Correlation of the modified dental anxiety scale value with salivary alpha-amylase in pre-odontectomy patients

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ABSTRACT

Introduction: Odontectomy is a minor surgical procedure that often results in dental anxiety. Dental anxiety can interfere during odontectomy treatment. Dental anxiety can be examined using the Modified Dental Anxiety Scale (MDAS) and through the level of the salivary alpha-amylase enzyme, both of which are dental anxiety biomarkers. The objective of this study was to analyse the correlation between anxiety values with salivary alpha-amylase levels using MDAS as an indicator of anxiety in pre-odontectomy patients. Methods: This study was conducted on 60 research samples of women aged 18-40 years who came to the minor surgery clinic of Department of Oral and Maxillofacial Surgery, Universitas Padjadjaran Dental Hospital, to have odontectomy treatment of maxillary or mandibular third molars impaction, not having systemic and oral diseases, and willing to participate in this study. Patients who met the inclusion criteria then required to sign the research consent statement; afterwards, the MDAS data was taken. The salivary alpha-amylase enzyme data was taken using the Cocoro meter (Nipro, Japan) tip which was kept under the tongue for 30 seconds, then the tip was inserted into the monitor, and the enzyme levels would be counted. The data obtained will be analysed using the Spearman rank correlation test. Results: The results showed that there was a significant relationship (p < 0.01) with a strong positive correlation (r = 0.85). Conclusion: There is a correlation between MDAS value and salivary alpha-amylase enzyme as an indicator of dental anxiety.

Keywords: Dental anxiety, Modified Dental Anxiety Scale (MDAS), salivary alpha-amylase.
between the ages of 17-21 years.\textsuperscript{1-4} The population of impacted third molar teeth is around 33%, and this is still quite high value.\textsuperscript{1} Odontectomy is a type of surgery with a high rate of complications which increases in elderly patients. Complications will be reduced if the extraction of third molars is performed at a younger age. Odontectomy complications can also be reduced with better and more thorough techniques and perioperative care. Complications that often occur in patients after odontectomy, such as pain, infection, dry socket, trismus, and many more.\textsuperscript{1,4,5}

Odontectomy often causes anxiety in patients because the thoughts about what will or can occur to them, such as local anaesthesia injection, pain, seeing the surgery equipment, and complications might occur.\textsuperscript{6-8} Excessive anxiety in the patient will interfere with the odontectomy procedure. Anxiety is an anxious and depressed state of future uncertainty.\textsuperscript{9} Anxiety, fear, and stress in dental care, commonly called dental anxiety.\textsuperscript{8} Dental anxiety can be an obstructing the dentists in performing dental care. Dental anxiety prevalence is still high, at 50% of all feared general situations. Only a few patients feel not worried about dental visits.\textsuperscript{10-12} Anxious feelings during dental treatment harm not only the patient, but also the dentist due to the consequences such as cancelling visits, patients being late, not cooperating, unable to carry out or remember post-treatment instructions.

Dental anxiety can cause several symptoms in the form of physiological and emotional symptoms. These physiological symptoms can include, among other things, increasing pulse rate, blood pressure, palpitations, nausea, sweating, trembling, shortness of breath, feelings of choking, dizziness and weakness, and many more.\textsuperscript{8,13-15}

Dental anxiety can be measured and analysed with an accurate and comprehensive measuring tool. Modified Dental Anxiety Scale (MDAS) is one of the accurate methods. This method is a scale that discusses all dental actions that often cause dental anxiety.\textsuperscript{16} Dental anxiety that measured using MDAS can also be seen and analysed from biochemical changes, namely from hormones or a secreted enzyme. One of them is the increased secretion of the salivary alpha-amylase enzyme. Salivary alpha-amylase is associated with the sympathetic adrenal medullary (SAM) system. Evidence from comparative studies shows that changes in salivary alpha-amylase enzyme levels are an accurate indicator of an individual’s response to stress, due to the high sensitivity of the SAM system. Therefore, the salivary alpha-amylase enzyme is used as a biomarker of both acute and chronic anxiety.\textsuperscript{17-19} Measurement of the salivary alpha-amylase enzyme is carried out using saliva, so it is not an invasive action. Measurement of dental anxiety can also be performed from norepinephrine through blood plasma. This present study can not use blood plasma, because when using blood plasma, the study sample must be taken through blood injection, which will add the anxiety level of the respondents.

