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# An Investigation of Pulp Stones as A New Diagnostic Indicator for Renal Diseases in Patients Requiring Dental or Orthodontic Care

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## Abstract

**Introduction:** Gingival overgrowth and delayed tooth eruption are two problems associated with renal disorders, such as chronic kidney disease and renal transplantation, which call for meticulous orthodontic planning and cooperation with doctors. Many a times patient are not aware of underlying renal disease and clinical manifestations during dental treatment and specially orthodontic management can help in identifying the condition thereby benefitting the patient not only dentally but also medically. The aim of this study is to evaluate relationship between the pulp stone and the renal disease /stones. Addressing this aspect is especially important in Pakistan, where chronic diseases have a negative influence on the population's quality of life and contributed an added strain on the healthcare system.

**Methodology:** The cross-sectional study was carried out from August 1 to September 30, 2023, at a private dental hospital in Peshawar, Pakistan, with a sample size of 30 people. Participants were divided into two categories: those with known kidney disease and those without but having clinical manifestations suggestive of renal disease. To manage orthodontic and dental issues, dental X-rays were performed, which also helped to detect pulp stones. Likely renal patients also got ultrasound scans to check for renal issues. The data was analyzed via Chi-square tests and descriptive statistics.

**Results:** While kidney stone patients showed a higher occurrence of pulp stones compared to others, the study did not establish a direct connection between pulp stone prevalence and any renal disease.

**Conclusions:** The study discovered that kidney stone patients had a higher prevalence of pulp stones, but no clear link between specific renal diseases and pulp stones was discovered.

**Keywords:** Renal Diseases, Pulp Stones, Pakistan, Systemic Diseases

## Introduction

Gingival overgrowth and delayed tooth eruption are two problems associated with renal disorders, such as chronic kidney disease and renal transplantation, which call for meticulous orthodontic planning and cooperation with doctors[1] Additionally, problems with collagen fragility, fast tooth movement, and orthodontic relapse are associated with renal illness.[2] Many a times patients are not aware of underlying renal disease and clinical manifestations during dental treatment and specially orthodontic management can help in identifying the condition thereby benefitting the patient not only dentally but also medically.[2]

One of the major challenges faced by medical practitioners worldwide is the diagnosis of renal diseases. They are challenging to handle due to their diverse clinical presentations. Establishing quick and affordable methods for identifying these illnesses is essential in

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areas with limited funding.[2] Kidney and bile stone disease are frequent in Pakistan, affecting a large proportion of the population and having a substantial negative influence on people's quality of life.[3] Renal stones may go years without being clinically detectable.[4] However, they can seriously compromise kidney structure and damage renal function when they develop larger than what allows for spontaneous clearance through the urine tract.

Pulp stones are focal areas of calcification that can appear as distinct calcified structures, more widely diffused structures that are either firmly attached to or implanted in the dentin, or freely dispersed lumps strewn throughout the pulp tissue.[5] All types of teeth can develop pulp stones, but molars are the most frequently affected Pulp stones can be detected during routine dental / orthodontic radiographic exposures.[6] Presence of pulp stones have been linked with the renal stones though the evidence is bleak.[7,8]

Traditional diagnostic methods include imaging modalities such as magnetic resonance imaging (MRI), computed tomography (CT) scans, and ultrasound. Despite their accuracy and dependability, these approaches have a number of drawbacks, especially in environments with limited resources including cost, ease of use, and the need for specialized training to operate and analyze the outcomes of these technologies.[8,9] The idea that normal dental records, such as peri-apical and OPG, could help with early renal disease identification is up for discussion. Researchers are constantly looking for new ways to improve disease detection and treatment, and establishing a link between pulp stones and kidney disease could increase diagnostic accuracy and early intervention.[10]

Aim of this study is thus to assess the potential of using pulp stones, discovered on dental X-rays, as a diagnostic tool for determining renal diseases.

## Methodology

The cross-sectional study was carried out from August 1 to September 30, 2023, at a private dental hospital in Peshawar, Pakistan, with a sample size of 30 people (calculated through Raosoft sample size calculator. The participants were selected for the study by a random sample method. Participants were divided into two categories: Group A {those with known kidney disease) and Group B (those without but having clinical manifestations suggestive of renal disease). Age of the sample ranged from 18-50 years. The study excluded participants who had a history of cardiovascular disease, gout, gallstones, or any other systemic illness. Additionally, those with heavy restorations, attrition or abrasion, radiographically evident periodontal disease, or carious lesion and large restorations were disregarded.

To manage orthodontic and dental issues, dental X-rays were performed, which also helped to detect pulp stones. The radiographs were read independently by two skilled oral radiologists in a controlled setting with minimal light interference and at a 2x magnification. The existence or absence of pulp stones as well as the severe narrowing (decrease in size) of pulp chambers and canals were noted. Likely renal patients got ultrasound scans to check for renal issues.

All the relevant information, including the demography, ultrasound examination for renal diseases, and dental examination feedback, was documented using a specially designed questionnaire.

Given the special conditions of our study, and even though a larger sample size might improve the precision and generalizability of our findings, the main objective of our study is to provide information on the occurrence of renal stones in Pakistan. We are certain that our results will provide a solid framework for additional research and the allocation of resources to solve this public health issue. To aid in statistical analysis, data was entered into Microsoft Excel and cross-

tabulated. The Chi-square test was used for data analysis along with descriptive statistics.

