

UNIVERSIDADE FEDERAL DE MINAS GERAIS
Faculdade De Odontologia
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**ANÁLISE DA CONDIÇÃO SISTÊMICA, MEDICAMENTOSA,
LABORATORIAL E ENDODÔNTICA EM PACIENTES DE
TRANSPLANTE RENAL: *UM ESTUDO DE COORTE
RETROSPECTIVO***

Belo Horizonte
2024

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Dissertação apresentada ao Colegiado de Pós-Graduação em Odontologia da Universidade Federal de Minas Gerais como requisito parcial à obtenção do grau de Mestre em Odontologia – área de concentração em Endodontia.

Orientador: Prof. Dr. Warley Luciano Fonseca Tavares

Coorientadora: Profa. Dra. Francine Benetti

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ANÁLISE DA CONDIÇÃO SISTÊMICA, MEDICAMENTOSA, LABORATORIAL E ENDODÔNTICA EM PACIENTES DE TRANSPLANTE RENAL: UM ESTUDO DE COORTE RETROSPECTIVO

LARISSA FASSARELA MARQUIORE

Dissertação submetida à Banca Examinadora designada pelo Colegiado do Programa de Pós-Graduação em ODONTOLOGIA, como requisito para obtenção do grau de Mestre em ODONTOLOGIA, área de concentração ENDODONTIA.

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RESUMO

A principal causa para a necessidade de realização de tratamento endodôntico é a cárie dentária. Alguns fatores sistêmicos inerentes ao paciente com doença renal crônica (DRC) podem favorecer o surgimento dessa doença na cavidade oral. Nesse sentido, propomos este estudo para investigar a frequência da necessidade de tratamento endodôntico, perfil epidemiológico e condição sistêmica de pacientes nas fases pré e pós-transplante de rins. Esse estudo foi aprovado pelo comitê de ética em pesquisa da Universidade Federal de Minas Gerais (UFMG) (CAAE: 77375517.9.0000.5149). Foi realizada a coleta dos dados dos prontuários de todos os pacientes atendidos no Programa de Assistência Odontológica a Pacientes de Transplante da UFMG (PAOPT-UFMG) no período de agosto de 2016 a dezembro de 2023. Os dados dos exames laboratoriais dos pacientes foram coletados no Sistema Intranet do Hospital das Clínicas da UFMG (HC-UFMG). Os dados foram tabulados e analisados utilizando o teste Qui-quadrado. O número de participantes do estudo foi de 89. A frequência de necessidade de tratamento endodôntico foi de 25,84%. A taxa de sucesso dos tratamentos foi de 89,28%. A insuficiência renal crônica foi a doença primária mais prevalente (28%). Os medicamentos mais comumente utilizados foram os anti-hipertensivos (40,4%), seguidos pelos anti-inflamatórios não esteroides (30,3%) e imunossupressores (21,3%). Níveis elevados de creatinina foram observados em 93,7% dos pacientes e níveis elevados de ureia em 100%. Além disso, 73,3% dos pacientes apresentaram contagens baixas de glóbulos vermelhos, e 21,73% dos que passaram por tratamento endodôntico estavam em hemodiálise. Não foi encontrada diferença estatística entre as variáveis. Pacientes pré e pós-transplante renal exibem várias alterações hematológicas e bioquímicas que afetam a saúde sistêmica e oral. Este estudo revelou que esses pacientes necessitam de tratamento endodôntico com mais frequência em comparação com estudos da população geral. No entanto, a taxa de sucesso dos tratamentos endodônticos foi semelhante à relatada na literatura.

Palavras-chave: periodontite apical; infecção endodôntica; tratamento endodôntico; insuficiência renal crônica; doença renal crônica.

ABSTRACT

Analysis of systemic, pharmacological, laboratory, and endodontic conditions in renal transplant patients: a retrospective cohort study

The main cause for the need for endodontic treatment is dental caries. Certain systemic factors inherent to patients with chronic kidney disease (CKD) may promote the onset of this condition in the oral cavity. In this context, we propose this study to investigate the frequency of the need for endodontic treatment, the epidemiological profile, and the systemic condition of patients in the pre- and post-kidney transplant phases. This study was approved by the Research Ethics Committee of the Federal University of Minas Gerais (UFMG) (CAAE: 77375517.9.0000.5149). Data were collected from the medical records of all patients treated in the UFMG Dental Care Program for Transplant Patients (PAOPT-UFMG) from August 2016 to December 2023. Patients' laboratory test data were collected from the Intranet System of the UFMG Clinical Hospital (HC-UFMG). The data were tabulated and analyzed using the Chi-square test. The number of study participants was 89. The frequency of the need for endodontic treatment was 25.84%. The success rate of treatments was 89.28%. Chronic renal failure was the most prevalent primary disease (28%). The most commonly used medications were antihypertensives (40.4%), followed by nonsteroidal anti-inflammatory drugs (30.3%) and immunosuppressants (21.3%). Elevated creatinine levels were observed in 93.7% of patients and elevated urea levels in 100%. Additionally, 73.3% of patients had low red blood cell counts, and 21.73% of those undergoing endodontic treatment were on hemodialysis. No statistical difference was found between the variables. Pre- and post-kidney transplant patients exhibit various hematological and biochemical alterations that affect systemic and oral health. This study revealed that these patients require endodontic treatment more frequently compared to studies of the general population. However, the success rate of endodontic treatments was similar to that reported in the literature.

Keywords: apical periodontitis; endodontic infection; endodontic treatment; renal insufficiency, chronic; chronic kidney disease.

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1. CONSIDERAÇÕES INICIAIS

O principal objetivo do tratamento endodôntico é prevenir que a periodontite apical se desenvolva ou, em casos em que a doença já estiver instalada, criar condições adequadas para cicatrização e regeneração dos tecidos perirradiculares. (ØRSTAVIK, 2020). Sabe-se que uma das causas para necessidade de realização de tratamento endodôntico é a cárie dentária e que alguns fatores sistêmicos inerentes ao paciente podem favorecer o surgimento dessa doença na cavidade oral (LANGELAND, 1987; RICUCCI; SIQUEIRA, 2013). Além disso, as condições sistêmicas dos indivíduos são fatores que podem interferir nas respostas imuno inflamatórias periapicais (DE BRITO *et al.*, 2015; FERREIRA, *et al.*, 2016).

