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

Daisy Wulansari[1*], Indra Hadikrishna[2], Endang Sjamsudin[2]

[1]Department of Prosthodontics, Faculty of Dentistry Universitas Padjadjaran, Indonesia
[2]Department of Oral and Maxillofacial Surgery, Faculty of Dentistry Universitas Padjadjaran, Indonesia

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.

p-ISSN: 1979-0201; e-ISSN: 2549-6212; Available from: http://jurnal.unpad.ac.id/pjd/article/view/15304
DOI: 10.24198/pjd.vol32no2.15304
Submission: Jan 18, 2018; Accepted: Jul 29, 2020; Published online: Jul 31, 2020

INTRODUCTION

Odontectomy is a minor surgical procedure for the removal of impacted teeth which is often performed regularly by a dental surgeon. The prevalence of impacted teeth is still high. The most frequently impacted teeth are third molars because it is the last tooth erupted, which is

[*]Corresponding author: Daisy Wulansari, Department of Oral and Maxillofacial Surgery, Faculty of Dentistry Universitas Padjadjaran, Indonesia. Department of Oral and Maxillofacial Surgery, Faculty of Dentistry Universitas Padjadjaran, Jalan Sekeloa Selatan I, Bandung, West Java, Indonesia, 40132. Phone: +628562175502; Email: daisy_wulansari@yahoo.co.id

between the ages of 17-21 years.[1-4] The population of impacted third molar teeth is around 33%, and this is still quite high value.[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.[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.[6-8] Excessive anxiety in the patient will interfere with the odontectomy procedure. Anxiety is an anxious and depressed state of future uncertainty.[9] Anxiety, fear, and stress in dental care, commonly called dental anxiety.[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.[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.[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.[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.[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.

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.[20] The value of each MDAS question will be added up and will be categorised as described in Table 1.

Table 1. MDAS score categories

MDAS value	Category	Score
0 – 5	Not anxious	1
6 – 10	Mild anxiety	2
11 – 14	Moderate anxiety	3
15 – 18	Severe anxiety	4
19 – 25	Phobia	5

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 ≥ 60 KU/L was "severe anxiety" with a score of 4.21 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.

Table 2. Salivary alpha-amylase enzyme value category

Enzymes value (KU/L)	Category	Score
0 – 30	Not anxious	1
31 – 45	Mild anxiety	2
46 – 60	Moderate anxiety	3
≥ 61	Severe anxiety	4

RESULTS

Based on the research procedures mentioned before, the data obtained is presented as follows.

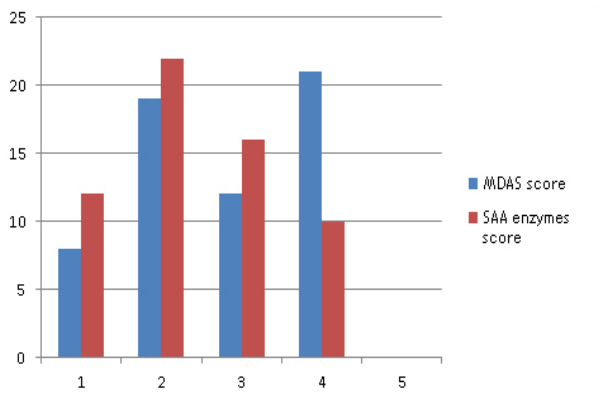

Figure 1. Graphic of MDAS and salivary alpha-amylase enzymes values

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

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

Variable	r_s	$t_{countable}$	p_{value}	Notes	Corr
MDAS and enzyme	0.85	12.34	$3.703E^{-18}$	Sign	72.41

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

experience dental anxiety, the amount of MDAS values also increases.[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 odon-tectomy, 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 depolari-zation of the chromaffin cell 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 open-ing of ion channels, then Ca^{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.[14,23-25]

According to research conducted by Thoma et al.[25], the salivary alpha-amylase enzyme has a significant relationship with the norepinephrine response. However, no significant relationship was found with the epinephrine response.[25] Based on research conducted by Nater et al.[26] and Vineetha et al.[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.[26,27] Also, based on research by Rashkova et al.[18], the levels of the salivary alpha-amylase enzymes are biomarkers of acute stress and chronic stress.[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

1. Ahmed SS, El-Sharrawy EA, Hamed TA. Clinical evaluation of cox-2 inhibitor for management of post operative complication after odontectomy of impacted lower third molar. J Am Sci. 2014; 10(11): 60-3.
2. Juodzbalys G, Daugela P. Mandibular third molar impaction: Review of literature and a proposal of a classification. J Oral Maxillofac Res. 2013; 4(2): e1. DOI: 10.5037/jomr.2013.4201
3. Landi L, Manicone PF, Piccinelli S, Raia A, Raia R. A novel surgical approach to impacted mandibular third molar to reduce the risk of paresthesia: A case series. J Oral Maxillofac Surg. 2010; 68(5): 969-74. DOI: 10.1016/j.joms.2009.09.097
4. Susarla SM, Blaeser BF, Magalnick D. Third molar surgery and associated complications. Oral Maxillofac Surg Clin North Am. 2003; 15(2): 177-86. DOI: 10.1016/S1042-3699(02)00102-4
5. Contar CMM, de Oliveira P, Kanegusuku K, Berticelli RDS, Azevedo-Alanis LR, Machado MAN. Complications in third molar removal: A retrospective study of 588 patients. Med Oral Patol Oral Cir Bucal. 2010; 15(1): e74-8. DOI: 10.4317/medoral.15.e74
6. Kim S, Lee YJ, Lee S, Moon HS, Chung MK. Assessment of pain and anxiety following surgical placement of dental implants. Int J Oral Maxillofac Implants. 2013; 28(2): 531-5. DOI: 10.11607/jomi.2713
7. Matsuda Y, Seto M, Kikuta T. Relationship between the evaluation of anxiety before the impacted third molar surgery and the autonomic nervous activity. Med Bull Fukuoka Univ. 2014; 41(2): 77-85.
8. Tarazona B, Tarazona-Alvarez P, Peñarrocha-Oltra D, Rojo-Moreno J, Peñarrocha-Diago MA. Anxiety before extraction of impacted

