Original paper

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Correlation of Blood Pressure, Heart Rate and Pain with Anxiety, and Importance of its Prevention in Surgery of Impacted Third Molars Under Local Anesthesia

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Key words

Anxiety; blood pressure; heart rate; pain; preventive psychiatry

Abstract

Aim: To examine whether there is a correlation between blood pressure, heart rate, and pain with the level of preoperative and postoperative anxiety in surgery of impacted third molars under local anesthesia. **Subjects and Methods:** In the study, which included adult patients of both sexes with an indication for surgical extraction of impacted third molars, research parameters were measured as follows: 1st measurement (day of examination) - blood pressure, heart rate, preoperative anxiety with Spielberger's State-Trait Anxiety Inventory (STAI); 2nd measurement (immediately before the intervention) – blood pressure, heart rate, preoperative anxiety with STAI; 3rd measurement (day after intervention) – blood pressure, heart rate, postoperative anxiety with STAI, postoperative pain with visual analog scale. **Results:** The values of preoperative and postoperative anxiety and the measured parameters of blood pressure, heart rate, and postoperative pain were statistically significantly positively correlated with each other during all measurements. **Conclusion:** In order to increase the satisfaction of both the patient and the ordinarius, and to prevent possible complications in this type of oral surgical intervention, it would be useful to consider adequate therapy in order to prevent the development of anxiety, considering the confirmed correlation with the measured parameters.

Introduction

The operation of an impacted third molar is the most common procedure performed in oral surgery and is associated with bone and soft tissue trauma, which is also the cause of patient morbidity [1]. It is to be expected that after oral surgical intervention, such as surgical extraction of impacted teeth, complications will appear. Common complications include swelling, pain, trismus. More serious complications are fractures of the alveolar ridge on the maxilla or mandible, paresthesia of the trigeminal nerve, etc [2]. Adequate choice of preoperative medication administration can significantly influence the intensity of swelling, pain and trismus after surgery [3].

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Given the possibility of more or less pronounced postoperative complications, a large number of patients may experience preoperative anxiety due to the expectation of them, but also postoperative anxiety due to the experience during oral surgical intervention [4]. Monitoring blood pressure parameters (systolic and diastolic) and heart rhythm through heart rate value during surgical procedures is an effective measure for risk assessment and prevention of possible hemodynamic complications [5]. Anxiety as a personality trait is an integral part of each of the individual forms of anxiety disorders and is their prerequisite, and is characterized by the continuity of anxious reactions to a large number of situations, whereby this phenomenon shows stability and persistence over time [6]. Anxiety caused by a particular situation generally refers to a psychologically healthy individual who is prone to experience anxiety in stressful situations. Anxiety caused by a certain situation is characterized by an emotional reaction of heightened internal tension related to the specific situation as the cause of that reaction [7]. Pain is one of the most common complications reported in the literature after surgical removal of impacted third molars [8]. Despite the existing knowledge of the mechanisms of pain and its treatment, acute postoperative pain has not yet been fully considered. Understanding the pathophysiology of pain and the inflammatory process is the basis for adequate management of postoperative complications. Acute pain has an alarming function, and the inflammatory process is a prerequisite for normal tissue healing. Factors such as exhaustion caused by pain, as well as a painful experience during and after oral surgery can be triggers for various anxiety states [9]. Pain and fear control is an extremely important segment of any surgical therapy [10]. The aim of the research was to examine whether there is a correlation between blood pressure, heart rate and pain with the level of preoperative and postoperative anxiety in operations of impacted third molars under local anesthesia.

Subjects and Methods

The study included patients indicated for removal of maxillary and mandibular impacted third molars with complete growth and root development, mesioangular position. The same operative approach was applied with standard surgical instruments, and adequate oral-surgical preoperative and postoperative therapy was prescribed, which includes analgesic, antibiotic and anaphlogistic medication. Each patient was diagnosed with an impacted maxillary and mandibular third molar or molars after a clinical examination and X-ray analysis of appropriate images, of which an orthopantomogram is mandatory.

