



## Effects of mouthwash interventions on xerostomia and unstimulated whole saliva flow rate among hemodialysis patients: A randomized controlled study



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### ABSTRACT

**Background:** Dry mouth (xerostomia) is a common symptom in hemodialysis patients, which is associated with a reduced salivary flow. Xerostomia affects patients' oral health and quality of life.

**Objectives:** The aim of this study was to investigate using a mouthwash as a means to reduce xerostomia and improve saliva flow rates in hemodialysis patients.

**Design:** A randomized controlled trial.

**Settings and methods:** Three dialysis centers in Northern Taiwan served as the study sites. Patients were purposively sampled from three hemodialysis centers in Taiwan and randomly assigned to one of three groups: pure water mouthwash;  $n = 41$ , licorice mouthwash;  $n = 44$ , or no mouthwash (control);  $n = 37$ . The Summated Xerostomia Inventory, and unstimulated whole salivary flow rate measured dry mouth and salivary flow, respectively. Data was collected at baseline, dialysis Day 5 and Day 10.

**Results:** One hundred twenty-two patients participated in this study. Baselines were adjusted for any imbalances in variables and generalized estimating equations analysed the data. Compared to control, a pure water mouthwash resulted in an increase in the unstimulated salivary flow rate of  $25.85 \times 10^{-3}$  mL/min and  $25.78 \times 10^{-3}$  mL/min ( $p < 0.05$ ) at Day 5 and Day 10, respectively. The estimated effect size was 1.38. However, there was no significant decrease in Summated Xerostomia Inventory scores. The licorice mouthwash also significantly improved the unstimulated salivary flow rates to  $114.92 \times 10^{-3}$  mL/min, and  $131.61 \times 10^{-3}$  mL/min at Day 5 and Day 10, respectively ( $p < 0.001$ ). However, in contrast to the pure water mouthwash, the licorice mouthwash resulted in a significant improvement in the scores for the Summated Xerostomia Inventory ( $p < 0.001$ ).

**Conclusion:** Although a pure water or a licorice mouthwash and improved the objective measure of salivary flow rate, only the licorice mouthwash provided subjective relief of xerostomia. This suggests the use of a licorice mouthwash may effectively relieve feelings of dry mouth in hemodialysis patients.

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### What is already known about the topic?

- Dry mouth is a common symptom experienced by hemodialysis patients.
- Dry mouth can affect the oral health, social life and quality of life of the patient.

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## What this paper adds

- A gargle intervention reduced xerostomia and the unstimulated salivary flow rate in hemodialysis patients.
- Gargling with pure water improved the unstimulated salivary flow rate in hemodialysis patients, but did not improve xerostomia.
- Gargling with a licorice mouthwash was more effective in improving salivary flow rate than was pure water, and also resulted in a significant reduction in xerostomia.

## 1. Introduction

Chronic end-stage renal disease is a critical public health issue. The prevalence of end-stage renal disease in the United States in 2011 was 1901 per million people; the prevalence in Taiwan in 2010 was 2584 per million people (USRDS, 2013). These patients often rely on dialysis or kidney transplants for life support and the most frequent method is hemodialysis. According to the Taiwan Ministry of Health and Welfare, 72,763 patients received hemodialysis in 2013.

One of the most common side-effects dialysis patients experience is dry mouth (xerostomia) (Curtin et al., 2002) with up to 66.4% experiencing this symptom in Taiwan (Yu et al., 2012). Although dry mouth is a subjective feeling, the failure to ameliorate this symptom can easily affect the oral health of the patient, often resulting in oral lesions, dysphagia, difficulty wearing dentures, and halitosis, which can affect both social life and quality of life (Bossola and Tazza, 2012).

Chronic hemodialysis patients also experience low saliva flow, which contributes to xerostomia (Bossola and Tazza, 2012). To treat the symptoms and discomforts of reduced saliva and xerostomia the use of artificial saliva and chewing gum were compared in hemodialysis patients (Bots et al., 2005). Although artificial saliva was more effective at relieving thirst and xerostomia, patients disliked the flavor and found chewing gum to be more acceptable. Unfortunately, the use of a chewing gum treatment for older adults necessitates special attention to problems with masticatory muscles and teeth, and is not suitable for older adults with dentures, as it may stick to dentures easily (Bots et al., 2005).