Based on the previous background, researchers were interested in measuring dental anxiety in female patients undergoing odontectomy treatment using MDAS and also by measuring the level of the salivary alpha-amylase enzyme, which will then be correlated. All study samples were women because predilection anxiety was known to be more common in female.

\textbf{METHODS}

This study involved 60 female patients aged 18-40 years who were going to perform odontectomy on their maxillary or mandibular third molars impacted teeth at the minor surgery clinic of Department of Oral and Maxillofacial Surgery, Universitas Padjadjaran Dental Hospital. The study samples were also patient without any history of systemic disease or other oral diseases. Before the research begins, a minimum research sample was calculated using the paired categorical analysis sample formula, and obtained a minimum number of study samples, which was 7 respondents.

The ethical approval was submitted to the Health Research Ethics Committee of the Faculty of Medicine Universitas Padjadjaran. Ethics Approval Letter was issued with the number of 709 / UN6.C1.3.2 / KEPK / PN / 2015. All respondents that agreed to participate in this study signed a Statement of Consent.

All patients filled in the MDAS, which is a scale to measure dental anxiety, which has been validated before. This questionnaire consisted of five questions. The first question was regarding the anxiety evaluation one day before treatment, the
second was regarding the anxiety evaluation in the patient’s waiting room, the third was regarding the evaluation of dental drill treatment anxiety, the fourth was the evaluation of dental cleaning and bleaching treatment anxiety, and finally the fifth was the evaluation of anxiety of the local anaesthesia injection during dental treatment. Each question consisted of five choice scales based on a Likert scale: the answer with the lowest value was the value number one, “not anxious”; the value number two was “a little anxious”; the value number three was “anxious”; the value number four was “much anxious”; and the value number five was “very much anxious”. The results of these answers were summed and categorised as follows: the amount 0 - 5 is categorised as “not anxious” with a score of 1; the amount of 6 - 10 is “mild anxiety” with a score of 2; the number 11-14 is “moderate anxiety”, with a score of 3; the amount of 15 - 18 is “severe anxiety” with a score of 4; and the amount of 19-25 is “phobia” with a score of 5. The value of each MDAS question will be added up and will be categorised as described in Table 1.

All samples were examined for the salivary alpha-amylase enzyme level using the Cocoro meter (Nipro, Japan) tip which was kept under the tongue for 30 seconds, then the tip was inserted into the monitor, and the enzyme level value would be counted. Furthermore, the enzyme value was categorised as follows: the enzyme levels of 0-30 KU/L was categorised as “not anxious” with a score of 1; the enzyme levels of 31-45 KU/L was “mild anxiety” with a score of 2; the enzyme levels of 46-60 was “moderate anxiety” with a score of 3; and the enzyme levels of ≥ 61 KU/L was “severe anxiety” with a score of 4. The value of the salivary alpha-amylase enzyme will be categorised as described in Table 2. Data obtained from the MDAS and salivary alpha-amylase enzymes will be analysed using the Spearman rank test.

The results of this study generating data which were then analysed using the Spearman correlation test, which is presented in the following table.

Based on the Spearman correlation test analysis showed that there was a significant relationship (p<0.01) with a strong positive correlation (r = 0.85).

DISCUSSION

Patients who experience dental anxiety can be seen from the results of MDAS values with a particular value limit, this scale is specific about dental care, so the results are accurate and can be used to check dental anxiety. The MDAS scale has good reliability and validity. When patients...