The research was conducted in accordance with the Helsinki Declaration on the Rights of Patients and with the ethical approval of the of the Primary health care center Zenica, in the period from march 2012 to march 2022 [11]. All patients signed an informed consent to participate in the study. Patients were free of pain and other inflammatory symptoms including swelling, hyperemia and reduced mouth opening at the time of surgery. Exclusion criteria for patients included: kidney or liver diseases, blood dyscrasias, previous and current gastric ulceration, heart disease, proven hypersensitivity allergic reactions to a research drug, pregnancy and lactation. In all subjects, the impacted teeth were extracted, with the prior consent of the patients and under local anesthesia (in a dose of 4 ccm 2 % lidocaine with adrenaline, 1:80,000) at the oral surgery department in the operating room of the Primary health care center Zenica.

The level of anxiety during the surgical removal of the impacted third maxillary and mandibular molar in the patient, as well as the values of blood pressure and heart rate were evaluated: day 1 (day of examination); 2nd day (immediately before the intervention itself); 3rd day (day after surgical intervention). The assessment of anxiety was done through the value of Spielberger's coefficients for general and current anxiety based on the STAI (Spielberger's State-Trait Anxiety Inventory) scale. The STAI scale is one of the most commonly used scales for assessing anxiety as a personality trait, i.e., general anxiety, as well as for assessing anxiety caused by a specific situation, i.e., current anxiety [12]. It consists of 40 items, 20 to assess general anxiety and 20 to assess current anxiety. Particles are scored on a 4-point scale. For research purposes, a scale translated into Croatian language was used, the reliability of which was confirmed in several studies [13-17]. The value of Cronbach's alpha in this study is 0.92.

Blood pressure and heart rate were measured using a digital manometer that measures all values simultaneously. Each measurement was repeated five times, every two minutes. The level of pain was assessed the day after the surgical intervention based on the VAS (visual analogue scale).

Statistical analysis was done in SPSS (Statistical Package for The Social Sciences, version 26.0). Determining the normality of the tested sample was performed with the Kolmogorov-Smirnov test. Abnormalities in the distribution were confirmed, which is why the non-parametric Spearman coefficient was used to determine the correlation between the observed variables. The significance level was $p < 0.05$. GraphPad Prism (version 9) was used for graph visualization.

Results

In total, 501 patients participated in the study, of which the majority were female (58.3 %) compared to male (41.7 %). The youngest respondents were 18 years old, and the oldest 45 (Table 1).

Table 2. presents descriptive values for all three measurements for the parameters of systolic and diastolic blood pressure, heart rate, general (Figure 1) and

Table 1. Demographic characteristics of participants

Variable		n (%)
Sex	Female	292 (58.3)
	Male	209 (41.7)
	Total	501 (100)
Age	Min	18
	Max	45
	Mean	25.57
	SD	7.892

current (Figure 2) anxiety. The exception is pain, which was measured the day after the operation.

Table 3 presents the preoperative values of the monitored parameters, where it was determined that there is a positive correlation and a statistically significant association of the intensity of preoperative anxiety assessed with Spielberg's patterns X1 and X2 with the preoperative values of blood pressure and heart rate for the 1st and 2nd measurements ($p < 0.01$). The differences between the correlation coefficients are insignificant and the results suggest that people who have high preoperative anxiety caused by the current event and high preoperative general anxiety on the 1st and 2nd day of measurement have correspondingly correlated values of the preoperatively measured parameters of blood pressure (systolic and diastolic) and heart rate. Additionaly, in Table 3 (3rd measurement) of the monitored parameters, it was determined that there is a positive correlation and a statistically significant connection between the intensity of postoperative anxiety assessed with Spielberg's patterns X1 and X2 with the postoperative values of blood pressure and heart rate ($p < 0.01$). The differences between the correlation coefficients are insignificant and the results suggest that people who have high postoperative anxiety caused by the current event and high postoperative general anxiety for the third day of measurement, have correspondingly correlated values of the postoperative parameters of blood pressure (systolic and diastolic) and heart rate. Furthermore, the values of the third measurement are presented (Table 3), where it was determined that there is a positive correlation between the level of postoperative pain for all values of preoperative and postoperative anxiety ($p < 0.01$). The positive values of the correlation coefficients suggest that pain, that is, the level of pain can have an influence on the value of the current anxiety score, which is an oral-surgical procedure. Patients with higher values of the current anxiety score, which was evaluated based on X1, had higher pain and vice versa. Similarly, pain can have an impact on the values of the general anxi-