A doença renal crônica (DRC) é um importante problema de saúde pública no mundo. Além de alterações metabólicas, pacientes com DRC podem apresentar diversas alterações na cavidade oral devido à própria doença, ou a fatores relacionados ao seu tratamento (BASTOS *et al.*, 2010). Sendo geralmente presentes xerostomia, alteração de paladar, odor urêmico, língua pilosa, inflamação, petéquias e úlceras na mucosa, hipoplasia de esmalte (AKAR *et al.*, 2011; RUOSPO *et al.*, 2014; BORAWSKI *et al.*, 2007; THORMAN, R.; NEOVIUS; HYLANDER, 2009). Em Saif *et al.* (2011b), foi demonstrado que erosão dentária, halitose e estomatites urêmicas, mucosa pálida, além de outras lesões como granuloma piogênico e líquenplano também podem ser encontradas em pacientes com DRC.

Evidências atuais demonstram que as infecções orais podem ser o local de origem para a disseminação de organismos patogênicos, pois seus produtos entram na corrente sanguínea e podendo se disseminar para outras regiões do corpo e, assim, afetar o curso e a patogênese de doenças cardiovasculares, pneumonia bacteriana, diabetes mellitus, e baixo peso ao nascer (SCANNAPIECO; CANTOS, 2016). Além disso, as infecções bacterianas crônicas podem ser um fator de risco para eventos tromboembólicos e aumentar a taxa de doenças coronarianas (PUSSINEN, *et al.*, 2007).

Sabe-se, também, que a hemodiálise, procedimento geralmente realizado em pacientes pré-transplante de rins, podem diminuir a taxa de fluxo salivar e resultar em alterações nas membranas mucosas orais, levando à xerostomia e aumento da

formação de cálculos, que aumentam o risco de infecção microbiana (LÓPEZ-PINTOR *et al.*, 2017). Apesar de a terapia de hemodiálise ter aumentado a taxa de sobrevivência entre os pacientes acometidos por doença renal, tem havido uma preocupação crescente em relação a outras doenças sistêmicas nesses pacientes, devido à falta de sua capacidade de controlar o equilíbrio hídrico e eletrolítico e filtrar os produtos residuais (JAIN *et al.*, 2014).

Um estudo revelou que a mortalidade causada por infecção em indivíduos com taxa de filtração glomerular diminuída e taxa elevada de albumina e creatinina foi aproximadamente 100 a 300 vezes maior para pacientes em diálise crônica do que para o público em geral (WANG *et al.*, 2011). Esses fatores aumentam a necessidade de tratamentos endodônticos. Portanto, a monitorização e o tratamento precoce de lesões endodônticas são cruciais para prevenir complicações sistêmicas graves.

Quando se trata do período após o transplante renal, os pacientes continuam a receber terapia imunossupressora para prevenir a rejeição do enxerto. Essa imunossupressão prolongada, como observado por, compromete a resposta imunológica, aumentando o risco de infecções orais persistentes (POL *et al.*, 2005). O uso de medicamentos imunossupressores, como ciclosporina e tacrolimus, pode levar a hiperplasia gengival e exacerbar condições periodontais (KLASSEN, KRASKO, 2002).

Pacientes com DRC geralmente apresentam alterações nos exames laboratoriais. Esses pacientes podem exibir anemia, refletida em baixas contagens de células vermelhas e hemoglobina. A anemia pode comprometer a oxigenação tecidual, afetando negativamente a cicatrização após procedimentos endodônticos (LOCATELLI *et al.*, 2004). Além disso, os níveis elevados de creatinina indicam função renal comprometida, que pode influenciar a resposta inflamatória e imunológica, crucial para a recuperação pós-tratamento (PATEL, 1997). No período pós-transplante, os pacientes frequentemente continuam a apresentar imunossupressão induzida por medicamentos, resultando em contagens reduzidas de linfócitos. Esses medicamentos, como ciclosporina e tacrolimus, são essenciais para prevenir a rejeição do enxerto, mas podem comprometer a resposta imunológica a infecções orais, aumentando a necessidade de intervenções endodônticas (KLASSEN, KRASKO, 2002).

As alterações hematológicas e bioquímicas em pacientes transplantados renais elevam o risco de infecções orais persistentes. A literatura aponta que essas infecções podem levar a complicações sistêmicas graves, especialmente em pacientes imunossuprimidos (KLASSEN, KRASKO, 2002). Assim, a monitorização constante dos exames laboratoriais é crucial para ajustar as abordagens terapêuticas e prevenir complicações.

Dessa maneira, pacientes portadores de DRC e que serão submetidos ao transplante de rins necessitam realizar previamente uma avaliação e planejamento odontológico para eliminar qualquer foco de infecção presente na cavidade oral. A eliminação dos focos de infecção antes do procedimento cirúrgico colabora para que não haja risco de perda do enxerto ou complicações durante a recuperação. Já após a realização do transplante é imprescindível a manutenção e controle da saúde bucal, principalmente devido ao uso de medicamentos imunossupressores. Sabendo que o objetivo final do tratamento endodôntico é prevenir ou tratar a periodontite apical, onde há infecção bacteriana, e que as condições sistêmicas dos indivíduos interferem nas respostas imunoinflamatórias periapicais é importante a compreensão da associação entre a necessidade de tratamento endodôntico e as características dos pacientes nas fases pré e pós-transplante de rins (BRITO *et al.*, 2016; FERREIRA *et al.*, 2015; ØRSTAVIK, 2020). Além disso, a realização deste trabalho justifica-se pela lacuna existente na literatura científica sobre a relação entre a condição dos pacientes pré e pós-transplante renal e a necessidade e sucesso do tratamento endodôntico. Embora haja um corpo significativo de pesquisa sobre complicações orais em pacientes transplantados, há uma escassez de estudos específicos que abordem como as alterações sistêmicas decorrentes do pacientes de transplante renal influenciam diretamente a necessidade e os resultados dos tratamentos endodônticos.

