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## Chamomile Mouthwash As A Supportive Care Intervention For Chemotherapy-Associated Oral Mucositis In Kidney Transplant Patients

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### Abstract

Chemotherapy-associated oral mucositis remains a common and debilitating complication that significantly affects quality of life, treatment continuity, and hospitalisation outcomes. Kidney transplant patients represent a particularly vulnerable population due to chronic immunosuppression, impaired mucosal healing, and heightened infection risk. Safe and effective supportive care strategies suitable for renal transplant settings remain limited. Exploring safe, accessible, and cost-effective interventions aligns with **Sustainable Development Goal (SDG) 3: Good Health and Well-Being**, which emphasizes improving healthy lifestyle and ensuring universal access to effective treatments in improving the health. To evaluate the effectiveness of chamomile mouthwash in reducing the severity of chemotherapy-associated oral mucositis in kidney transplant patients and to assess its impact on pain intensity and oral functional outcomes during hospitalisation. A prospective, controlled, hospital-based interventional study was conducted among 120 hospitalised adult kidney transplant recipients receiving chemotherapy. Participants were allocated to either a chamomile mouthwash group (n = 60) or a standard oral care group (n = 60). Oral mucositis severity, pain intensity, oral intake tolerance, treatment compliance, and adverse events were assessed at baseline and during follow-up. Data were analysed using appropriate inferential statistical methods, including independent samples *t*-tests, chi-square tests, repeated-measures analysis of variance, and Kaplan–Meier survival analysis. Patients receiving chamomile mouthwash demonstrated a significant reduction in oral mucositis severity compared with controls ( $p = 0.003$ ). Pain intensity decreased more rapidly in the intervention group ( $p < 0.001$ ), and mucositis resolution occurred earlier (log-rank  $p = 0.01$ ). Treatment compliance was high, and no serious adverse events were reported. Chamomile mouthwash appears to be a safe and effective supportive care intervention for managing chemotherapy-associated oral mucositis in kidney transplant patients, with potential benefits for patient comfort, treatment continuity, and inpatient outcomes.

**Keywords:** Kidney transplantation; Oral mucositis; Chamomile mouthwash; Chemotherapy complications; Supportive care, Health, Healthy life style, Inclusive education, Oncology, Cancer.

### 1. Introduction

Oral mucositis remains one of the most frequent and debilitating complications associated with chemotherapy, manifesting as painful, inflammatory and ulcerative lesions of the oral mucosa that interfere with nutrition, speech, and oral hygiene [1]. Regardless of the improvements in oncological management and supportive measures, randomised control studies and systematic reviews show that its incidence is still significant, which leads to longer hospitalisation, higher analgesic needs, increased risk of infection, and

disruptions in cancer treatment [2]. These clinical outcomes contribute greatly to the morbidity and mortality of patients and escalate the health care burden. Patients undergoing kidney transplantation are vulnerable to oral mucositis caused by chemotherapy since the chronic immunosuppression, impairment of the mechanisms of inflammatory regulation, and the change in the process of tissue healing make these patients susceptible [3]. In cases of transplantation of the kidney, mucosal injury presents a disproportionate clinical outcome, such as opportunistic infections,

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nutritional depletion, electrolyte imbalance, and long-term hospitalisation, which indirectly affect the stability of the graft and renal performance [4]. Diffusion-supportive care approaches that do not violate mucosal integrity thus fit well in nephrology objectives supporting patient safety and long-term kidney graft survival. Symptomatic treatment and traditional oral hygiene interventions are the main pillars of the standard management of oral mucositis. Pharmacological methods, however, are usually associated with pitfalls of systemic toxicity and possible nephrotoxicity, which restrict their application in transplant patients [5]. Consequently, there has been an increase in interest in complementary and non-pharmacological interventions that have local effects but show positive safety profiles. Natural health product reviews in cancer care have highlighted the growing importance of integration of plant-based treatment, and have underlined the need to implement this treatment more in medically-complicated groups [6]. *Matricaria chamomilla* (chamomile) has been widely studied on account of its anti-inflammatory, antimicrobial, antioxidant, and wound healing effects. The clinical trials reveal that the chamomile mouth rinses have positive clinical and microbiological effects in inflammatory periods of the mouth, and this promotes their relevance in therapy at the mucosal surfaces [7]. The  $\alpha$ -bisabol and other bioactive compounds help in the healing of the epithelials and in alleviating the postoperative inflammation of the mouth, as evidenced in the controlled surgery conditions [8]. Systematic and umbrella reviews all support the claim that chamomile-based interventions have a detrimental effect on the occurrence and intensity of oral mucositis in chemotherapy and radiotherapy [9,10]. Natural product reviews also affirm the positive topical safety profile and low absorption into the system of chamomile, making it effective in vulnerable and immunocompromised groups of patients [11]. More comprehensive oncology-related evaluations also embrace the efficacy of chamomile to reduce the symptoms of cancer and also enhance the comfort of a patient receiving cancer treatments [12].

