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Effect of Endodontic Therapy on Vital Signs

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ABSTRACT

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Background: Endodontic therapy is frequently associated with pain, fear, and anxiety, which may activate physiological stress responses and influence vital signs.

Objectives: This study aimed to evaluate the effect of endodontic therapy on changes in blood pressure, heart rate, and blood glucose levels and to determine the relationship between dental anxiety and changes in these parameters.

Methods: This quantitative experimental study used a one-group pretest–posttest design involving 100 adult patients undergoing endodontic treatment. Blood pressure, heart rate, and blood glucose levels were measured before and after treatment. Dental anxiety was assessed using a Modified Dental Anxiety Scale questionnaire. Data normality was analyzed using the Kolmogorov–Smirnov test. Paired T-test was used for normally distributed variables, while the Wilcoxon test was applied to non-normally distributed data. The relationship between anxiety level and changes in vital signs was evaluated using Spearman correlation analysis.

Results: The results showed significant reductions in systolic blood pressure (134.24 to 129.80 mmHg), diastolic blood pressure (85.22 to 82.08 mmHg), heart rate (85.60 to 81.15 beats/minute), and blood glucose levels (159.29 to 145.95 mg/dL) after endodontic therapy ($p < 0.001$). Most participants presented with low to moderate dental anxiety. No significant correlation was found between anxiety level and changes in systolic blood pressure, diastolic blood pressure, blood glucose levels, or heart rate ($p > 0.05$).

Conclusions: Endodontic therapy significantly affected patients' vital signs by reducing physiological stress parameters; however, dental anxiety was not significantly associated with these changes.

KEYWORDS:
Blood pressure, Heart rate, Blood glucose, Dental anxiety, Root canal treatment

INTRODUCTION

Endodontic therapy is a dental procedure performed to eliminate infection and inflammation of the pulp and periapical tissues while preserving the natural function of the tooth. Although modern endodontic techniques have significantly improved patient comfort, root canal treatment remains one of the dental procedures most commonly associated with fear, pain perception, and anxiety.

Pain and anxiety before dental treatment can activate the sympathetic nervous system and the hypothalamic–pituitary–adrenal axis, resulting in increased secretion of catecholamines and cortisol. This physiological response may cause elevations in blood pressure, heart rate, and blood glucose levels. Therefore, monitoring vital signs before and after endodontic procedures is important to assess patient safety and physiological responses during treatment.

Previous studies have demonstrated that dental anxiety may influence pain perception and physiological responses during dental procedures. However, the relationship between endodontic therapy, changes in vital signs, and the role of dental anxiety remains inconclusive. Several factors, including the degree of inflammation, individual pain threshold, previous dental experiences, and systemic conditions, may contribute to variations in physiological responses.

Therefore, this study aimed to evaluate the effect of endodontic therapy on blood pressure, heart rate, and blood glucose levels and to analyze the relationship between dental anxiety and changes in these vital signs.

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MATERIALS AND METHODS

This quantitative experimental study used a one-group pretest–posttest design to evaluate changes in patients' vital signs before and after endodontic therapy. The study was conducted from September 2025 to May 2026 and involved adult patients undergoing endodontic treatment. A total of 100 participants were included using a purposive sampling technique based on predetermined inclusion and exclusion criteria.

The inclusion criteria were patients aged 18–59 years who underwent endodontic treatment, agreed to participate in the study by signing informed consent, completed the dental anxiety questionnaire, and underwent measurement of blood pressure, heart rate, and blood glucose levels before and after the procedure. Patients who were unable to attend the examination or declined participation were excluded from the study.

Dental anxiety was evaluated using the Modified Dental Anxiety Scale questionnaire before treatment. Vital signs measured included systolic and diastolic blood pressure, heart rate, and blood glucose levels. Blood pressure and heart rate were measured using a digital sphygmomanometer (Sinocare BA-801, Sinocare Inc., China). Blood glucose levels were measured using a blood glucose monitoring device (Autocheck 3-in-1 glucometer, Autocheck, Indonesia) with disposable glucose test strips and sterile blood lancets.

Before the endodontic procedure, participants completed the anxiety questionnaire followed by baseline measurements of blood pressure, heart rate, and blood glucose levels. Endodontic therapy was then performed according to standard clinical procedures. Immediately after completion of the treatment, the same physiological parameters were measured again using identical instruments.