2 OBJETIVOS

2.1 Objetivo Geral

Avaliar a frequência e sucesso de tratamento endodôntico em pacientes pré e pós-transplante de rins.

2.2 Objetivos Específicos

- 2.2.1 Caracterizar o perfil epidemiológico e investigar a relação da necessidade de tratamento endodôntico em pacientes de transplante de rins;
- 2.2.2 Analisar a relação da necessidade de tratamento endodôntico e a condição sistêmica e medicamentosa dos pacientes;
- 2.2.3 Avaliar a relação da necessidade de tratamento endodôntico com exames laboratoriais dos pacientes.

3 METODOLOGIA

O estudo foi realizado utilizando dados dos pacientes de transplante de rins encaminhados pelo Hospital das Clínicas da Universidade Federal de Minas Gerais (HC-UFMG). Esses pacientes são submetidos a um regime pré-transplante com objetivo de eliminação de focos de infecção de origem bucal e redução de complicações durante a realização/recuperação do transplante, que possam comprometer o sucesso do procedimento cirúrgico. Já os pacientes pós-transplante são acompanhados devido a necessidade de manutenção da saúde bucal mesmo após o transplante, principalmente devido a necessidade de terapia imunossupressora. Assim, esses pacientes são submetidos a um criterioso exame clínico e radiográfico para construção de um plano de tratamento a ser executado em um menor tempo possível. Portanto, foram coletados dados clínicos odontológicos e médicos, epidemiológicos e laboratoriais desses pacientes para realização deste estudo.

3.1 Aspectos Éticos

Este estudo foi realizado utilizando o parecer do Programa de Assistência Odontológica a Pacientes de Transplante da Universidade Federal de Minas Gerais (PAOPT-UFMG)(CAAE: 77375517.9.0000.5149).

3.2 Coleta de Dados

3.2.1 Dados epidemiológicos e clínicos

Foram avaliados os dados epidemiológicos e clínicos dos prontuários de todos os pacientes de transplante de rins do PAOPT-UFMG da Faculdade de Odontologia da UFMG, atendidos no período de agosto de 2016 a dezembro de

2023. Foram coletados: idade, sexo, estágio do transplante, tipo de transplante, doença primária, medicação em uso, necessidade de tratamento endodôntico e número de tratamentos endodônticos realizados durante o tratamento odontológico no Programa. Os dados ausentes ou incompletos serão registrados como “Dados ausentes/omitidos”.

3.2.2 Dados dos exames complementares

Foram coletados hemogramas completos de todos os pacientes por meio de acesso ao Sistema Intranet do HC-UFMG. Foram excluídos pacientes cujos registros médicos não forem recuperados.

3.2.3 Dados endodônticos

O diagnóstico da necessidade de tratamento endodôntico foi baseado em radiografias periapicais, anamnese e testes de sensibilidade pulpar e percussão. Relatos de complicações durante o tratamento foram registrados. A técnica de instrumentação utilizada foi a cinemática rotatória com o sistema ProTaper Next (Dentsply Sirona, Charlotte, Carolina do Norte, EUA). Radiografias periapicais foram analisadas antes e depois do tratamento endodôntico, com pelo menos 12 meses entre o primeiro e o segundo exames. Avaliações radiográficas e clínicas foram realizadas por dois examinadores: um avaliador sênior e um segundo examinador treinado de acordo com os critérios estabelecidos pelo primeiro. As avaliações foram conduzidas conjuntamente com *feedback* contínuo.

O tratamento endodôntico foi considerado bem-sucedido se houvesse resolução completa da lesão periapical ou manutenção da integridade do tecido perirradicular após a radiografia de controle. Além disso, os dentes deveriam mostrar resposta negativa aos testes de percussão vertical e horizontal e palpação. Finalmente, a necessidade de tratamento endodôntico e o sucesso do tratamento endodôntico foram considerados como variáveis dependentes, dicotomizadas como "sim" e "não". As variáveis independentes do estudo foram

sexo, doença primária, medicação sistêmica e exames laboratoriais.

3.3 Análise Estatística

Os dados obtidos foram tabulados e analisados. O teste Qui-quadrado foi utilizado para estabelecer associações estatisticamente significativas entre as variáveis dependentes e independentes. Será adotado um nível de confiança de 95% e de nível de significância de 5%.

4 ARTIGO

Estudo de coorte retrospectivo

Endodontics and systemics aspects in pre- and post-kidney transplant: a retrospective cohort study

ABSTRACT

Objectives: This study investigates the frequency and success rate of endodontic treatment, the epidemiological profile, medications in use, laboratory tests, and systemic alterations in patients during the pre- and post-kidney transplant phases. Approval from the research ethics committee was obtained to conduct this study.

Materials and methods Data were collected from the medical and dental records of all patients treated by the UFMG Dental Assistance Program for Transplant Patients (PAOPT-UFMG) from August 2016 to December 2023. Additionally, laboratory tests were collected from patients registered in the Intranet System of the UFMG Hospital das Clínicas (HC-UFMG). The data were tabulated and analyzed using the Chi-square tests considering a significance level of 95% ($p < 0.05$). **Results:** The number of study participants was 89. The frequency of the need for endodontic treatment was 25,84%. The success rate of treatments was 89,28%. Chronic renal failure was the most prevalent primary disease (28%). The most commonly used medications were antihypertensives (40.4%), followed by SAIDs (30.3%) and immunosuppressants (21,3%). Elevated creatinine levels were observed in 93.7% of patients and elevated urea levels in 100%. Additionally, 73.3% of patients had low red blood cell counts, and 21.73% of those undergoing endodontic treatment were on hemodialysis. No statistical difference was found between the variables. **Conclusions:** Pre- and post-kidney transplant patients exhibit various hematological and biochemical alterations

that affect systemic and oral health. This study revealed that these patients require endodontic treatment more frequently compared to studies of the general population. However, the success rate of endodontic treatments was similar to that reported in the literature.

