ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26jan1139

Effect of Blood Pressure on Pulp Sensitivity Test – A Clinical Study

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Publication Date: 2026/01/31

Abstract:

- ***Background***
  A crucial step in the diagnostic procedure for evaluating pulpal health is pulp sensitivity testing. Numerous lines of evidence point to a connection between blood pressure regulation and pain management systems.

- ***Aim***
  To compare pulp sensitivity test response in normotensive and hypertensive individual.

- ***Material and Method***
  The study included 40 patients, 20 in each of the hypertension and normotensive groups. For both the electric pulp test (EPT) and the cold test, the value and time at which the reactions were induced were noted.

- ***Results***
  The difference between Normotensive & Hypertensive groups is statistically significant (P value < 0.05) In both the tests the value for Hypertensive group is greater than that of Normotensive group.

- ***Conclusion***
  Compared to healthy persons, patients with developed hypertension had a higher threshold for cold stimulation and electric pulp testing.

Keywords: *Electric Pulp Test, Cold Test, Hypertension, Pulp Sensitivity Test.*

How to Cite: Dr. Sana Khan; Dr. Sadashiv Daokar; Dr. Kalpana Pawar Patil; Dr. Mohit Thakur; Dr. Rahul Kshirsagar; Dr. Nikita Sarate; Dr. Safiya Khan (2026) Effect of Blood Pressure on Pulp Sensitivity Test – A Clinical Study. *International Journal of Innovative Science and Research Technology*, 11(1), 2334-2337. https://doi.org/10.38124/ijisrt/26jan1139

I. INTRODUCTION

A accurate diagnosis is essential for designing an oral rehabilitation therapy plan, and in endodontic treatment, determining the pulp state is critical. Several approaches have been presented for evaluating pulp sensitivity and circulation. The sensitivity of pulpal nerves (vital sensitive nerves or nonvital necrotic nerve) is determined by dentists using thermal and electric tests. The ideal test should be simple to do, quick, economical, noninvasive, painless, repeatable, and accurate.(1)

A number of systemic diseases can affect pulp sensitivity testing, including diabetes and hypertension. Numerous lines of evidence point to a connection between pain management systems and blood pressure regulation. Both functions are related with the same brain stem nuclei; medications that alter blood pressure, such as clonidine, also alter pain reactions. Furthermore, the same neurotransmitters—such as monoamines and endorphins—are engaged in both functions.(2)

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Rat studies have demonstrated a connection between arterial hypertension and hypoalgesia (delayed response to unpleasant stimuli like a hot plate or an electric shock). Studies on humans are less thorough than those on animals, it appears to show a relationship between hypoalgesia and high blood pressure.[3,4]

It is hypothesized that pulp sensitivity responses in patients with hypertension may be different from those in people with normotension. The pulp sensibility responses of both hypertension and non hypertensive people are now measured on the same scale; nevertheless, can lead to an inaccurate interpretation of the pulp sensibility response and subsequent improper treatment. Therefore, having a thorough understanding of these variations may enable us to create a suitable scale for hypertension patients, which would further support treatment planning.[1,5]

Tooth pulp stimulation is a useful technique to explore pain processes since it is simple, noninvasive, and acceptable. The tooth pulp is essentially a sensory system, and numerous researchers have discovered a good correlation between pain perception and pulpal activity.[6]

Hence, the aim of the study is to compare pulp sensibility test responses in normotensive and hypertensive individuals.

II. MATERIAL AND METHODS

- This study was done in the Department of Conservative Dentistry and Endodontics.
- After getting written consent, patients were separated into 2 groups:
  - Group 1 – non hypertensive individual (ranging below 140mmHg systolic and 90mmHg diastolic)
  - Group 2 -hypertensive individual (ranging equal or >140mmHg systolic and 90mmHg diastolic)
- Each group had 20 individuals based on their blood pressure state.
- The arterial blood pressure was measured from the brachial artery using a device called a sphygmomanometer. Systolic and diastolic blood pressure were calculated based on the average of three readings.
- Patients' blood pressure status was not known during the EPT and cold test. An electric pulp tester (Parkell, Brentwood, NY, USA) was used for the testing. Each tooth was dried and separated with cotton rollers. The pulp tester's lip clip was placed in the individual's mouth, and a thin layer of Colgate toothpaste was applied to the incisal/occlusal third of the crown. Following that, the patient was asked to alert the evaluator if tingling, discomfort, or any other sensation happened when activating the electric pulp tester. Patients' responses were recorded as a numerical value representing the pulp tester's current.
- The sensitivity tests were carried out with a one to two - minute delay to reduce the impact of one test on the other.
- Cold spray (Roeko Endofrost, Coltene) was used to conduct the test. The teeth were dried and isolated using cotton rolls. A size 2 cotton pellet was sprayed and placed on the incisal or occlusal third of each tooth's crown for 10 seconds, or anytime the patient raised his or her hand to indicate pain or a cold feeling. Each pellet was sprayed at most twice before being replaced with a new pellet for the next tooth/teeth. The information gathered was collated, and statistical analysis was carried out.

III. RESULT

In the current investigation, pulp sensitivity test responses differed statistically significantly between the non-hypertensive and hypertensive groups. The hypertensive group had greater values for EPT and time required to respond to cold test for incisors, canine, premolars, and molars in both maxillary and mandibular arches.