Table 2. Descriptive statistics of observed variables measured on three occasions

Variable	1st measurement		2nd measurement		3rd measurement	
	M ± SD (min – max)	p value*	M ± SD (min – max)	p value*	M ± SD (min – max)	p value*
BP_S	131.64 ± 7.71 (114.0 – 146.8)	0.000	132.59 ± 7.82 (115.4 – 147.6)	0.000	125.27 ± 9.24 (110.0 – 143.2)	0.000
BP_D	81.84 ± 7.72 (64.2 – 96.6)	0.000	82.99 ± 7.71 (66 – 97)	0.000	75.9 ± 9.32 (60.0 – 93.6)	0.000
HR	88.45 ± 9.91 (64.6 – 105.6)	0.000	88.91 ± 9.83 (65.6 – 106.4)	0.000	81.56 ± 11.3 (60.0 – 104.6)	0.000
X1	47.03 ± 9.84 (26 – 62)	0.000	46.14 ± 9.55 (25 – 62)	0.000	39.01 ± 9.79 (23 – 59)	0.000
X2	50.99 ± 10.1 (28 – 66)	0.000	50.11± 9.87 (28 – 67)	0.000	41.91 ± 10.41 (24 – 63)	0.000
VAS	-	-	-	-	5.7 ± 2.14 (2 – 9)	0.000

Legend: M - mean; SD - standard deviation; min - minimal value; max - maximal value; * - Kolmogorov-Smirnov test of distribution normality, significant < 0.05; BP_S - systolic blood pressure; BP_D - diastolic blood pressure; HR - heart rate; X1 - coefficient of general anxiety assessed by Spielberger's form STAI X1; X2 - coefficient of current anxiety assessed by Spielberger's form STAI X2; VAS - Visual analog scale of pain.

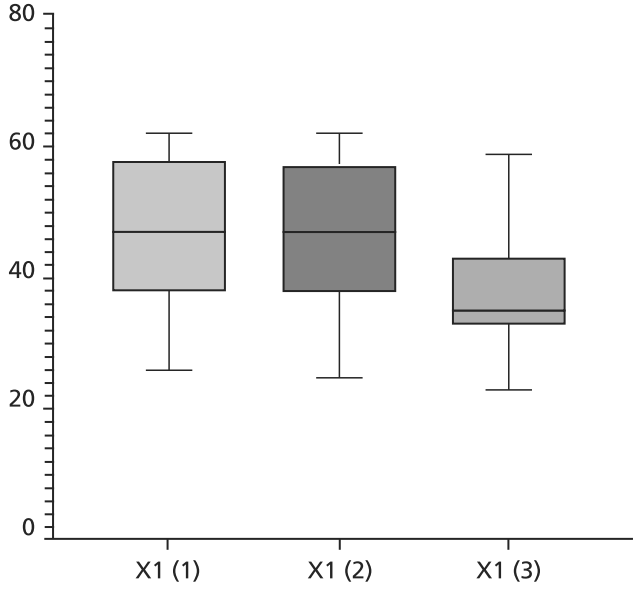

Figure 1. Coefficient of general anxiety (X1) assessed by Spielberger's form for first (1), second (2) and third (3) measurement

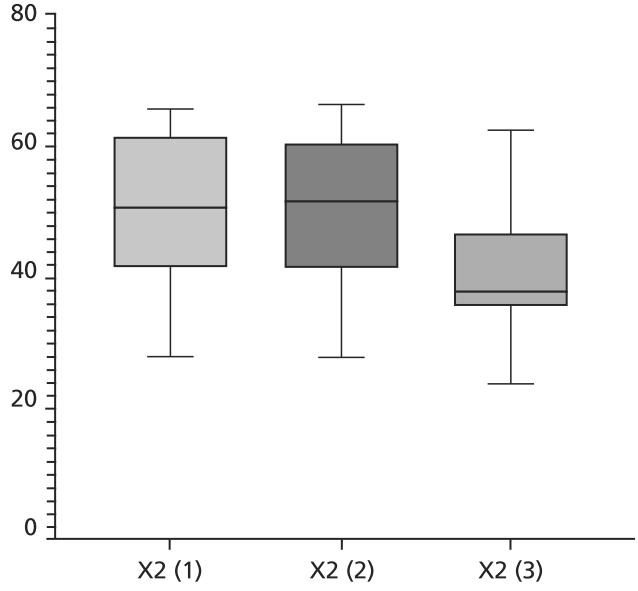

Figure 2. Coefficient of current anxiety (X2) assessed by Spielberger's form for first (1), second (2) and third (3) measurment