INTRODUCTION

The primary objective of endodontic treatment is to prevent the development of apical periodontitis or to create appropriate conditions for the healing and regeneration of periradicular tissues (Ørstavik, 2020). It is well known that dental caries is one of the main reasons for the need for endodontic treatment (Langeland, 1987; Ricucci D *et al*, 2013) and that certain systemic factors inherent to the patient can promote the occurrence of this disease in the oral cavity. Additionally, the systemic conditions of individuals can interfere with periapical immunoinflammatory responses (De Brito LC *et al.*, 2015; Ferreira SB *et al.*, 2016).

Among patients with conditions that can influence the course of endodontic treatment are organ transplant recipients. These patients can be in the pre- or post-transplant phase. A condition commonly associated with pre-kidney transplant patients is chronic kidney disease (CKD), which is a significant public health issue worldwide. In addition to metabolic alterations (Bastos *et al.*, 2010), CKD patients may experience various changes in the oral cavity due to the disease itself or factors related to its treatment (Akar *et al.*, 2011; Ruospo M *et al.*, 2014; Borawski *et al.*, 2007; Thorman *et al.*, 2009).

Current evidence indicates that oral infections can serve as a source for the dissemination of pathogenic organisms, as their products enter the bloodstream and may spread to other regions of the body, thus affecting the course and pathogenesis

of cardiovascular diseases, bacterial pneumonia, diabetes mellitus, and low birth weight (Scannapieco & Cantos, 2016). Moreover, chronic bacterial infections can be a risk factor for thromboembolic events and increase the rate of coronary diseases (Pussinen *et al.*, 2007). In post-transplant patients, the success of endodontic treatment and the healing of periradicular tissues can be influenced by systemic medication (Hecking, 2021).

Given that the ultimate goal of endodontic treatment is to prevent or treat apical periodontitis, which involves bacterial infection (Ørstavik, 2020), and that the systemic conditions of individuals affect periapical immunoinflammatory responses (De Brito LC *et al.*, 2015; Ferreira SB *et al.*, 2016), it is important to understand the association between endodontic treatment response and the characteristics of patients in the pre- and post-kidney transplant phases. Therefore, the present study evaluated the necessity and success rate of endodontic treatments in patients before and after kidney transplantation, analyzing systemic data and correlating these findings with the risk of persistent endodontic infections and potential complications in these individuals.

MATERIALS AND METHODS

This was a retrospective cohort study analyzing data from 89 pre- or post-kidney transplant patients. The study was conducted following the Strengthening the reporting of observational studies in epidemiology (STROBE) guidelines (Vandenbroucke JP *et al.*, 2014).

Patients

This study was approved by the ethics committee (CAAE: 77375517.9.0000.5149) of the Federal University of Minas Gerais (UFMG). The study population consisted of kidney transplant patients from the Hospital das Clínicas of UFMG (HC-UFMG) who were referred for dental treatment at the School of Dentistry of the same institution (FO-UFMG). These patients were treated from August 2016 to June 2023.

Eligibility Criteria

All pre- or post-kidney transplant patients treated at FAO-UFMG were included. Patients whose medical records could not be retrieved and who did not require endodontic treatment were excluded. For the analysis of the success rate, patients who did not attend follow-up consultations were also excluded.

Sociodemographic and Medical Data

Data were collected from the medical records of HC-UFMG and the dental records of FO-UFMG. The following data were collected: sex (male and female), age, transplant phase (pre- or post-transplant), primary disease, medications in use, and hemodialysis (yes or no). Missing or incomplete data were recorded as “missing/omitted data”. Laboratory tests were collected from the HC-UFMG Intranet System. The following laboratory tests were collected on the date of the consultation prior to endodontic treatment: platelets, lymphocytes, red blood cells, creatinine, glomerular filtration rate (GFR), urea, calcium, and phosphorus.

Analysis of the Need and Success Rate of Endodontic Treatments

The diagnosis of the need for endodontic treatment was based on periapical radiographs, anamnesis, and pulp sensitivity and percussion tests. Reports of complications during treatment were recorded. The instrumentation technique used was rotary kinematics with the ProTaper Next system (Dentsply Sirona, Charlotte, North Carolina, USA). Periapical radiographs were analyzed before and after endodontic treatment, with at least 12 months between the first and second examinations. Radiographic and clinical evaluations were performed by two examiners: a senior evaluator and a second examiner trained according to the criteria established by the first. Evaluations were conducted jointly with continuous feedback.

Endodontic treatment was considered successful if there was complete resolution of the periapical lesion or maintenance of periradicular tissue integrity after the control radiograph. Additionally, teeth should show a negative response to vertical and horizontal percussion tests and palpation. Finally, the need for endodontic treatment and success of endodontic treatment was considered as a dependent variable, dichotomized as “yes” and “no.” The independent variables of the study were sex, underlying disease, systemic medication, and laboratory tests.

Statistical Analysis

The analysis was performed using IBM SPSS software (Version 25.0; SPSS, Chicago, IL, USA). In the descriptive analysis, quantitative variables were expressed as means and standard deviations. The chi-square test was used to assess the association between the dependent and independent variables considering a significance level of 95% ($p < 0.05$).

RESULTS

Sociodemographic and Medical Data

The total number of patients is 89, with 23 requiring endodontic treatment. Among the patients receiving endodontic treatment, their ages ranged from 27 to 80 years, with an average age of 37.95 years. There were 9 female patients and 14 male patients. Additionally, 69.56% of the patients were in the pre-transplant phase, and 30.43% were in the post-transplant phase.