Data analysis was performed using Statistical Package for the Social Sciences software. The normality of data distribution was evaluated using the Kolmogorov–Smirnov test. Normally distributed variables, including systolic blood pressure, diastolic blood pressure, and heart rate, were analyzed using the paired T-test to compare pre-treatment and post-treatment values. Blood glucose data, which did not show normal distribution, were analyzed using the Wilcoxon signed-rank test. The relationship between dental anxiety levels and changes in vital signs was analyzed using Spearman correlation analysis. Statistical significance was defined as a p-value less than 0.05.

RESULTS

A total of 100 participants undergoing endodontic therapy were included in this study, consisting of 42 males and 58 females. The evaluation of vital signs was performed before and after treatment. The results of normality testing, descriptive analysis, anxiety distribution, correlation analysis, and comparative analysis are presented in the following tables.

Table I. Normality Test of Vital Sign Variables Before and After Endodontic Therapy

Variables	Kolmogorov–Smirnov (p)	Sample Size	Distribution
Systolic blood pressure before treatment	0.200	100	Normal
Systolic blood pressure after treatment	0.200	100	Normal
Diastolic blood pressure before treatment	0.123	100	Normal
Diastolic blood pressure after treatment	0.200	100	Normal
Blood glucose level before treatment	0.023	100	Non-normal
Blood glucose level after treatment	0.038	100	Non-normal
Heart rate before treatment	0.052	100	Normal
Heart rate after treatment	0.068	100	Normal

The normality analysis showed that systolic blood pressure, diastolic blood pressure, and heart rate data were normally distributed, whereas blood glucose data showed a non-normal distribution.

Table II. Mean Values of Vital Signs Before and After Endodontic Therapy

Variables	Mean Value	Sample Size
Systolic blood pressure before treatment (mmHg)	134.24	100
Systolic blood pressure after treatment (mmHg)	129.80	100
Diastolic blood pressure before treatment (mmHg)	85.22	100
Diastolic blood pressure after treatment (mmHg)	82.08	100
Blood glucose before treatment (mg/dL)	159.29	100
Blood glucose after treatment (mg/dL)	145.95	100
Heart rate before treatment (beats/min)	85.60	100
Heart rate after treatment (beats/min)	81.15	100

The mean values of all measured physiological parameters decreased after completion of endodontic therapy.

Table III. Distribution of Dental Anxiety Levels Among Participants

Anxiety Category	Total (n)	Male	Female
Low or no anxiety	46	21	25
Moderate anxiety	49	19	30
High anxiety	5	2	3
Total	100	42	58

Most participants experienced low to moderate levels of dental anxiety, while only a small proportion showed high anxiety.

Table IV. Normality Test of Changes in Vital Sign Variables (Δ Values)

Variables	Kolmogorov–Smirnov (p)	Distribution
Δ Systolic blood pressure	0.000	Non-normal
Δ Diastolic blood pressure	0.000	Non-normal
Δ Blood glucose level*	0.040	Non-normal
Δ Heart rate	0.002	Non-normal

*The Shapiro–Wilk test was considered for blood glucose changes and demonstrated a non-normal distribution.

The distribution of changes in vital signs was predominantly non-normal; therefore, correlation analysis was performed using a non-parametric approach.

Table V. Interpretation of Spearman Correlation Coefficient

Correlation Coefficient (r)	Interpretation
0.00–0.19	Very weak
0.20–0.39	Weak
0.40–0.59	Moderate
0.60–0.79	Strong
0.80–1.00	Very strong

Positive values indicated that higher anxiety levels were associated with greater changes in vital signs, whereas negative values indicated an inverse relationship.

Table VI. Correlation Between Dental Anxiety and Changes in Vital Signs

Variables	Spearman r	p-value	Interpretation
Anxiety vs Δ systolic blood pressure	0.049	0.625	Very weak positive, not significant
Anxiety vs Δ diastolic blood pressure	0.092	0.363	Very weak positive, not significant
Anxiety vs Δ blood glucose level	-0.158	0.117	Very weak negative, not significant
Anxiety vs Δ heart rate	0.193	0.054	Very weak positive, not significant

No statistically significant correlation was observed between dental anxiety levels and changes in blood pressure, blood glucose levels, or heart rate ($p > 0.05$).

