The impact of a patient's financial situation on their heartbeat per beat as a predictor of anxiety during an oral surgical.

Abdulrahman Mohammed Alhowikan

Department of Physiology, College of Medicine, King Saud University, Riyadh, Saudi Arabia.
Correspondence: Abdulrahman Mohammed Alhowikan. Email: amalhowikan@gmail.com

Abstract
Objective: *This study aimed to compute the heart rate and patients' anxiety in Saudi patients during an oral surgical procedure.*
Methods: *A male referral patients (N=20) for 3rd molar extraction who were recruited with their written consent. Inclusion criteria' a need for surgical 3rd molar extraction, negative medical history, low to high-income status, free of medical drugs, age 18-45 years,. Before the start of the surgical procedure, a video demonstration was given to the participants. Heartbeat and dental fear were recorded at distinct intervals namely in the waiting area, sitting on the dental chair, surgical incision, bone drilling, tooth extraction, suturing and in the postoperative area.*
RESULTS: *Overall, the mean heart rate was higher for the participants who had higher income of ≤ 20000 SR. The heart rate was below 80/pm for patients whose income was below ≤ 5000 SR per month. A zigzag pattern of heart rate was observed at various stages of dental procedure. The heartbeat ranged from 72 to 102 beats per minute during distinct phases of the procedure. The highest reported mean for HR was 101.9 ± 16 bpm before leaving the clinic phase and the lowest reading of heart rate recorded was 94.2± 16 bpm after extraction phase*
CONCLUSION: *This study suggested that the financial condition of the patients has a significant role in dental pain. The patients with the better socioeconomic conditions have more dental anxiety and their heartbeat is increased during the procedure as compared to lower socioeconomic patients.*
Keywords: *3rd Molar extraction, Dental anxiety, Heartbeat*

I.   Introduction

The brain is the first organ that implies a representation of body emotion and attentional processes. Hypothalamus is part of the brain that releases epinephrine. This neurotransmitter triggers the fight or flight response in case of afraid or anxiety. Beside other responses, this also causes a quickened heartbeat and changes in breathing patterns.

Fear states are strongly combined with sympathetic nervous activation and highly uneasy and individuals glare increased sensitivity to a psychological threat that translates into enhanced autonomic reactivity [1,2].

The origin of dental fear may be a negative dental experience during childhood behavioral problems of the patient or the treating dentists during treatment [3, 4, 5]. The lack of knowledge about dental procedures could also be a cause of dental fear. The prevalence of dental fear in adults ranges from 3% to 32% [4,6,7] and it reflects cultural differences, past unpleasant dental experience, or use of various measures and different cut off points for determining the definition of dental fear [8, 9].

Impacted 3rd molar extraction involves the minor drilling of bone and sectioning of the crown under the local anesthesia. Despite adequate verbal explanation and reassurance, this procedure is associated with pain, significant physiological stress, and anxiety to the patients. Anxiety due to this dental procedure further results as barriers to patients' returning for further dental care, longer postoperative pain and larger doses of analgesics [10]. Anguishing emotions reorder the neurovascular functions of the patients bringing undesirable pain and other disadvantageous effects that are tangibly displayed with the sensitive oral mucosa [11].

Wealth shapes people's patterns of thought, feelings, and actions [12]. Having abundant resources and elevated rank upper-class individuals are more prone to sensitivity about fear or pain. In contrast, poor or lower-class individuals have more tolerance for physical pain. Wealth makes the rich anxious and psychologists believe that the knot of wealth is complex. What changes in heartbeat take place during a dental surgical procedure was the question the author investigated. Further was there any difference of fear feeling between

rich and poor. This aspect has been neglected to the best knowledge of the author. In other words, social science aspect (money/richness) was integrated with health sciences (dental procedure).

II. Methods

A collaborative study of the Department of Physiology with Oral and maxillofacial surgery department of the King Saud University Hospital was conducted from September 2017 to July 2018. The referral patients (N=20) for 3rd molar extraction were enrolled with their written consent. A need for surgical 3rd molar extraction, age 18-50 years, negative medical history, income status (low to high), free of medical drugs, no pregnancy history, and other medical conditions' was followed as inclusion criteria as per the protocol of the study. This study was registered in Saudi Clinical trials.

Written and verbal consents were obtained before the start of the surgical procedure. and approved by the Dental Faculty Ethical Review Board (DERB) at King Saud University and complied with the rules related to the 'Research Ethics on Living Organisms' issued by Royal Decree no. M/29 and with the World Medical Association's Declaration of Helsinki. Patients, or their formal guardians in cases involving young adults (under 17 years of age)The Body Mass Index (BMI) of each participant was recorded by taking the height and weight of each participant to categorize them as underweight, normal, overweight and obese. Before the start of surgical procedure, a video demonstration was given to the participants. Heartbeat and dental anxiety were recorded in the waiting area, sitting on the dental chair, surgical incision, bone drilling, tooth extraction, suturing and in the postoperative area.