Need for Endodontic Treatment

A total of 89 patients were treated, with 23 (25.84%) requiring endodontic treatment (Figure 1). In total, 37 teeth required treatment, with 34.78% of patients needing treatment in more than one tooth. The number and frequency of teeth needing endodontic treatment and reinterventions are detailed in Table 1. The highest prevalence of endodontic treatments was in premolars (48.6%) and molars (35.1%). Of the teeth requiring reintervention (6), the highest prevalence was 50% in premolars. The average number of sessions for endodontic treatments was 2.51 (range 1-6). During the endodontic treatments, the following complications were reported: perforation of the pulpal chamber floor in one tooth, and one patient could not undergo the procedure due to preoperative blood pressure of 170/100 mmHg. No other complications were reported. No statistical difference was found between the variables.

Analysis of Endodontic Treatment Success Rate

Twenty-three patients were selected for clinical and radiographic follow-up. Among these patients, 4 patients died, 1 patient was hospitalized and could not attend the follow-up consultation, and 1 patient had the tooth with endodontic treatment extracted for prosthetic reasons. In total, 28 teeth were clinically and radiographically examined. Success was observed in 25 teeth, and failure was noted in 3. Therefore, the success rate of the endodontic treatments was 89,28%. There was no statistical difference considering the independent variables, underlying disease, systemic medication, and laboratory tests ($p>0.05$). In successful cases, complete regression of the periapical lesion or maintenance of periapical integrity in vital teeth was observed. The unsuccessful cases were in teeth with chronic apical periodontitis, where no regression of the periapical lesion was observed one year after endodontic treatment. These patients were referred for endodontic retreatment. No statistical difference was found between the variables.

Underlying Diseases

The underlying diseases and their frequencies are detailed in Table 2. Among the 89 kidney transplant patients evaluated, chronic kidney disease (CKD) was the most prevalent comorbidity, affecting 31.5% of the total patients, 36.4% before the transplant, and 13.04% after the procedure. Diabetes was present in 21.35% of patients, and 66.3% of patients had hypertension. Among patients who underwent endodontic treatment, CKD accounted for 30.45% of cases and was the predominant condition before and after kidney transplantation, with 31.25% before transplant and 14.29% after transplant. Nephrotoxicity and glomerulonephritis were present in 8.69% of the sample, with 12.5% before transplantation and none post-transplantation. Other primary diseases, such as myeloma, Alport and Falconi

syndromes, renal tuberculosis, and polycystic kidney disease, were found in 20.2% of patients, with 25% pre-transplant and 85.71% post-transplant. Of these patients, 21.73% were diabetic, while 78.27% were not. Moreover, 69.57% of patients had hypertension.

Systemic Medication

All patients were on medication. Among the 89 kidney transplant patients evaluated, the most commonly used class of medication was antihypertensives, accounting for 40.4%. Pre-transplant, the most frequently used medications were antihypertensives (39.9%), with amlodipine and losartan being the most common. In Post-transplant patients, the most frequently used medications were steroidal anti-inflammatories (86.9%), with prednisone being the most common. Antihypertensives were continuously used by 39.3% of patients pre-transplant and 43.4% post-transplant. Anti-gout medications were used by 7.5% of patients pre-transplant and 13% post-transplant. In addition to the medications listed in Table 3, 23.5% of individuals were taking other medications, such as electrolyte supplements (8.9%, 0% pre and 34.7% post-transplant), minerals (4.4%, 6% pre and 0% post-transplant), hormonal supplements (3.3%, 3% pre and 4.3% post-transplant), anxiolytics (3.3%, 4.5% pre and 0% post-transplant), antipsychotics (2.2%, 1.5% pre and 4.3% post-transplant), antivirals (2.2%, 1.5% pre and 4.3% post-transplant), antihistamines (1.1%, 1.5% pre and 0% post-transplant), contraceptives (1.1%, 1.5% pre and 0% post-transplant), urinary antispasmodics (1.1%, 0% pre and 4.34% post-transplant), bronchodilators (1.1%, 1.5% pre and 0% post-transplant), pancreatic enzymes (1.1%, 1.5% pre and 0% post-transplant), and laxatives (1.1%, 1.5% pre and 0% post-transplant). Regarding missing data, 23 patients out of 89 had missing data.

Laboratory Tests

Table 4 describes the number and frequency of laboratory tests analyzed. The most altered data were: creatinine levels above the reference range in 93.7%, and urea levels above the reference range in 100% of patients. Below the reference range were red blood cells and glomerular filtration rate (GFR), in 73.3% and 75% of patients, respectively.

Hemodialysis

Of the 23 individuals who underwent endodontic treatment, 21.73% were on hemodialysis, including one on peritoneal dialysis.

DISCUSSION

Apical periodontitis is an inflammatory condition that affects the tissues surrounding the apical portion of the dental root, triggered by the presence of microorganisms and their toxins in the root canal (Takahashi, 1998; Siqueira Jr. and Rocas, 2008). The patient's systemic condition can play a crucial role in the development and severity of apical periodontitis (Siqueira Jr. and Rocas, 2008; Li *et al.*, 2000; Segura-Egea JJ., 2023; Berlim-Broner Y, 2016; Segura Egea JJ, 2005; Segura-Egea JJ, 2015). Patients who require or have undergone kidney transplantation, due to pre- and post-transplant immunosuppressive therapy, present leukopenia and have an increased risk of infection by microorganisms in the oral cavity (Lamba J *et al.*, 2023). Although there are many studies associating oral condition with kidney transplant patients, few studies address the association between this patient profile and the need for endodontic treatment. This study analyzed the necessity and success rate of endodontic treatment, correlating them with the systemic aspects of the evaluated patients.

This study identified an endodontic treatment necessity rate of 25.84%. Brazilian research indicated apical periodontitis rates of 7.87% (Berlinck T, 2015) and 4.4% (Ferreira ML *et al.*, 2022). Furthermore, Ferreira ML *et al.* (2022) reported a 4.5% rate of endodontic treatments performed. Despite differences in sample sizes, these rates were notable. Dental caries is the primary cause of endodontic treatment need. Patients with chronic kidney disease (CKD) are more prone to developing caries due to factors like xerostomia, medication use, and dialysis, which accelerate caries progression (Bossola and Tazza, 2012).