The results of clinical trials comparing structured oral care protocols underline the significance of preventative oral care to decrease the severity of mucositis and enhance the tolerance to treatment [13]. The clinical applicability of specific oral supportive care interventions is further evidenced by systematic reviews of the evidence regarding the use of mouthwashing in radiation-induced stomatitis and chemotherapy-related xerostomia [14]. The research on plant extracts suggests that they can be used to reduce the side effects of cancer treatments, such as mucosal damage and cachexia [15]. Other experimental studies also reinforce the antimicrobial and anticariogenic effects of chamomile, which, as an ingredient in oral care products aimed at safeguarding mucosa and dental health, is hence appropriate [16]. The therapeutic advantages of *Matricaria recutita* in oral mucositis have been reported both in clinical and experimental studies [17], and the anti-inflammatory and epithelial

protective properties of the agent in mucocutaneous therapy have been reported in the dermatology literature [18]. Regardless of this growing amount of evidence, there are still significant gaps in regards to kidney transplant recipients. The majority of literature is on head and neck cancer, pediatric oncology or mixed cancer groups and does not apply to immunosuppressed patients receiving kidney transplants [19]. Oral mucostoma intervention reviews are rarely stratified by transplant status and renal vulnerability, and interventional studies on oral mucostoma in populations of kidney transplant specifically consider the use of supportive oral care are limited. This deficiency of transplant-specific evidence inhibits the formation of customary supportive care guidelines in the practice of nephrology.

The need to offer supportive care measures that do not affect the health of the mucosa without interfering with renal safety is increasingly becoming a requirement because patients receiving a kidney transplant are more in need of oncologic therapies, as their survival rates have been improving with time. Chamomile mouthwash is a cheap, non-invasive, and topical agent that has proven value in terms of anti-inflammatory and antimicrobial properties. Its proven effectiveness in oral mucositis, low levels of systemic exposure and the lack of nephrotoxic reactions predetermine its use as an adjunctive therapy with renal transplant patients. The trial of chamomile mouthwash in a kidney transplant ward population of hospitalised patients covers a significant clinical interface point relating to nephrology, transplantation medicine, and supportive oncology care. It supports SDG 3 targets on:

- 3.4: Reduce premature mortality from noncommunicable diseases (including cancer) through prevention and treatment.
- 3.8: Achieve universal access to safe, effective, and quality therapies.

Thus, **SDG 3** directly aligns with improving patient outcomes and enhancing quality of care

## Research Objectives

1. To evaluate the effectiveness of chamomile mouthwash in reducing the severity of chemotherapy-associated oral mucositis in kidney transplant patients.
2. To assess the impact of chamomile mouthwash on pain intensity and oral functional outcomes during hospitalisation.

## 2. Methodology

### 2.1 Study Design

A prospective, controlled, hospital-based interventional study design was employed to evaluate the effectiveness of chamomile mouthwash in the management of chemotherapy-associated oral mucositis among kidney transplant patients. The study was structured to allow systematic comparison between an intervention group and a control group, ensuring rigorous assessment of clinical outcomes during hospitalisation within a renal transplant care framework.