The audiovisual information about the surgical procedure was given to each patient in a vacant room before they were taken into the dental chair. The audio –visual illustrations were created by a local company that was initially supervised by two consultants. This short video straightforwardly described the procedure with complications and what precautions should be taken.

Heart rate sensor (Polar H10, UK) was used to detect the heartbeat of patients. The function of this sensor is associated with the fear or anxiety of the patient. Its precision is accurate due to improved electrodes. There is increased palpitation in case of fear/anxiety. This sensor was placed on the chest skin of the participating patient (at the apex beat). It is compatible with Bluetooth devices. In this study, it related to ActiGraph wGT3X-BT (USA) – a monitoring system to capture the physical activity of medical–grade of heartbeat.

The tool was a modified dental anxiety scale. It was used to rate the agitation of the patient at the following phases i.e., immediately after seating, after injection before extraction, during drilling, after extraction, during suturing and post-operatively before surgery. This validity of this scale has been tested during local anesthesia [16].The patients' agitations were recorded from 0 (no anxiety) to 5 (maximum) with their cardiac activity.

III. Statistics

Parametric tests were used to analyze the data to observe the association of heartbeat and video display of the procedure. Dental anxiety and physiological heartbeat measures were recorded using repeated measures and a selection of the covariance structure. The student t-test was used with a 95% confidence interval.

IV. Results

Heart rate was recorded with the help of an HR sensor (POLAR H1, UK, which related to ACTIGRAPH wGT3X-BT, USA) over seven occasions (waiting area, sitting on the dental chair, incision, bone drilling, tooth elevation, suturing, and in the postoperative period. Because of its improved electrodes, it can detect the most accurate heart rate sensor. The HR sensor was placed on the apex beat area of the patient. The ActiGraph wGT3X-BT (USA) is a system to monitor the physical activity and sleep data of the human body. A time of 3 seconds was used to monitor the activity of the heart rate. The collected data was exported to SPSS for statistical analysis.

Table: 1A
Descriptive variables

Elements	Variables	n (%)
Social status	Married	14 (70)
	Unmarried	6 (30)
Education level	School	8 (40)
	College	6 (30)
	University	6 (30)
Income level	≤ 5000	9 (45)
	≥ 20000	11 (55)

Table: 1B

NO	Physical characteristics	Mean & SD
1	Age	26.5 ± 8
2	Height	166 ± 5
3	Bodyweight	60.9 ± 13
4	BMI	24.0785±5
5	BSA	1.6295±0.2

A zigzag pattern of heart rate was observed at dissimilar stages of dental procedure (Fig.1). The heartbeat ranged from 72 to 102 beats per minute during distinct phases of the procedure. The highest reported mean for HR was 101.9 ± 16 bpm before leaving the clinic phase and the lowest reading of heart rate recorded was 94.2± 16 bpm after extraction phase

Considering the economic status of the patients, we found, the heartbeat was much higher in patients who had an income of ≥20K SR per month as compared to the individuals' with≤ 5K SR per month.

The dental anxiety was also observed at a higher rate.The highest heart rate was 103.5 ±27 beats per minute before leaving the dental office whereas the lowest mean heart rate was after extracting the tooth. It can be observed that the heart rate had a zigzag pattern during the five stages of the procedure. During the injection phase, it reached up to 97 beats per minute and it increased at the next phase that was extraction. The heartbeat dropped down once the tooth had been taken out (94 beats per minute). The heart rate increased at the suturing phase and it reached up to almost 103.5 beat per minute at the time the patient left the dental chair (Postoperative phase).

