akobeng, 2005; Murti, 2018).
b. Funnel plot

The funnel plot in Figure 4 shows that for studies with small samples, the distribution of effect estimates is asymmetric more to the left than to the right of the flat vertical line, thus indicating publication bias. Because the distribution of effect estimates is more to the left in the funnel plot, which is in the same direction as the diamond shape which is also to the left in the forest, publication bias tends to overestimate the true effect.

A funnel plot is a diagram of meta-analysis research that is used to demonstrate possible bias in publications. The funnel plot shows the relationship between sample size and effect size or standard error of the effect size from the various studies examined (Murti, 2018). The existence of bias in the publication of meta-analyses can be further tested statistically. There are 2 statistical tests for publication bias, namely: (1) Begg and Mazumdar's controlled correlation test; and (2) Egger et al's regression asymmetry test (D'Souza et al, 2002; Murti, 2018).

The Egger method is a method used to detect publication bias, consisting of a simple linear regression of the effect size in a study divided by the standard error, against the inverse of the standard error, then testing whether the intercept from the regression model is statistically significant ($p<0.01$) (Delgado-Rodriguez, 2001; D'Souza et al., 2002; Murti, 2018).
2. The effect of applying the desensitizing agent casein phosphopeptide-amorphous calcium phosphate (CPP-ACP) on tooth sensitivity after office bleaching treatment

a. Forest plot

The forest plot in Figure 5 shows that there is an effect of applying the desensitizing agent casein phosphopeptide amorphous calcium phosphate (CPP-ACP) on tooth sensitivity after office bleaching. According to the results of the analysis, the use of the desensitization agent casein phosphopeptide amorphous calcium phosphate (CPP-ACP) can reduce tooth sensitivity by 0.46 units lower than without the use of the desensitization agent, but it is statistically significant (SMD= -0.46; CI 95%=-0.67 to -0.24; p<0.001). The forest plot shows low heterogeneity in effect estimates between studies (I²=49%; p=0.070), therefore the calculation of the average effect estimate was carried out using a fixed effect model approach.

b. Funnel plot
The funnel plot in Figure 6 shows that for studies with small samples, the distribution of effect estimates is asymmetric more to the right than to the left of the flat vertical line, thus indicating publication bias. Because the distribution of effect estimates is more to the right in the funnel plot, which is in the opposite direction to the location of the diamond shape which is also to the left in the forest, publication bias tends to underestimate the true effect.

**DISCUSSION**

This systematic review and meta-analysis research discusses the effect of using chlorhexidine and povidone iodine mouthwash on the SARS-CoV-2 saliva viral load. The independent variables used in this study were the use of chlorhexidine and povidone iodine mouthwash. Meanwhile, the dependent variable used is salivary SARS-CoV-2 viral load.

1. **The effect of potassium nitrate desensitization agent on tooth sensitivity after office bleaching treatment**

Based on the analysis of 7 RCTs carried out with a systematic review and meta-analysis of the effect of applying potassium nitrate desensitization agents on tooth sensitivity after office bleaching treatment, it shows that there is homogeneity between studies ($I^2 = 10\%$) so that the analysis using a fixed effects model. This research article shows that the application of a potassium nitrate desensitization agent can reduce tooth sensitivity by 0.20 times compared to without the application of the desensitization agent and is statistically significant (SMD = -0.20; 95% CI = -0.37 to -0.03; $p=0.020$).

Maran et al., 2020’s study stated that the use of the desensitizing agent potassium nitrate can reduce tooth sensitivity because potassium nitrate has a calming effect on the nerves by preventing the nerves from repolarizing after experiencing depolarization in the pain cycle (Tageela et al., 2022). Research conducted by Tarique et al., 2017 showed that the application of a potassium nitrate agent for 14 days significantly reduced tooth sensitivity after bleaching treatment. Kose et al reported that the use of potassium nitrate can reduce tooth sensitivity (Tageela et al., 2022).

2. **The effect of desensitizing agent casein phosphopeptide-amorphous calcium phosphate (CPP-ACP) on tooth sensitivity after office bleaching treatment**

Based on the analysis of 7 primary studies with a RCT carried out with a systematic review and meta-analysis of the effect of applying the casein desensitization agent phosphopeptide-amorphous calcium phosphate (CPP-ACP) on tooth sensitivity after office bleaching treatment, the results obtained from Forest The plot shows homogeneity between studies ($I^2 = 49\%$) so the analysis uses a fixed effect model. This research article shows that the application of the CPP-ACP desensitization agent can reduce tooth sensitivity 0.46 times compared to without the application of the desensitization agent and is statistically significant (SMD = -0.46; 95% CI = -0.67 to -0.24; $p<0.001$).

Research by Singh et al. (2017) states that using the CPP-ACP desensitization agent for 14 days can reduce tooth sensitivity after bleaching treatment. A study conducted by Tageela et al., 2022 shows that the results of applying a desensitizing agent after office bleaching treatment carried out for 14 days can reduce tooth sensitivity. This is because the CPP-ACP desensitization agent works to close open dentin tubules by increasing...
enamel density, thereby preventing the transmission of pain stimuli to nerve endings, thereby reducing tooth sensitivity (Oldoini et al., 2018).

This study shows the positive effect of applying desensitizing agents potassium nitrate and CPP-ACP on tooth sensitivity after office bleaching treatment. The results of the meta-analysis showed a significant reduction in tooth sensitivity after applying potassium nitrate desensitization agents and CPP-ACP to patients after office bleaching treatment. In this study, potassium nitrate and CPP-ACP agents have different mechanisms of action. The mechanism of action of potassium nitrate is by interfering with the neural response to painful stimuli, while the mechanism of action of CPP-ACP is by blocking the flow of tubular fluid thereby closing the dentinal tubules. The benefits of desensitization agents can be maximized by paying attention to the application time of each desensitization agent (Busman et al., 2018).

**AUTHOR CONTRIBUTION**

Diyanti Safitri was the main researcher who chose the topic, searched for and collected study data. Eti Poncorini Pamungkasari and Bhisma Murti played a role in analyzing the data reviewing study documents.

**FUNDING AND SPONSORSHIP**

This study is self-funded.

**CONFLICT OF INTEREST**

There is no conflict of interest in this study.

**ACKNOWLEDGEMENT**

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**REFERENCE**


Lumuhlu EFS, Kaseke MM, Parengkuan WG (2016). Perbedaan efektivitas jus tomat (Lucopersicon esculentum Mill.) dan jus apel (Mallus sylvestris Mill.) sebagai bahan alami pemutih...
gigi (Differences in the effectiveness of tomato juice (*Lycopersicon esculentum* Mill.) and apple juice (Mallus sylvestris Mill.) as natural teeth whitening ingredients). E-GIGI. 4(2). https://doi.org/10.35790/eg.4.2.-2016.13488