The success rate of endodontic treatments in this study was 89,28%. Patients with unsuccessful outcomes had teeth with chronic apical periodontitis and were in the pre-transplant phase, undergoing weekly hemodialysis and using immunosuppressive medications as preparation for the transplant. However, the success rates of endodontic treatments in patients with comorbidities, such as chronic kidney disease or diabetes, are generally comparable to those in healthy individuals. Studies demonstrate that, although systemic conditions can influence the healing process, the overall success of endodontic treatments remains similar (Lopez-Valverde I, 2023; Gudac J, 2021; Laukkanen E, 2019). This similarity can be attributed to advancements in endodontic techniques, effective infection control, and individualized patient management that considers the specific health conditions of patients with comorbidities. Thus, with appropriate care, endodontic treatments can achieve high success rates across different patient populations.

In evaluating the patients' systemic conditions, the most common primary disease was chronic kidney disease (CKD), affecting 28 patients (31.5%). This finding aligns with existing literature, which identifies CKD as the leading cause of kidney transplantation. Patients with CKD are more susceptible to infections, have a

higher incidence of dental caries, periodontal diseases, and salivary gland issues that can result in xerostomia. These conditions increase the necessity for endodontic treatments (Klassen & Krasko, 2002).

When analyzing the medications used by the study patients, the most commonly used were antihypertensives (40.4%). Kidney transplant patients often use these medications to control blood pressure, elevated due to renal dysfunction and the use of immunosuppressants. Calcium channel blockers, angiotensin-converting enzyme inhibitors, and angiotensin receptor blockers are commonly prescribed. These medications can cause gingival hyperplasia (Wentz LA *et al.*, 2012) and xerostomia, increasing the risk of periodontal diseases and, consequently, the need for endodontic treatments (Klassen & Krasko, 2002).

Steroidal anti-inflammatory drugs (SAIDs) were the second most used class (30.3%). The use of SAIDs in kidney transplant patients is a common practice to prevent graft rejection, but it can impact oral health. These medications, such as prednisone, have immunosuppressive effects that increase susceptibility to oral infections, potentially elevating the need for endodontic treatments. Studies indicate that although immunosuppression may compromise healing, the success rate of endodontic treatments in kidney transplant patients is similar to that observed in systemically normal patients (Di Spirito F *et al.*, 2022). Of the patients analyzed, 19 (21.3%) used immunosuppressive medications. Immunosuppressants such as cyclosporine, tacrolimus, and mycophenolate are essential to prevent graft rejection in kidney transplant patients. However, these medications may cause adverse effects, such as gingival hyperplasia (Wentz LA *et al.*, 2012), increased susceptibility to infections, and impaired wound healing, thus increasing the risk of requiring endodontic intervention (Klassen and Krasko, 2002).

Kidney transplant patients often present with anemia, characterized by a reduced number of erythrocytes in the blood. Anemia can be caused by chronic kidney disease, use of immunosuppressants, and other complications associated with transplantation. Erythropoietin, a hormone responsible for erythrocyte production, is often deficient in renal patients, exacerbating anemia (Locatelli *et al.*, 2009). Of the patients analyzed, 73.3% had erythrocyte levels below the reference value. This condition can affect tissue oxygenation, including oral tissues, delaying healing and increasing the risk of infections. During endodontic procedures, poor tissue oxygenation can hinder the inflammatory response and postoperative recovery, compromising treatment success (Georgakopoulou EA, 2011).

Creatinine serves as a crucial indicator of kidney function. In this study, 15% of patients had levels exceeding reference values, signifying renal insufficiency. Post-transplant, creatinine levels are monitored to evaluate graft functionality. Elevated creatinine levels after transplantation can signify graft rejection or other complications (Patel R., 1997). Renal dysfunction heightens susceptibility to infections due to immunosuppression, complicating the need for endodontic treatment, as dental infections can propagate more readily and exacerbate the patient's clinical condition (Proctor R., 2005).

Additionally, lymphocyte counts were below the reference level in 30.8% of the study patients. Post-kidney transplant immunosuppression causes a significant reduction in lymphocyte count, cells crucial for the immune response. Lymphopenia induced by immunosuppressive drugs such as cyclosporine and tacrolimus reduces the body's ability to fight infections (De Brito LC *et al.*, 2015). This reduction increases the risk of opportunistic infections, including those of dental origin,

necessitating a more cautious approach to dental treatment (De Brito LC *et al.*, 2015).

Another altered substance in the patients' tests was urea. One hundred percent of the patients analyzed in the study had urea levels above the reference level. Urea is a protein degradation product excreted by the kidneys (Pascual J *et al.*, 2008). In kidney transplant patients, elevated urea levels can significantly impact oral health, leading to xerostomia and increasing the incidence of infections and, consequently, the greater need for endodontic treatment. These infections can spread and cause apical periodontitis, with patients with high urea levels showing altered inflammatory responses and compromised healing, impairing the success of endodontic treatments (Proctor R *et al.*, 2005; Klassen and Krasko, 2002).

Kidney transplant patients may require hemodialysis due to graft rejection, transplant failure, or postoperative complications (Georgakopoulou EA, 2011). Hemodialysis removes waste and excess fluids from the blood when the kidneys can no longer perform these functions effectively (Scannapieco & Cantos, 2016). Hemodialysis can cause xerostomia, increasing the risk of dental caries and periodontal infections, and potentially the need for endodontic treatment (Proctor R *et al.*, 2005). Additionally, it alters the composition of the oral microbiota, favoring the growth of pathogens that can cause infections (Khocht A *et al.*, 1997). Transplant patients are generally on immunosuppressive therapy to prevent graft rejection, and the combination of immunosuppression and hemodialysis can increase susceptibility to infections, including those in the oral cavity (Pol R *et al.*, 2022).

A limitation of the study is the absence of some medical data, thus the initial sample could not be considered in all analyses. To the best of our knowledge, this is the first study to present data on kidney transplantation, the necessity and success

rate of endodontic treatments, and to correlate these factors with systemic, medicational, and laboratory data. This is crucial for filling knowledge gaps and providing preliminary insights that can guide future investigations. Moreover, it can reveal important trends and hypotheses that justify and support subsequent studies with larger samples.