blower third molar. Med Oral Patol Oral Cir Bucal. 2015; 20(2): e246-e250. DOI: 10.4317/medoral.20105
9. Al-Madi EM, Abdel Latif H. Assessment of dental fear and anxiety pamong adolescent females in Riyadh, Saudi Arabia. Saudi Dent J. 2002; 14(2): 77-81.
10. Bare LC, Dundes L. Strategies for combating dental anxiety. J Dent Educ. 2004; 68(11): 1172-7. DOI: 10.1002/j.0022-0337.2004.68.11.tb03862.x
11. Hmud R, Walsh LJ. Dental anxiety: Causes, complication and management approaches. Journal of Minimum Intervention in Dentistry. Int Dent SA. 2007; 9(5): 6-16.
12. Kanegane K, Penha SS, Borsatti MA, Rocha RG. Dental anxiety in an emergency dental service. Rev Saude Publica. 2003; 37(6): 786-92. DOI: 10.1590/s0034-89102003000600015
13. Armfield JM, Heaton LJ. Management of fear and anxiety in the dental clinic: A review. Aust Dent J. 2013; 58(4): 390-407. DOI: 10.1111/adj.12118
14. Shives LR. Basic Concepts of Psychiatric-Mental Health Nursing. 8th ed. Philadelphia: Lippincott Williams & Wilkins; 2012.
15. Suhartini S. Effectiveness of music therapy toward reducing patient's anxiety in intensive care unit. Nurse Med J Nursing. 2008; 2(1): 31-6. DOI: 10.14710/nmjn.v2i1.737
16. Humphris GM, Morrison T, Lindsay SJ. The Modified Dental Anxiety Scale: Validation and United Kingdom norms. Community Dent Health. 1995; 12(3): 143-50.
17. Payne LA, Hibel LC, Granger DA, Tsao JCI, Zetlzer LK. Relationship of salivary alpha amylase and cortisol to social anxiety in healthy children undergoing laboratory pain tasks. J Child Adolesc Behav. 2014; 2: 1000129. DOI: 10.4172/jcalb.1000129
18. Rashkova MR, Ribagin LS, Toneva NG. Correlation between salivary α-amylase and stress-related anxiety. Folia Med (Plovdiv). 2012; 54(2): 46-51. DOI: 10.2478/v10153-011-0088-4
19. Takai N, Yamaguchi M, Aragaki T, Eto K, Uchihashi K, Nishikawa Y. Effect of psychological stres on the salivary cortisol and amylase level Ni healty young adults. Arch Oral Biol. 2004; 49(12): 963-8. DOI: 10.1016/j.archoralbio.2004.06.007
20. Humphris GM, Morrison T, Lindsay SJ. The Modified Dental Anxiety Scale: Validation and United Kingdom norms. Community Dent Health. 1995; 12(3): 143-50.
21. Sugimoto K, Kanai A, Shoji N. The effectiveness of the Uchida-Kraepelin test for psychological stres: An analysis of plasma and salivary stress substances. Biopsychosoc Med. 2009; 3(5): 1-11. DOI: 10.1186/1751-0759-3-5
22. Appukuttan D, Datchnamurthy M, Deborah SP, Hirudayaraj GJ, Tadepalli A, Victor DJ. Reliability and validity of the Tamil version of modified dental anxiety scale. J Oral Sci. 2012; 54(43): 313-20. DOI: 10.2334/josnusd.54.313
23. Lynch CD, Sundaram R, Maisog JM, Sweeney AM, Louis GMB. Preconception stress increase the risk of infertility: Results from a couple-based praspective cohort study--The LIFE study. Hum Reprod. 2014; 29(5): 1067-75. DOI: 10.1093/humrep/deu032
24. Mulrine BL, Sheehan MF, Burrell LM, Matthews MD. Measuring stres and ability to recover from stres with salivary α-amylase level. Department of Behavioral Sciences and Leadership. Report number: PL488E11, 2011. p. 8-16.
25. Thoma MV, Kirschbaum C, Wolf JM, Rohleder N. Acute stress responses in salivary alpha-amylase predict increases of plasma norepinephrine. Biol Psychol. 2012; 91(3): 342-8. DOI: 10.1016/j.biopsycho.2012.07.008
26. Nater UM, Rohleder N. Salivary alpha-amylase as a non-invasive biomarker for the sympathetic nervous system: Current state of research. Psychoneuroendocrinology. 2009; 34(4): 486-96. DOI: 10.1016/j.psyneuen.2009.01.014
27. Vineetha R, Pai KM, Vengal M, Gopalakrishna K and Narayanakurup D. Usefulness of salivary alpha amylase as a biomarker of chronic stress and stress related oral mucosal changes-A pilot study. J Clin Exp Dent. 2014; 6(2): e132-e137. DOI: 10.4317/jced.51355