Table 3. Correlation between the examined variables

Variable		X1	X2	BP_S	BP_D	HR	VAS
1st measurement	X1	1	0.997*	0.880*	0.880*	0.915*	0.689*
	X2	0.997*	1	0.888*	0.887*	0.921*	0.695*
	BP_S	0.880*	0.888*	1	0.999*	0.940*	-
	BP_D	0.880*	0.887*	0.999*	1	0.941*	-
	HR	0.915*	0.921*	0.940*	0.941*	1	-
	VAS	0.689*	0.695*	-	-	-	1
2nd measurement	X1	1	0.996*	0.703*	0.845*	0.924*	0.789*
	X2	0.996*	1	0.713*	0.850*	0.930*	0.794*
	BP_S	0.703*	0.713*	1	0.793*	0.758*	-
	BP_D	845*	0.850*	0.793*	1	0.896*	-
	HR	0.924*	0.930*	0.758*	0.896*	1	-
	VAS	0.789*	0.794*	-	-	-	1
3rd measurement	X1	1	0.995*	0.780*	0.852*	0.914*	0.877*
	X2	0.995*	1	0.776*	0.847*	0.914*	0.876*
	BP_S	0.780*	0.776*	1	0.877*	0.850*	-
	BP_D	0.852*	0.847*	0.877*	1	0.905*	-
	HR	0.914*	0.914*	0.850*	0.905*	1	-
	VAS	0.877*	0.876*	-	-	-	1

Legend: * - p < 0,05; BP_S - systolic blood pressure; BP_D - diastolic blood pressure; HR - heart rate; X1 - coefficientof general anxiety assessed by Spilberger's form STAI X1; X2 - coefficient of current anxiety assessed by Spilberger's form STAI X2; VAS - Visual analog scale of pain.

ety score, or anxiety as a personality trait. Patients with higher values of the general anxiety score, which was evaluated based on X2, had higher pain, and vice versa.

Discussion

Although often neglected, fear and discomfort play an important role in the success of an intervention in the oral cavity [13]. Causing anxiety by intervention in the oral cavity is a universal phenomenon, which can be enhanced by smell, sound, light, and previous experience. Most patients who experienced it consider it one of the worst experiences in their life [4,18-22]. Recent research indicates that patients with pronounced anxiety tend to categorize oral surgical interventions as extremely unpleasant even though they have not had or experienced such an experience, and show a tendency to overestimate the intensity of postoperative pain [23,24]. Anxiety before the application of local anesthesia and tooth extraction confirms a wide range of physical and psychological complications, and can stimulate the adrenal cortex to increase serum cortisol levels. Some authors, such as Thayumanavan and associates, point to a significant increase in cortisol in saliva before tooth extraction, which indicates the patient's mental stress [25,26]. Spielberger's State-Trait Anxiety Inventory (STAI) is a conceptual research instrument for assessing anxiety in adult patients [18]. There are two scales: the STAI-S, which registers an anxious state, and the STAI-T, which registers anxiety as a relatively stable personality trait. Anxiety coefficients X1 and X2 are calculated based on the score.

In this research, the influence of the level of anxiety on the value of blood pressure (systolic and diastolic) and heart rate was considered. The respondents in our research showed that the levels of preoperative general and current anxiety tended to decrease slightly, but also significantly, as the date of oral surgical intervention approached. According to the research protocol, all patients underwent detailed preoperative information preparation and decisive explanations of the very act of intervention, pharmacological medication and the postoperative period, as well as possible postoperative complications and ways to overcome them. Good preoperative information of the patients and gradual coping with the upcoming intervention led to a subconscious reduction of feelings of restlessness, anxiety and fear of the operative procedure, and this can be accepted as an explanation for the decrease in postoperative general and immediate anxiety. Sorribes and associates, Souza and associates, Monteiro and associates, Martinez-Bernal and associates, are just some of the authors from a large body of research that considers ways to alleviate preoperative anxiety in patients through various preparations of patients for the upcoming treatment, which ultimately leads to increased satisfaction, both the patient and the surgeon [27-30]. While the results of some studies indicate a significant increase in systolic and diastolic blood pressure before extraction, and a slight increase in heart rate, some studies show a significant increase in preoperative heart rate values [31-33].