## 2.2 Study Setting and Population

The study included a total sample size of 120 hospitalised adult kidney transplant recipients receiving chemotherapy. Eligible participants were aged 18 years or older, had a confirmed history of kidney transplantation, and were maintained on stable immunosuppressive regimens. Patients with unrelated active oral infections, known hypersensitivity to chamomile, acute graft rejection, or concurrent participation in other interventional studies were excluded to reduce confounding influences.

## 2.3 Intervention Protocol

Participants were allocated into two groups of equal size, with 60 patients receiving standard oral care and 60 patients receiving chamomile mouthwash in addition to standard care. Standard oral care followed institutional protocols, while the chamomile mouthwash was administered at a standardised concentration three times daily after meals, with participants instructed to retain the solution in the oral cavity for 30–60 seconds before expectoration. The intervention was continued throughout the chemotherapy course or until hospital discharge, and adherence was monitored daily by nursing staff.

## 2.4 Outcome Measures

The researcher determines that the primary outcome measure was the severity of oral mucositis, assessed using a standardised grading scale at baseline and during follow-up. Secondary outcomes included pain intensity measured using a numeric rating scale, oral intake tolerance evaluated through dietary intake records, and patient-reported oral discomfort. Safety outcomes, including adverse reactions and overall treatment compliance, were systematically recorded to

evaluate tolerability in the kidney transplant population.

## 2.5 Data Collection and Analysis

Baseline and follow-up data on oral mucositis severity, pain scores, oral intake, compliance, and adverse events were systematically collected during hospitalisation and analysed using statistical software. Continuous variables were summarised as means with standard deviations and compared using independent samples *t*-tests, while categorical variables were analysed using chi-square tests. Changes in pain scores over time were assessed using repeated-measures analysis of variance, and time to mucositis resolution was evaluated using Kaplan–Meier survival analysis with log-rank testing. Statistical significance was defined as a two-tailed *p*-value < 0.05.

## 3. Results

### 3.1 Baseline Demographic and Clinical Characteristics

A total of 120 hospitalised kidney transplant patients receiving chemotherapy were included in the analysis, with 60 patients allocated to the chamomile mouthwash group and 60 to the standard oral care group. Baseline demographic and clinical characteristics were comparable between the two groups. Independent samples *t*-tests showed no significant differences in mean age (*p* = 0.78) or time since transplantation (*p* = 0.64). Categorical variables, including sex distribution, immunosuppressive regimen, and baseline oral mucositis grade, were compared using the chi-square test and did not differ significantly between groups (*p* > 0.05), confirming baseline homogeneity (Table 1).

**Table 1.** Baseline Demographic and Clinical Characteristics of Study Participants (n = 120)

Variable	Chamomile Group (n = 60)	Control Group (n = 60)	<i>p</i> value
Age (years), mean ± SD	46.8 ± 9.4	47.2 ± 8.9	0.78
<b>Sex, n (%)</b>			
Male	38 (63.3)	36 (60.0)	0.71
Female	22 (36.7)	24 (40.0)	
Time since transplant (years), mean ± SD	4.6 ± 2.1	4.8 ± 2.3	0.64
Calcineurin inhibitor use, n (%)	52 (86.7)	50 (83.3)	0.59
Baseline mucositis (Grade ≥2), n (%)	34 (56.7)	36 (60.0)	0.71

## 3.2 Effect of Chamomile Mouthwash on Oral Mucositis Severity

At follow-up, the distribution of oral mucositis severity differed significantly between the two groups. The chi-square test demonstrated a statistically significant reduction in higher-grade mucositis among patients receiving chamomile mouthwash compared with those

receiving standard oral care (*p* = 0.003). Severe mucositis (Grade 3–4) was observed in 11.7% of the intervention group compared with 30.0% of the control group, while mild or no mucositis (Grade 0–1) was more frequent in the chamomile group (48.3% vs. 23.3%), indicating a clinically meaningful benefit of the intervention (Table 2).