## Result

The objective of the study was to explore any possible correlation between renal disorders that have been identified and pulp stones found during dental examinations in a sample of thirty participants. The participants were divided into two groups: those with renal diseases (the case group) and those without any renal diseases (the control group).

In the case group, 60% (n=9) cases were female, and 40% (n=6) males were identified. Nephrolithiasis was the most prevalent kidney disease, constituting 66.7% (n=10) of all cases—60% (n=9) among females and 6.6% (n= 1) among males. Ureterolithiasis affected 20% (n=3) solely among males. In contrast, 13.3% (n=2) of the cases—one in a male and one in a female—were found to have Cystolithiasis. Smaller stones (<5 mm) were prevalent in 83.3% (10) of cases—87% (8) in females and 67% (2) in males. Moderate-sized stones (5-10 mm) were present in 16.7% (5) of cases; they were primarily discovered in females (60%, n = 4). These findings indicate that nephrolithiasis, is frequently associated with smaller stones, is more common in females.

Pulp stones were found in 73.3% (n=11) of cases. Among these cases, 20% (n=3) were males, and 53.3% (n=8) were females. Nephrolithiasis (53.3%, n=8), Ureterolithiasis (13.3%, n= 2), and Cystolithiasis (6.7%, n= 1) were linked to these conditions. Regarding location, 53.3% (n=8) of pulp stones were in the maxillary region, while 20% (n=3) were identified in the mandibular area. The distribution of pulp stone attachment showed 40% (n=6) with attached stones and 26.7% (n=4) with free pulp stones. Surprisingly, an equal occurrence was noted on both the right and left sides of the jaw, each accounting for 46.7% (n=7) of cases with pulp stones among individuals diagnosed with renal diseases.

A chi-square test was employed to explore the potential association between different types of renal diseases (Nephrolithiasis, Ureterolithiasis, Cystolithiasis) and the presence of pulp stones among individuals diagnosed with renal diseases in our sample. The findings from the chi-square test suggest that there isn't enough evidence to support a significant association between the types of renal diseases and the presence of pulp stones in this specific sample of individuals diagnosed with renal diseases.

## Discussion

While the prevalence of pulp stones was high in people with renal diseases, particularly nephrolithiasis, our study tried to explore the relationship between pulp stones and renal diseases. However, the chi-square test didn't find any significant evidence linking that certain renal diseases were associated with the presence of pulp stones. This is in contrast to earlier studies that found a strong correlation between renal diseases and dental pulp stones.[11] The study suggested a significant association, emphasizing renal stone types impacting dental health. However, Sayegh and Edds findings resonate with our chi-square test, indicating a complex interplay of systemic factors influencing dental pathologies.[12,13] Although our study did not find a direct association between the presence of pulp stones with specific renal diseases, our findings support the systemic theory proposed by Sayegh and Edds by pointing to various systemic implications on dental symptoms that extend beyond renal health. This more thorough viewpoint emphasizes the need for comprehensive patient care and the need for dental screenings in patients with renal disease, even in the absence of a strong association between stone types and dental disease.

The gender-specific prevalence of nephrolithiasis, notably higher among females, along with the dominance of smaller stones in females (<5 mm), underscores

intriguing systemic connections between renal health and dental manifestations. This aligns with Bains study which observed similar gender-specific trends linking renal disorders and dental pathologies. He reported a higher prevalence of dental pulp stones in females diagnosed with renal diseases.[14] This highlights the complex relationship that exists between systemic health, specifically renal disorders, and dental manifestations. Additionally, the distribution pattern of pulp stones in patients with renal disorders, which is equal on both sides of the jaw, points to a systemic impact on dental pathology. Understanding how systemic health parameters, such as renal diseases, might manifest as oral pathologies requires a systemic viewpoint. It implies that the appearance of pulp stones during dental examinations in patients with renal diseases may indicate a more widespread systemic effect on oral health rather than just localized dental problems.

The proposition that dental disorders may function as potential markers or reflections of systemic health issues is strengthened by the inclusion of these gender-specific correlations and the systemic nature of pulp stone distribution throughout the jaw. In order to offer comprehensive care to patients, it emphasizes the need of considering systemic health variables into account during dental examinations and the necessity of multidisciplinary collaboration between dentistry and other medical specialties, such as nephrology.

## Conclusion

Based on the results, the study's conclusions are as follows:

1. Kidney stone patients had a higher prevalence of pulp stones than those without kidney disease
2. The study did not find a direct correlation of renal diseases and the incidence of pulp stones.
3. Female participants were more likely to have smaller kidney stones, showing gender-specific trends in renal diseases.
4. Pulp stones were found to be scattered throughout both jaws, demonstrating that their occurrence is not confined to a single location.
5. Although the association was not specific, the data indicate that pulp stones could be used as an additional, non-invasive indicator of renal health.

## Limitation

It is essential to recognize the constraints of this research, though. The cross-sectional design and limited sample size limit the capacity to demonstrate cause and effect or establish the temporal association between renal diseases and the development of pulp stones. Moreover, dietary practices and genetic predispositions are examples of potential confounding variables that might affect the observed correlations but were not taken into consideration in this investigation.

## Ethical Approval

The study was approved by the Research Ethics committee of Bacha Khan College of Dentistry, Mardan.

## Disclaimer

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## Conflict of Interest

It is declared that the authors don't have any conflict of interest.

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