The results of this research agree with the observations that such a correlation does exist. In this research, the influence of the level of anxiety on the body's response was primarily considered, following the values of systolic and diastolic blood pressure and heart rate. The differences between the correlation coefficients were mutually insignificant, but the results of this research in general suggest that people who have high anxiety, registered on the day of the first examination of the patient, immediately before the intervention and the day after the intervention, accordingly, have elevated values of blood pressure and heart rate.However, it is possible that the change in the initial values of blood pressure and heart rate can be influenced by a positive or negative family history of hypertension [34-35]. Whether local anesthesia with adrenaline causes a change in blood pressure and heart rate during oral surgery or whether it is the result of psychological stress due to oral surgery is the subject of discussion by many authors [36-38]. The author Liau FL sought the cause of the increase in blood pressure during oral surgical interventions in the very act of applying local anesthesia and the direct contact of the injection needle, as well as the manipulation of the needle in the soft tissue of the oral milieu. Pain caused by injection is associated with an increase in the cardiovascular response [39,40]. The research examined the level of postoperative pain the day after oral surgery. Pain is an expected post-surgical complication after surgical removal of third molars [41,42]. Postoperative pain begins when the effect of the local anesthetic decreases and reaches its maximum intensity during the first 12 postoperative hours. The description of pain is always subjective [42]. It is not possible to evaluate or measure pain directly, but based on the patient's statement about the pain experienced, and the ordinarius' inspection, which includes observation of facial expressions and body movements, it is measured in an indirect way. The measurement of the intensity of painful sensations is made possible by one-dimensional and multidimensional scales for determining the intensity of pain. The most commonly used is visual analog scale (VAS). The positive values of the correlation coefficients suggest that pain, that is, the level of pain can have an impact in terms of increasing the value of the current anxiety score, that is, anxiety triggered by a stressful experience, which is an oral surgical procedure. Patients with higher values of the current anxiety score, which was evaluated

based on X1, had higher pain and vice versa. Likewise, pain can have an impact on the values of the general anxiety score, that is, anxiety as a personality trait, in the sense of increasing it. Patients with higher values of the general anxiety score, which was evaluated based on X2, had higher pain, and vice versa.

The results of the research can help the surgeon to assess the anxiety status of patients who have planned and performed the removal of an impacted third molar, and prescribe adequate therapy in a timely manner in order to prevent possible complications related to this type of intervention. The usefulness of considering adequate therapy in order to prevent preoperative anxiety is unquestionable, given the positive correlation with postoperative anxiety, systolic and diastolic blood pressure values, as well as pain. This would certainly create predispositions to increase the satisfaction of patients and ordinarius', while reducing the complications of such interventions.

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Conflict of Interest

None to declare.