The effectiveness of endodontic treatment can be compromised by impaired healing in immunosuppressed and hemodialysis patients. Adequate healing of periapical tissues may be delayed, increasing the risk of treatment failure (Siqueira Jr. and Rocas, 2008). The reduced ability to fight infections may require endodontic procedures to be performed with greater rigor and attention to prevent complications (Nair, 2004). Systemic alterations, changes in laboratory tests, and medication use reflect the compromised overall health of kidney transplant patients. These factors increase vulnerability to infections and systemic complications, directly affecting the approach, necessity, and success of endodontic treatment (Laheij A, 2022).

CONCLUSION

Pre or post- kidney transplant patients present various hematological and biochemical alterations that affect systemic and oral health. In this study, the need for endodontic treatment was higher than in systemically normal patients. However, the success rate was similar to that found in the literature for these patients. Future studies focused on the direct relationship between kidney transplant patients and the prevalence of endodontic treatments are necessary for a deeper understanding of these changes and for the effective management of endodontic treatments, ensuring the overall health and quality of life of these patients.

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FIGURES

Figure 1

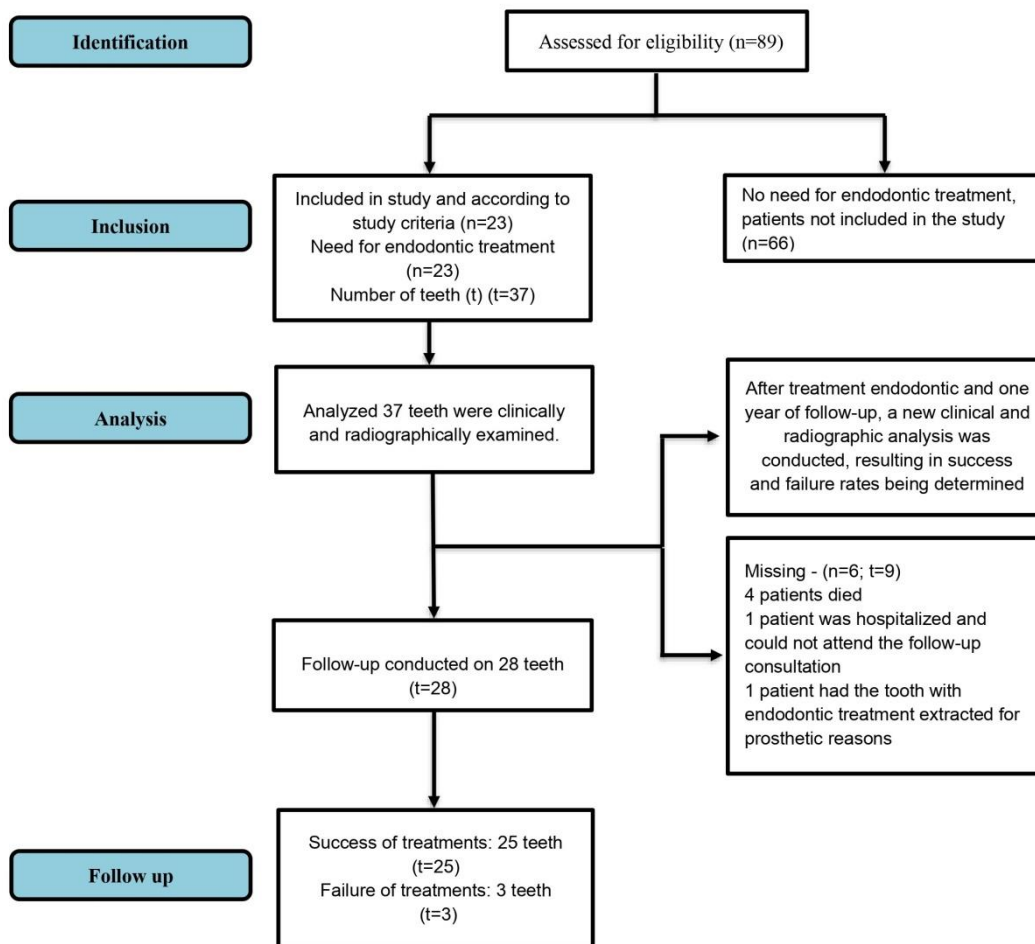


Figure 1- Strengthening the reporting of observational studies in epidemiology (STROBE) flowchart.

TABLES**TABLE 1.** Description of teeth in need of endodontic treatment and success rate of treatments carried out in the Program of Dental Care for Transplanted Patients of UFMG.

Need for endodontic treatment	Frequency	%
Endodontic treatment		
Premolar	18	48.6
Molar	13	35.1
Canine	4	10.8
Incisor	2	5.4
Total	37	100
Endodontic reintervention		
Premolar	3	50.0
Molar	1	16.6
Canine	1	16.6
Incisor	1	16.6
Total	6	100

TABLE 2. Percentages of systemic diseases exhibited by individuals enrolled in the Program of Dental Care for Transplanted Patients of UFMG.

Primary disease	Pacient n(%)		
	Global	Pre- KT*	Post- KT
IRC	28 (31.5)	24 (36.4)	4 (13.0)
Diabetic Nephropathy	7 (7.8)	6 (9.0)	1 (4.3)
Polycystic Kidney Disease	6 (6.7)	4 (6.0)	2 (8.6)
Nephritis	5 (5.6)	2 (3.0)	3 (13.0)
Hypertensive Nephrosclerosis	4 (4.4)	3 (4.5)	1 (4.3)
IgA nephropathy	4 (4.4)	4 (6.0)	0 (0.0)
Lupus	3 (3.3)	3 (4.5)	0 (0.0)
Hepatitis	1 (1.1)	1 (1.5)	0 (0.0)
Other	18 (20.2)	10 (15.1)	8 (34.7)
Missing	13 (14.6)	11 (16.6)	2 (8.6)
Total	89 (100)	66 (100)	23 (100)

*KT: Kidney transplant.