**Table 2.** Comparison of Oral Mucositis Severity at Follow-Up

Mucositis Grade	Chamomile Group (n = 60)	Control Group (n = 60)	<i>p</i> value
Grade 0–1, n (%)	29 (48.3)	14 (23.3)	0.003
Grade 2, n (%)	24 (40.0)	28 (46.7)	
Grade 3–4, n (%)	7 (11.7)	18 (30.0)	

### 3.3 Pain Intensity and Oral Functional Outcomes

Changes in oral pain scores over time were analysed using repeated-measures analysis of variance. A significant group-by-time interaction was observed ( $p < 0.001$ ), indicating a greater reduction in pain intensity among patients receiving chamomile mouthwash compared with controls. Mean pain scores in the

intervention group decreased from  $6.2 \pm 1.1$  at baseline to  $2.9 \pm 1.0$  by day 7, whereas the control group showed a more modest decline from  $6.3 \pm 1.0$  to  $4.6 \pm 1.2$ . This pattern demonstrates superior pain control and improved oral functional outcomes associated with the intervention (Figure 1).

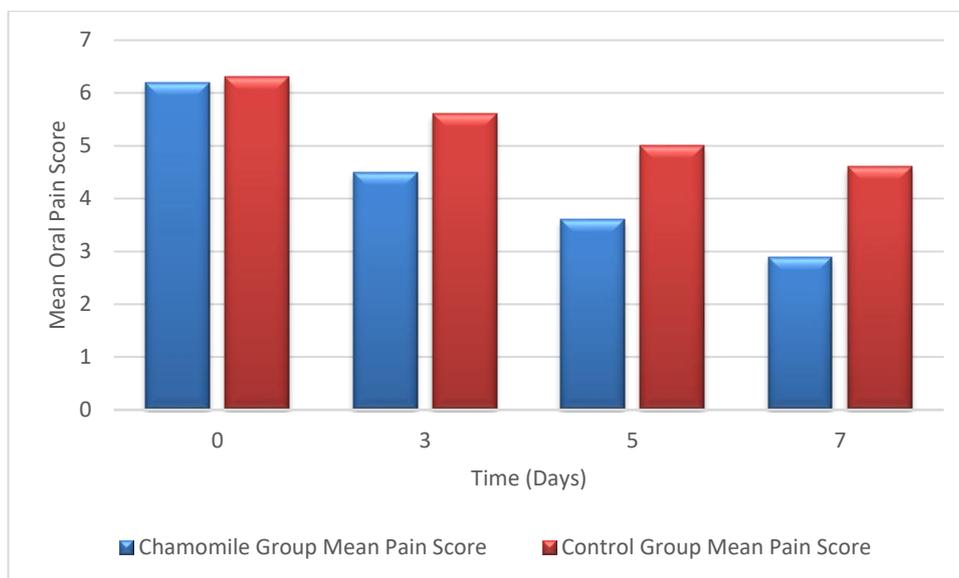


Figure 1. Mean Oral Pain Scores Over Time in Study Groups

### 3.4 Treatment Compliance and Safety Outcomes

Treatment compliance in the chamomile mouthwash group was high, with 91.7% of patients completing the full prescribed regimen. Mild, transient oral irritation was reported in 6.7% of patients, while no allergic reactions or serious adverse events were observed. No

participants discontinued the intervention due to intolerance. These findings support the safety and feasibility of chamomile mouthwash use in immunosuppressed kidney transplant patients (Table 3).