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References

1. Gay-Escoda C, Sánchez-Torres A, Borrás-Ferreres J, Valmaseda-Castellón E. Third molar surgical difficulty scales: systematic review and preoperative assessment form. Med Oral Patol Oral Cir Bucal. 2022;27:e68-76.
2. Hallab L, Azzouzi A, Chami B. Quality of life after extraction of mandibular wisdom teeth: a systematic review. Ann Med Surg (Lond). 2022;81:104387.
3. Bailey E. Prevention and management of post-operative pain in oral surgery.Prim Dent J. 2018;7:57-63.
4. Lin CS, Wu SY, Yi CA. Association between anxiety and pain in dental treatment: a systematic review and meta-analysis. J Dent Res. 2017;96:153-62.
5. Li J, Tian Z, Qi S, Zhang J, Li L, Pan J. Cardiovascular response of aged outpatients with systemic diseases during tooth extraction: a single-center retrospective observational study. Front Public Health. 2022;10:938609.
6. Buckman JEJ, Saunders R, Stott J, Arundell LL, O'Driscoll C, Davies MR, at al. Role of age, gender and marital status in prognosis for adults with depression: an individual patient data meta-analysis. Epidemiol Psychiatr Sci. 2021;30:e42.
7. Ayano G, Betts K, Calderon Maravilla J, Alati R. The risk of anxiety disorders in children of parents with severe psychiatric disorders: a systematic review and meta-analysis. J Affect Disord. 2021;282:472-87.
8. Rudin A, Eriksson L, Liedholm R, List T, Werner MU. Prediction of postoperative pain after mandibular third molar surgery. J Orofac Pain. 2010;24:189-96.
9. Biziaev AF, Ivanov SIu, Khramelashvili VV, Dzhaginov EA. Evaluation of patient psychophysiological status by a clinical scale before a dental surgery intervention. Stomatologiia (Mosk). 1983;62:39-41.
10. McNeil DW, Helfer AJ, Weaver BD, Graves RW, Kyle BN, Davis AM. Memory of pain and anxiety associated with tooth extraction. J Dent Res. 2011;90:220-4.
11. Shrestha B, Dunn L. The declaration of Helsinki on medical research involving human subjects: a review of seventh revision. J Nepal Health Res Counc. 2020;17:548-52.
12. Du Q, Liu H, Yang C, Chen X, Zhang X. The development of a short Chinese Version of the state-trait anxiety inventory. Front Psychiatry. 2022;13:854547.
13. Jurin T, Jokic-Begic N, Korajlija AL. Factor structure and psychometric properties of the anxiety sensitivity index in a sample of Croatian adults. Assessment. 2012;19:31-41.
14. Jonovska S, Jengić VS, Zupancić B, Klarić M, Klarić B, Marinović M, et al. The relationships between self-esteem, emotional reactions and quality of life in pediatric locomotory trauma patients. Coll Antropol. 2009;33:487-94.
15. Jonovska S, Franciskovic T, Kvesić A, Nikolić H, Brekalo Z, Pavlović E, et al. Self-esteem in children and adolescents differently treated for locomotory trauma. Coll Antropol. 2007;31:463-9.
16. Nakić Radoš S, Tadinac M, Herman R. Validation study of the Croatian version of the Edinburgh Postnatal Depression Scale (EPDS). Contemporary Psychology. 2013;16:203-18.
17. Jokić-Begić N, Korajlija A, Jurin T, Evans C. Factor structure, psychometric properties and cut-off scores of the Croatian version of the Clinical Outcomes in Routines Evaluation – Outcome Measure (CORE-OM). Psychological Topics. 2014;2:265-88.
18. De Ramón LAS, Ferrández Martínez AF, García Carricondo AR, Espín Gálvez F, Alarcón Rodrígue R. Effect of virtual reality and music therapy on anxiety and perioperative pain in surgical extraction of impacted third molars. J Am Dent Assoc. 2023;154:206-14.
19. Donelli D, Antonelli M, Bellinazzi C, Gensini GF, Firenzuoli F. Effects of lavender on anxiety: a systematic review and meta-analysis. Phytomedicine. 2019;65:153099.
20. Guo P, Li P, Zhang X, Liu N, Wang J, Yang S, et al. The effectiveness of aromatherapy on preoperative anxiety in adults: A systematic review and meta-analysis of randomized controlled trials. Int J Nurs Stud. 2020;111:103747.
21. Aravena PC, Almonacid C, Mancilla MI. Effect of music at 432 Hz and 440 Hz on dental anxiety and salivary cortisol levels in patients undergoing tooth extraction: a randomized clinical trial. J Appl Oral Sci. 2020;28:e20190601.
22. Pachimsawat P, Tangprasert K, Jantaratnotai N. The calming effect of roasted coffee aroma in patients undergoing dental procedures. Sci Rep. 2021;11:1384.
23. Etemadi Sh M, Kaviani N, Salimian K, Tajmiri G. effect of dexmedetomidine added to lidocaine cartridge on the level of patient sedation, cooperation, and patient