The mean dental anxiety scale (DAS) was 35.37±3.23 for high socioeconomic patients while it was 43.09±94 for low socioeconomic patients. The difference in DAS was highly significant (p =0.001). The mean DAS was high before the surgical procedure, on the incision. (Fig.2). showing example of changing beat per beat of heart rate during molar extraction for different income patients
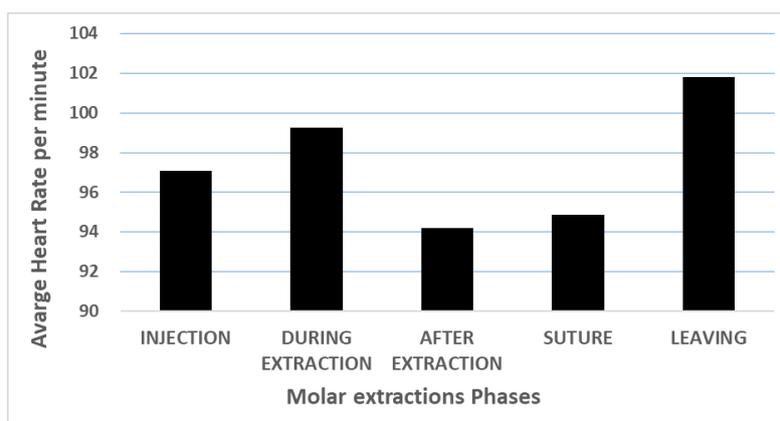
Fig (1) pattern of heart rate during different surgical stages of dental procedure
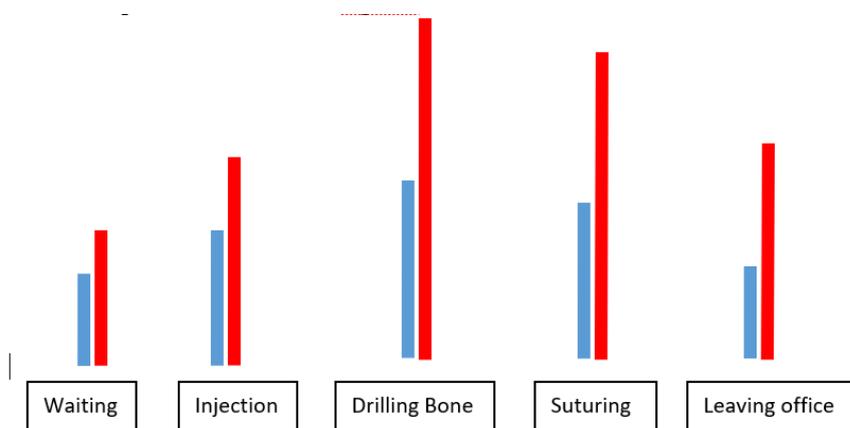
Fig(2) Heart Rate in Red (Rich) and Blue (Poor) patients during surgical procedure, Comparing the association of heartbeat with income. Higher socioeconomic conditions have the higher association of heartbeats with dental anxiety

V.   Discussion

As compared to other health care procedures, anxiety, fear, and pain are more associated with dental patients [13]. A relatively higher heart rate was observed at several phases of dental surgical procedure in patients who were ranked socially upper class. The anticipation of forthcoming dental treatment induces a physiological stress response in patients that manifests a change in cardiovascular reactions [14]. An increase in blood pressure is common because of the high heartbeat in normotensive patients even the procedure is performed under local anesthesia. This increase is influenced by factors such as psychological and physiological stress, painful stimuli, and action of catacholomanies present in local anesthetics [15].

In this study, after watching the video demonstration, patients filled Corah's DAS questionnaire before receiving the local anesthesia [16]. The overall mean DAS score was 12.3±2.78. This mean DAS score was slightly higher than earlier studies in adults' patients which reported values in the range from 9.3 ± 2.1, 8.6± 3.7, 7.98±3.5 and 7.26±2.7 for Taiwani, German, Norwegian and Denish dental patients respectively [13, 17, 18, 19].

The mean age of the patient was 30 years in this study. The mean anxiety level was low. Studies have shown that younger individuals tend to have more anxiety as compared to elderly patients [20, 21]. Contrast to previous studies, Erten et al., [17] study concluded that age was not the factor affecting the anxiety level.

Another remarkable finding in this study was to have higher dental pain scores in high socioeconomic patients. This aspect is a new finding and we suggest other researchers to investigate the process. Is there any changes in the neuromuscular junction, catecholamine and other factors which are found more in rich people as compared to lower sociofinancial people

Researchers reported that patients who appeared clam or who pretend to be calm were actually under significant physiologic stress [22]. Therefore, attempts to assess patient anxiety subjectively during pre-operative sessions may not evaluate the association of video demonstration at the pre-operative procedures.

The contribution of pain expectation to dental anxiety suggested that this might usefully be a specific focus of intervention in programs to reduce dental anxiety [23].

Besides, the neurovascular function which are physiological changes between the sympathetic and parasympathetic nervous system influence the heart rate. This hemodynamic parameter has been attributing as a trustworthy way to measure stress levels during the dental procedure [24, 25].

The studies were conducted utilizing stress-relieving techniques such as PowerPoint presentation, video, and anxiety surveys as nonpharmacological stress releasing techniques [26, 27, 28]. The purpose of this study was to evaluate the patients' hemodynamic parameters by intervening in an educational animated procedural video that demonstrated the whole procedure.

VI.   Conclusion

This study suggested that the financial condition of the patients has a significant role in dental pain. The patients with the better socioeconomic conditions have more dental anxiety and their heartbeat is increased during the procedure as compared to lower socioeconomic patients.

CONFLICT OF INTEREST
The author declares no conflict of interest.

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