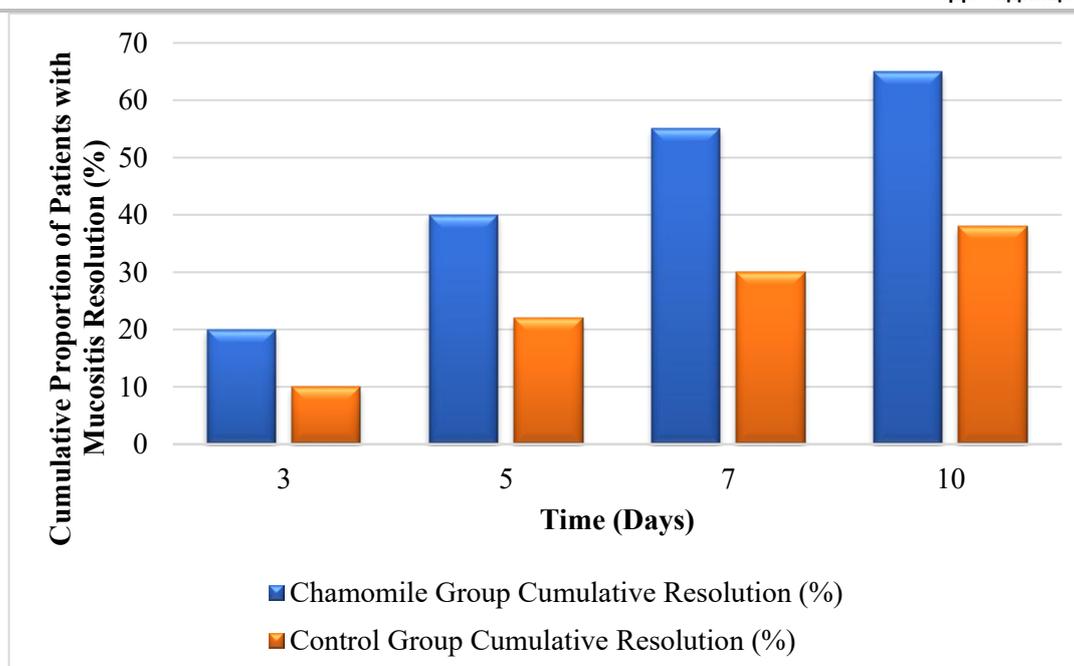
Table 3. Treatment Compliance and Adverse Events in the Chamomile Group (n = 60)

Outcome	n (%)
Full compliance	55 (91.7)
Partial compliance	5 (8.3)
Mild oral irritation	4 (6.7)
Allergic reaction	0
Intervention discontinuation	0

### 3.5 Temporal Trend of Oral Mucositis Resolution

Time to oral mucositis resolution was analysed using Kaplan–Meier survival analysis, with group differences assessed using the log-rank test. Patients in the chamomile mouthwash group demonstrated significantly faster mucositis resolution compared with

the control group (log-rank  $p = 0.01$ ). By day 10 of hospitalisation, partial or complete resolution was observed in 65% of intervention patients compared with 38.3% of controls, indicating accelerated mucosal healing associated with chamomile use (Figure 2).



**Figure 2. Temporal Trend of Oral Mucositis Resolution During Hospitalisation**

### 3. Discussion

This study emphasizes the importance of chamomile mouthwash produced a clinically meaningful reduction in chemotherapy-associated oral mucositis severity among hospitalised kidney transplant patients. The improvement was found not only with mucosal grading but also with decreases in the intensity of pain, improvement in oral intake tolerance, and resolution of mucosal damage. This fact is specifically significant in terms of the renal transplant population, where even a slight disruption of the mucosal features can cause systemic infection, nutritional impairment, or extended hospitalisation. The results imply that secondary complications with a cascade of effects on graft survival and general renal well-being can be addressed through a specific oral supportive care. These outcomes are further enhanced in relevance by the immunosuppressed nature of those who have undergone kidney transplantation. Chronic immunosuppressive treatment changes the inflammatory process and slows down the regeneration of the tissues, making the mucosal healing process slow and less predictable. In this framework, the faster rate of recovery in the intervention group implies that chamomile mouthwash can facilitate epithelial recovery without causing extensive pharmacological strain on the body. The positive safety and compliance profile also affirms its appropriateness in application among immunocompromised renal patients, as tolerance and adherence are the key factors of clinical feasibility.