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**Table 1. MDAS score categories**

<table>
<thead>
<tr>
<th>MDAS value</th>
<th>Category</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 5</td>
<td>Not anxious</td>
<td>1</td>
</tr>
<tr>
<td>6 - 10</td>
<td>Mild anxiety</td>
<td>2</td>
</tr>
<tr>
<td>11 - 14</td>
<td>Moderate anxiety</td>
<td>3</td>
</tr>
<tr>
<td>15 - 18</td>
<td>Severe anxiety</td>
<td>4</td>
</tr>
<tr>
<td>19 - 25</td>
<td>Phobia</td>
<td>5</td>
</tr>
</tbody>
</table>

**Table 2. Salivary alpha-amylase enzyme value category**

<table>
<thead>
<tr>
<th>Enzymes value (KU/L)</th>
<th>Category</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 30</td>
<td>Not anxious</td>
<td>1</td>
</tr>
<tr>
<td>31 - 45</td>
<td>Mild anxiety</td>
<td>2</td>
</tr>
<tr>
<td>46 - 60</td>
<td>Moderate anxiety</td>
<td>3</td>
</tr>
<tr>
<td>≥ 61</td>
<td>Severe anxiety</td>
<td>4</td>
</tr>
</tbody>
</table>

**Table 3. Correlation between MDAS value and salivary alpha-amylase enzyme**

<table>
<thead>
<tr>
<th>Variable</th>
<th>r_s</th>
<th>t_countable</th>
<th>p_value</th>
<th>Notes</th>
<th>Corr</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDAS and enzyme</td>
<td>0.85</td>
<td>12.34</td>
<td>3.703E-18</td>
<td>Sign</td>
<td>72.41</td>
</tr>
</tbody>
</table>
experience dental anxiety, the amount of MDAS values also increases.\textsuperscript{22}

Patients who experience dental anxiety will also show an increase in the value of the salivary alpha-amylase enzyme level. That is because when patients get stressors in the form of dental anxiety due to an odontectomy, the stressors will send a signal to the hypothalamus, which will then increase the activation of the SAM system and will cause an increase in acetylcholine release. The increase in acetylcholine release occurs because one’s anxiety also causes stimulation of the sympathetic nerves which release acetylcholine resulting in depolarization of the chromaffin membrane which is a cell that produces catecholamines, namely L-DOPA, dopamine, norepinephrine, or epinephrine. Furthermore, depolarization of the cell membrane will then cause the opening of ion channels, then Ca\textsuperscript{2+} ions will flow into the chromaffin cells, causing an increase in catecholamine exocytosis consisting of norepinephrine and epinephrine. With the increase in the secretion of norepinephrine, it will cause an increase in the secretion of the alpha-amylase enzyme.\textsuperscript{14,22-25}

According to research conducted by Thoma et al.\textsuperscript{25}, the salivary alpha-amylase enzyme has a significant relationship with the norepinephrine response. However, no significant relationship was found with the epinephrine response.\textsuperscript{25} Based on research conducted by Nater et al.\textsuperscript{26} and Vineetha et al.,\textsuperscript{27} which comparing alpha-amylase enzyme activity with acute stress and/or adrenergic activity, suggested that salivary alpha-amylase en-zymes reflect adrenergic activity and thus can be used as a reliable index of SAM system activity during acute stress and adrenergic activity.\textsuperscript{26,27} Also, based on research by Rashkova et al.\textsuperscript{19}, the levels of the salivary alpha-amylase enzymes are biomarkers of acute stress and chronic stress.\textsuperscript{18} These results prove that the MDAS scale and alpha-amylase enzyme levels are both increased in patients with dental anxiety.

In patients with dental anxiety, dentists can provide measures that can reduce dental anxiety, such as good communication between doctors and patients, and providing complete information about the treatment procedure. Listening to music in the waiting room or the dentist’s office can also provide tranquillity for the patient.

**CONCLUSION**

Examination of dental anxiety can be performed using the Modified Dental Anxiety Scale (MDAS) and also by examining the value of salivary alpha-amylase enzyme levels prior to the odontectomy treatment. These results indicated a correlation between MDAS and salivary alpha-amylase levels.

**REFERENCES**

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