TABLE 3. Percentages of medications used by individuals enrolled in the Program of Dental Care for Transplanted Patients of UFMG.

Medication	Patient n(%)		
	Global	Pre- KT*	Post- KT
In use	89 (100)	66 (100)	23 (100)
Antihypertensive	36 (40.4)	26 (39.3)	10 (43.4)
Amlodipine	21 (23.5)	15 (16.8)	6 (26.0)
Losartan	18 (20.5)	15 (16.8)	3 (13.0)
Atenolol/Metoprolol	11 (12.3)	9 (13.6)	2 (8.6)
Other antihypertensives	16 (17.9)	13 (19.6)	3 (13.0)
Steroid anti-inflammatory	27 (30.3)	7 (10.6)	20 (86.9)
Prednisone	26 (29.2)	7 (10.6)	19 (82.6)
Prednisolone	1 (1.1)	0 (0.0)	1 (4.3)
Diuretic	25 (28.0)	21 (31.8)	4 (17.3)
Furosemide	25 (28.0)	20 (30.3)	4 (17.3)
Spironolactone	1 (1.1)	1 (1.5)	0 (0.0)
Anticoagulant	22 (24.7)	18 (27.2)	4 (17.3)
Acetylsalicylic acid	16 (17.9)	13 (19.6)	3 (13.0)
Heparin	4 (4.4)	4 (6.0)	0 (0.0)
Marevan	2 (2.2)	1 (1.5)	1 (4.3)

Immunosuppressant	19 (21.3)	2 (3.0)	17 (73.9)
Tacrolimus	13 (14.6)	2 (3.0)	11 (47.8)
Mycophenolate Mofetil	11 (12.3)	1 (1.5)	10 (43.4)
Sirolimus	3 (3.3)	0 (0.0)	3 (13.0)
Cyclosporine	2 (2.2)	0 (0.0)	2 (8.5)
Everolimus	1 (1.1)	0 (0.0)	1 (4.3)
Vitamins and Mineral Supplements	16 (17.9)	13 (19.6)	3 (13.4)
Anti-lipemic	15 (16.8)	11 (16.6)	4 (17.3)
Simvastatin	14 (15.7)	11 (16.6)	4 (17.3)
Ciprofibrate	2 (2.2)	0 (0.0)	1 (4.3)
Antacid	12 (13.4)	9 (13.6)	3 (13.0)
Hypoglycemic	9 (10.1)	8 (12.2)	1 (4.3)
Insulin	9 (10.1)	8 (12.1)	1 (4.3)
Hematopoietic Growth Factor	8 (8.9)	8 (12.1)	0 (0.0)
Anti-gouty	7 (7.8)	5 (7.5)	3 (13.0)
Antibiotic	5 (5.6)	2 (3.0)	3 (13.0)
Bactrim®	3 (3.3)	1 (1.5)	2 (8.6)
Gentamicin	1 (1.1)	1 (1.5)	0 (0.0)
Sulfamethoxazole(a) + Trimethoprim(b)	1 (1.1)	0 (0.0)	1 (1.5)
Antidepressant	4 (4.4)	2 (3.0)	2 (8.6)
Sertraline	2 (2.2)	2 (1.5)	1 (4.3)
Paroxetine	1 (1.1)	1 (1.5)	0 (0.0)
Doxepin	1 (1.1)	0 (0.0)	1 (4.3)
Phosphorus Pickup	4 (4.4)	4 (6.0)	0 (0.0)
Renagel/Sevelamer	4 (4.4)	4 (6.0)	0 (0.0)
Bisphosphonate	2 (2.2)	2 (2.2)	0 (0.0)

			40
Anti-parathyroid	1 (1.1)	1 (1.1)	0 (0.0)
Others	21 (23.5)	13 (19.6)	8 (34.7)

*KT: Kidney transplant

TABLE 4. Description of the frequency of laboratory test results for patients in need of endodontic treatment registered in the Program of Dental Care for Transplanted Patients of UFMG.

Laboratory tests	Pacient			
	Frequency below reference level	Adequate	Frequency above reference level	Total n
	n (%)	n (%)	n (%)	***
Blood count				
Platelets	0 (0.0)	15 (83.8)	3 (16.7)	18 (100)
Lymphocytes	4 (30.8)	8 (61.5)	1 (7.7)	13 (100)
Red Cells	11 (73.3)	3 (20.0)	1 (6.7)	15 (100)
Other exams				
Creatinine	0 (0.0)	1 (6.3)	15 (93.7)	16 (100)
RFG*	12 (75.0)	4 (25.0)	0(0)	16 (100)
Urea	0 (0.0)	0 (0.0)	14 (100)	14 (100)
Calcium	2 (20.0)	4 (40.0)	4 (40.0)	10 (100)
Phosphor	1 (6.6)	7 (46.7)	7 (46.7)	15 (100)
RDW	0 (0.0)	6 (46.2)	7 (53.8)	13 (100)

*RFG: Glomerular filtration rate.

**RDW: Erythrocyte distribution width.

***Total number of patients according to the eligibility criteria and already excluding patients with missing data.

CONSIDERAÇÕES FINAIS

As condições sistêmicas dos pacientes encaminhados para tratamento odontológico estavam significativamente comprometidas, especialmente no período pré-transplante, estando associadas a uma alta prevalência de necessidade de tratamento endodôntico. Esses dados indicam que, se não tratadas, as infecções nos canais radiculares poderão prejudicar os esforços para garantir a saúde integral desses pacientes, bem como o sucesso do transplante. O estudo enfatiza a necessidade de uma análise interdisciplinar consistente nos diversos campos do conhecimento para alcançar resultados cada vez mais satisfatórios e robustos, visando a promoção da saúde global dos pacientes que necessitam de transplante renal. No futuro, será fundamental realizar estudos clínicos que investiguem o tempo necessário para o reparo completo dos tecidos perirradiculares, comparando esses dados com indivíduos saudáveis.

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