The current study's findings concluded the present results are in line with the earlier evidence that shows chamomile has positive effects on cancer-related

complications, and this is due to anti-inflammatory and mucosal protective effects. In an otherwise systematic review assessing chamomile in oncologic environments, the authors have indicated that it produces consistent effects on symptom burden, namely mucosal inflammation and treatment-related discomfort effects, in which the biological plausibility of the current findings is justifiable [20]. Although that review included a heterogeneous group of cancers, the present study applies these findings to the kidney transplant recipients who have not been studied in this area before. The larger assessments of the herbal oral care products have shown a decrease in the microbial load and inflammatory complications in the critically ill patients, which highlights the ability of plant-based oral interventions to modulate mucosal and systemic outcomes [21]. Even though this study specifically looked at ventilator-associated pneumonia, these findings indicate the validity of oral mucosal integrity in hospitalised populations and can be extrapolated to transplant inpatients. The scoping reviews of cancer survivors have identified quality-of-life effects of oral difficulties related to therapy, which include chronic pain, nutritional problems, and psychosocial distress related to mucositis [22]. The functional change and reduction of pain in the current study are indicative that the chamomile mouthwash can be used to help counter some of these wider burdens, especially when patients are admitted to hospitals over a long duration of time, which is characteristic of transplant care. Guidelines on clinical practice that focus on the prevention of mucositis highlight oral care methods that are structured and those guided by nurses as a component of supportive oncology management [23]. These guidelines, however, do not provide transplant-specific guidelines. The current research provides new evidence that can be used to adapt such protocols to renal transplant. Previous systematic reviews of adjunctive therapies in the prevention of mucositis have found

natural agents as promising, with limited support from population-specific trials [24]. In the same vein, research on natural product intervention to manage side effects of the therapy has also been reviewed to recommend specific studies in high-risk clinical subgroups [25]. The given study fills a literature gap as it targets kidney transplant patients.

There are various clinical benefits of incorporating chamomile mouthwash into the process of supporting the care of kidney transplant patients undergoing chemotherapy. Its topical application keeps the systemic exposure to a minimum, avoiding the issues of nephrotoxicity or drug-drug interactions with immunosuppressive drugs. The enhanced mucosal integrity can help in delivering chemotherapy in an uninterrupted manner, increase patient comfort and minimise the use of systemic analgesics. Moreover, improved mucositis recovery can be used to benefit hospital stays and reduce the embarrassment of infectious complications, which is in line with nephrology objectives of achieving the best inpatient outcomes and graft retention. [27].

There are a number of constraints that should be considered. Though the sample size is sufficient in identifying clinically meaningful differences, it restricts subgroup analyses between the various immunosuppressive regimens or types of cancers. The mucosal follow-up was limited in the short-term follow-up of the long-term outcomes and the recurrence rates. Moreover, the single-centre design might not be generalizable to other transplant populations that have different care protocols or demographic characteristics. All these ought to be factored into the interpretation of the findings.

Multicenter trials should be emphasised in future research on different populations of renal transplant recipients to increase the external validity. There is also a need to have long-term safety and effectiveness studies to determine the use over a series of chemotherapy cycles. Comparative research comparing the chamomile mouthwash to the conventional pharmacological substance or any other form of non-pharmacological therapy would better explain its relative clinical worth. These studies can be useful in the development of transplant-specific supportive care guidelines to be used in nephrology practice. The importance of early identification and intervention is highlighted in this present study

## 5. Conclusion

The present study provides evidence supporting the role of chamomile mouthwash as an effective supportive care intervention in the management of oral mucositis that comes with chemotherapy in hospitalised patients who underwent kidney transplantation. The results prove the fact of a significant decrease in the severity of mucositis in the patients who received chamomile mouthwash as opposed to the standard oral care, which is an indication of its clinical usefulness in a population with immunosuppression and high risk of developing complications of the treatment process. Chamomile mouthwash was linked to significant decreases in the intensity of oral pain and enhanced oral

intake tolerance that were noted during hospitalisation, besides positive mucosal outcomes. Such practical advantages are of particular concern to renal transplant recipients, in whom malnutrition, susceptibility to infections, and extended hospitalisation may hurt the general recovery and stability of the graft. The observed increased rate in mucositis healing is also another indication of the capabilities of chamomile mouthwash in mucosal repair without adding to the systemic and nephrotoxic load. Notably, the intervention had a positive safety and compliance profile and high adherence, and no severe adverse events occurred. This justifies its applicability to be used regularly in inpatient nephrology and oncology care centres. The supportive care priorities in kidney transplant medicine are congruent with the non-invasive, lower price, and locally acting characteristics of chamomile mouthwash.

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