Table 1. Descriptive Statistics

Test	Group	Mean	Std. Deviation	S.E. Mean
Electric Pulp Test	Normotensive	1.55	0.51	0.11
	Hypertensive	2.55	0.51	0.11
Cold Test	Normotensive	1.4	0.5	0.11
	Hypertensive	2.5	0.51	0.11

Table 2. Comparison Between Normotensive and Hypertensive Groups

Group	t	df	P Value	Mean Difference	Inference
Electric Pulp Test	-6.2	38	0.000	-1	Significant
Cold Test	-6.85	38	0.000	-1.1	Significant

The difference between Normotensive & Hypertensive groups is statistically significant (P value < 0.05) In both the tests the value for Hypertensive group is greater than that of Normotensive group.

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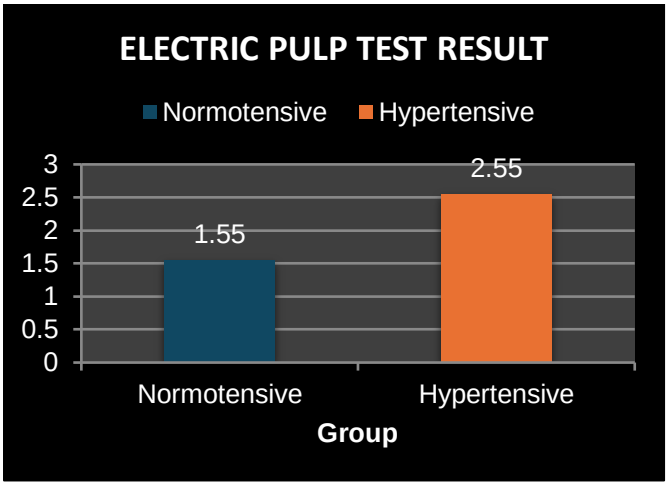

Fig 1 – Electric Pulp Test Result

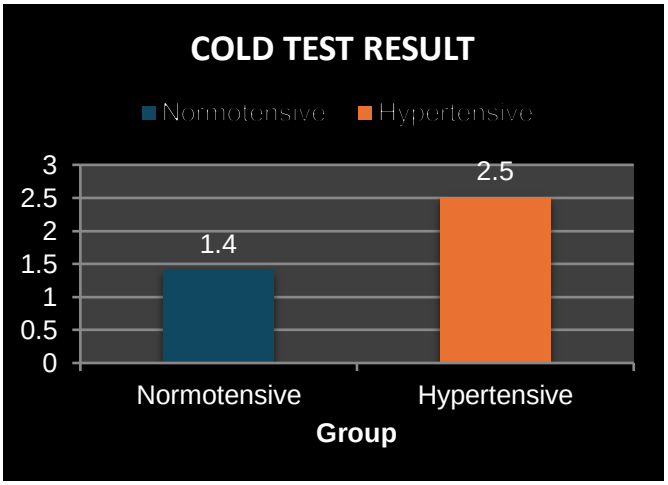

Fig 2 – Cold Test Result

IV. DISCUSSION

Endodontic treatment relies heavily on assessing pulp tissue health. Thermal tests and EPT are commonly used methods for assessing pulp responsiveness. Pulp testing should be straightforward, dependable, objective, and affordable.

Pulp sensibility tests can provide useful diagnostic information when used in conjunction with a history, clinical examination, and radiographs, despite their limitations.[1] Systemic diseases have been shown to impair pulse sensibility testing. Hyperparathyroidism, hypothyroidism, and diabetes mellitus are among the systemic illnesses that might affect the pulpal response. Hyperparathyroidism patients may need twice as much electric current to trigger a pulp reaction compared to healthy teeth.[7]

Research indicates that individuals with high blood pressure had a decreased pain response or rating in both animal and human trials including diverse pain types. Hypertension is one of the systemic illnesses that can impact pulpal responsiveness. Anti-inflammatory medicines with analgesic effects may affect the results of pulp sensibility testing. Participants who have taken the medication the day before or have a systemic condition Subjects who did not have hypertension were excluded from the study.[8,9]

A-delta fibers are primarily found at the pulp-dentin boundary zone and the pulp periphery. The coronal region of the pulp contains the bulk of A-delta fibers, and the pulp horns have the highest nerve density. Permanent teeth's pulp horns have the most neural components, while cervical and radicular portions include fewer. The pulp sensitivity test was performed at the incisal third in maxillary and mandibular incisors, buccal cusp tip in premolars, and mesiobuccal cusp tip in molars. Furthermore, EPT investigations reveal regional variability in dentinal discomfort. The lowest threshold is found on the incisal border or third of the facial area.[10,11]

This study found a strong association between hypertension patients and decreased pulp responsiveness to EPT and cold tests. Hypertensive individuals reported higher EPT values and response times to cold tests for incisors, canine, premolars, and molars in both maxillary and mandibular arches than the non hypertensive group($P < 0.05$).

The data suggest a probable relationship between blood pressure and pain regulating mechanisms. Recent research supports a correlation between blood pressure and pain perception, as both processes use the same brain stem nuclei.[12]

Hypertensive persons may experience a higher pain threshold and reduced awareness of unpleasant stimuli. Increased inhibitory descending pathways may contribute to arterial hypertension. Research indicates that the brain stem areas responsible for regulating blood pressure and pain transmission are closely connected and may overlap.[13,14]

Villa-Chávez et al found that the electric test shows the lowest accuracy (0.76), followed by heat (0.86) and cold test being highest (0.94)[15]

A combination of pulp sensitivity tests yields more consistent results for assessing pulpal vitality.

V. CONCLUSION

Within the study's limitations, the findings revealed a statistically significant difference in the pulp sensitivity test responses between the nonhypertensive and hypertension groups. (P value < 0.05).

Hypertensive persons have a higher threshold for pain response. Because of this, compared to people with normotension, the tooth needs a stimulus that is either longer duration or is of increased intensity before responding.

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ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26jan1139

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