and surgeon satisfaction during mandibular third-molar extraction surgery: a randomized double-blind controlled trial. Int J Dent. 2022;2022:4722674.
24. Thayumanavan B, Krithika C, Mohideen K, Ranjalitha AVR, Twinkle CMS, Pravda C, et al. assessment of salivary cortisol concentrations as a level of stress indicator among individuals undergoing dental extraction procedure. J Pharm Bioallied Sci. 2021;13:S735-40.
25. Aher S, Waknis P, Shah S, Saha A, Bhujbal P, Gupta D. evaluation of presurgical serum cortisol level in patients undergoing major maxillofacial surgery. Ann Maxillofac Surg. 2020;10:25-30.
26. Zsido AN, Teleki SA, Csokasi K, Rozsa S, Bandi SA. Development of the short version of the spielberger state-trait anxiety inventory. Psychiatry Res. 2020;291:113223.
27. Souza MRF, Gonçalves MWA, de Souza GM, Fernandes IA, Galvão EL, Falci SGM. Does watching an informative video reduce the anxiety in patients undergoing third molar surgery: a systematic review of randomized controlled trials. Oral Maxillofac Surg. Forthcoming 2022.
28. Monteiro JLGC, da Silva Barbirato D, Moraes SLD, Pellizzer EP, do Egito Vasconcelos BC. Does listening to music reduce anxiety and pain in third molar surgery? - a systematic review. Clin Oral Investig. 2022;26:6079-86.
29. Martinez-Bernal D, Vidovich C, Keenan C, Correll L, Laserna A, Hasselberg M, et al. The use of virtual reality to reduce pain and anxiety in surgical procedures of the oral cavity: a scoping review. J Oral Maxillofac Surg. 2023;81:467-82.
30. Silvestre FJ, Martinez-Herrera M, García-López B, Silvestre-Rangil J. Influence of anxiety and anesthetic vasoconstrictors upon hemodynamic parameters during dental procedures in controlled hypertensive and non-hypertensive patients. J Clin Exp Dent. 2021;13:e156-64.
31. Agani ZB, Benedetti A, Krasniqi VH, Ahmedi J, Sejfija Z, Loxha MP, et al. Cortisol level and hemodynamic changes during tooth extraction at hypertensive and normotensive patients. Med Arch. 2015;69:117-22.
32. Rayen R, Muthu MS, Rao RC, Sivakumar N. Evaluation of physiological and behavioral measures in relation to dental anxiety during sequential dental visits in children. Indian J Dent Res. 2006;17:27-34.
33. Karm MH, Kim M, Park FD, Seo KS, Kim HJ. Comparative evaluation of the efficacy, safety, and hemostatic effect of 2% lidocaine with various concentrations of epinephrine. J Dent Anesth Pain Med. 2018;18:143-9.
34. Bader JD, Bonito AJ, Shugars DA. A systematic review of cardiovascular effects of epinephrine on hypertensive dental patients. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2002;93:647-53.
35. Xue ZX, Cui T, Hou R, Ju Y, Lu B. Prevalence of dental anxiety in 144 patients with cardiovascular diseases before tooth extraction. Zhonghua Liu Xing Bing Xue Za Zhi. 2004;25:531-3.
36. Richardson ME. The etiology and prediction of mandibular third molar extraction. Angle Orthodont. 1980;47:165-8.
37. Behbehani F, Artun J, Thalib L. Prediction of mandibular third-molar impaction in adolescent orthodontic patients. Am J Orthod Dentofacial Orthod. 2006;130:47-55.
38. Tremblay MA, Denis I, Turcotte S, De-Grâce M, Tully PJ, Foldes-Busque G. cognitive-behavioral therapy for panic disorder in patients with stable coronary artery disease: a feasibility study. J Clin Psychol Med Settings. 2023;30:28-42.
39. Allen LB, White KS, Barlow DH, Shear MK, Gorman JM, Woods SW. Cognitive-Behavior Therapy (CBT) for Panic Disorder: Relationship of Anxiety and Depression Comorbidity with Treatment Outcome. J Psychopathol Behav Assess. 2010;32:185-92.
40. Selvido DI, Bhattarai BP, Rokaya D, Niyomtham N, Wongsirichat N. Pain in oral and maxillofacial surgery and implant dentistry: types and management. Eur J Dent. 2021;15:588-98.
41. Chen YW, Chi LY, Lee OKS. Revisit incidence of complications after impacted mandibular third molar extraction: A nationwide population-based cohort study. PLoS One. 2021;16:e0246625.
42. Bufalari A, Adami C, Angeli G, Short CE. Pain assessment in animals. Vet Res Commun. 2007;31:55-8.