Table VII. Paired T-Test Results for Blood Pressure and Heart Rate Before and After Endodontic Therapy

Variables	p-value	Sample Size	Interpretation
Systolic blood pressure (before vs after)	<0.001	100	Significant difference
Diastolic blood pressure (before vs after)	<0.001	100	Significant difference
Heart rate (before vs after)	<0.001	100	Significant difference

Paired T-test analysis demonstrated significant reductions in systolic blood pressure, diastolic blood pressure, and heart rate after endodontic therapy.

Table VIII. Wilcoxon Signed-Rank Test Result for Blood Glucose Level Before and After Endodontic Therapy

Variables	p-value	Sample Size	Interpretation
Blood glucose level (before vs after)	<0.001	100	Significant difference

The Wilcoxon analysis showed a significant reduction in blood glucose levels following endodontic therapy.

DISCUSSION

The present study evaluated the effect of endodontic therapy on physiological parameters, including blood pressure, heart rate, and blood glucose levels, as well as the relationship between dental anxiety and changes in these vital signs. The findings demonstrated that endodontic therapy was

associated with significant reductions in systolic blood pressure, diastolic blood pressure, heart rate, and blood glucose levels following treatment. However, no significant association was identified between the level of dental anxiety and the magnitude of changes in these physiological parameters.

The reduction in vital signs observed after endodontic therapy may be explained by the decrease in physiological stress responses following the elimination of pain and control of pulpal inflammation. Before treatment, patients may experience pain, fear, and psychological stress related to anticipated discomfort during dental procedures. These stimuli activate the sympathetic nervous system and the hypothalamic–pituitary–adrenal axis, resulting in the release of catecholamines and cortisol. The activation of these pathways increases cardiac activity, peripheral vascular resistance, and glucose production through glycogenolysis and gluconeogenesis. Once the source of pain and inflammation is managed through endodontic intervention, the stress response decreases, leading to the stabilization of blood pressure, heart rate, and blood glucose levels.

The findings of this study are consistent with previous reports indicating that dental procedures associated with pain and anxiety can induce changes in autonomic nervous system activity and cardiovascular responses. Alterations in blood pressure and heart rate are commonly observed during dental treatment due to emotional stress, fear, and nociceptive stimulation. The significant reduction in these parameters after treatment suggests that successful pain management and patient adaptation to the procedure contribute to improved physiological stability.

The present study also demonstrated a significant decrease in blood glucose levels after endodontic therapy. This finding may be associated with reduced activation of stress hormones, particularly cortisol and catecholamines, which play important roles in increasing blood glucose concentration. During periods of stress, increased secretion of these hormones promotes hepatic glucose release and reduces insulin sensitivity, resulting in elevated blood glucose levels. The resolution of acute dental stress after treatment may therefore contribute to lower post-treatment glucose measurements.

Despite the significant changes in vital signs, no statistically significant relationship was found between dental anxiety and the magnitude of physiological changes. The correlation coefficients obtained for systolic blood pressure, diastolic blood pressure, blood glucose levels, and heart rate indicated very weak relationships. Several factors may explain these findings. First, most participants exhibited low to moderate levels of anxiety, with only a small proportion presenting high anxiety, which may have limited the ability to detect a stronger association. Second, physiological responses during endodontic treatment are multifactorial and may be influenced by preoperative pain intensity, severity of pulpal inflammation, previous dental experiences, duration of treatment, administration of local anesthetics containing vasoconstrictors, systemic diseases, and individual variations in stress responses.

These findings have important clinical implications for dental practitioners. Routine assessment of vital signs before and after endodontic procedures may provide valuable information regarding the patient's systemic condition and physiological response to treatment. Furthermore, effective communication, adequate explanation of treatment procedures, and appropriate anxiety management strategies should remain essential components of patient-centered endodontic care to improve comfort and safety during dental treatment.

This study had several limitations. The participants were not categorized according to systemic conditions such as hypertension or diabetes mellitus, medication use, baseline pain severity, and duration or complexity of endodontic procedures. These factors may have affected the observed changes in blood pressure, heart rate, and blood glucose levels. Future studies with more controlled participant characteristics and additional physiological or biochemical stress markers are recommended to further clarify the relationship between endodontic therapy, anxiety, and systemic responses.

In conclusion, endodontic therapy significantly influenced patients' physiological conditions by reducing blood pressure, heart rate, and blood glucose levels after treatment. Nevertheless, dental anxiety was not significantly associated with the magnitude of these changes, indicating that factors other than anxiety may have contributed more substantially to physiological responses during endodontic therapy.

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