Two studies in Taiwan described successful methods to relieve xerostomia: one used pilocarpine to increase the amount of saliva (Sung et al., 2005) and the other used transcutaneous acupoint electrical stimulation (Yang, 2010). However, both have disadvantages: prolonged use of pilocarpine causes sweating, urinary frequency, lacrimation, flushing, chest tightness, shortness of breath, gastrointestinal disorders, and visual disturbances (Visvanathan and Nix, 2010); transcutaneous acupoint electrical stimulation requires a specialist to operate the equipment, thus preventing wide use.

A mouthwash is a therapy often used in oral care to moisten the mouth and ameliorate bad breath. It has almost no risks, and is easy to implement. However, no studies have explored its effectiveness in reducing xerostomia. The ability to moisten the mouth with mouthwashing led us to consider this as a possible intervention for xerostomia in hemodialysis patients. Chinese medicine is widely accepted by Taiwanese people, and an increasing number of therapies and studies are integrating Chinese and Western medicine (Wang et al., 2013). Licorice root (*Radix Glycyrrhizae*) is commonly used as a single herb prescription in Chinese medicine to clear heat, improve dry throat, relieve throat pain, and is also considered to have anti-ulcer, anti-inflammatory, and anti-allergic pharmacological effects (Aly et al., 2005; Wang et al., 2013). Agarwal et al. (2009) used a licorice gargle to reduce

throat pain and coughing in postoperative patients; the licorice gargle significantly reduced the severity of throat pain, mainly due to its anti-inflammatory effects. Some clinical practices recommend a licorice mouthwash to relieve symptoms of mouth dryness following head or neck radiotherapy (Li, 2006). The objective of this study was to examine the effects of using a mouthwash with either pure water, or containing licorice to reduce xerostomia and improve saliva flow rates in hemodialysis patients.

## 2. Methods

### 2.1. Study design

A single blind randomized design with repeated measures was conducted to determine whether a mouthwash intervention could improve xerostomia and unstimulated whole-saliva flow rates for hemodialysis patients. We compared no intervention with a pure water mouthwash or a licorice mouthwash. Three dialysis centers in Northern Taiwan served as the study sites. All three dialysis centers (A, B, and C) are located in the center of the second biggest city in Northern Taiwan and serve approximately the same number of patients. One dialysis center is located in a community of comparatively older patients who live with their children. The three centers organized dialysis treatments into two regimens: Regimen I met every Monday, Wednesday, Friday; Regimen II met every Tuesday, Thursday, Saturday. To prevent mutual influence between patients, participants from each of the centers were clustered into Regimen I or Regimen II. Participants in the two regimens were randomly distributed by ballot into one of three study groups: two experimental groups (Group X, a mouthwash of pure water; Group Y, a licorice mouthwash) or the control group (Group Z, no mouthwash). The six groups were then randomly distributed by ballot into one of three study groups. For example, if the participants from Center A undergoing Regimen I was randomly assigned to Group Y in the ballot, then all those participants were instructed to use a licorice mouthwash on the next three dialysis days. The distribution of the study groups is shown in Table 1. Repeated measures were taken at three time points: the first dialysis (Day 1; baseline), third dialysis (Day 5) and the fifth dialysis (Day 10).

### 2.2. Participants

Participants were purposively sampled and included in the study by these criteria: age  $\geq 20$  years, regularly received hemodialysis, felt mouth dryness in the past 4 weeks, were fully conscious, and able to communicate in Mandarin, Taiwanese or written text. Exclusion criteria were: presence of head and neck cancer and receiving radiotherapy, Sjögren's syndrome, a systolic blood pressure over 160 mmHg and diastolic blood pressure over 95 mmHg before dialysis, 5% heavier than their dry weight between two dialysis sessions, habitually chewed betel nuts or used mouthwash, were administered diuretics, tricyclic antidepressants, anticholinergics, antihistamines, or antianginal drugs (patients who had been administered these drugs were required to withdraw from treatment for at least a week in order to

**Table 1**  
Dialysis centers and dialysis regimens of the three treatment groups.

Dialysis Regimen	Center A		Center B		Center C	
	I	II	I	II	I	II
Treatment	Licorice	Water	No Gargle	Licorice	No Gargle	Water

Class I had treatments on day 1, 3 and 5, Class II had treatments on day 2, 4 and 6.

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