

Qualitative and Quantitative Evaluation of the Efficiency of the Application of Foams with False Xerostomia

Marianna G. Arakelyan¹, Maria A. Polyakova¹, Ksenia S. Babina¹, Nina E. Novozhilova¹, Edita G. Margaryan¹, Vladlena Y. Doroshina¹, Alina V. Arzukanyan¹, Maria K. Makeeva²

¹Department of Therapeutic Dentistry, I. M. Sechenov First Moscow State Medical University (Sechenov University), Institute of Dentistry, Moscow, Russia, ²Department of Therapeutic Dentistry, People's Friendship University of Russia, Moscow, Russia

Received : 26-04-19.
Accepted : 28-06-19.
Published : 06-08-19.

ABSTRACT

Aims: Xerostomia syndrome is a significant medical and social problem. It is manifested by objective and subjective symptoms of a “dry mouth” and a decrease in sialometry. The aim of the study was to determine the dental status of students of different nationalities, to identify xerostomia induced on a background of stress, and to assess the effectiveness of the use of moisturizing foams in alleviating xerostomia. **Materials and Methods:** A prospective cohort study survey (Fox test) of 100 students of the dental faculty was conducted to detect false xerostomia. The study involved 60 people with false xerostomia, divided into four groups of 15 each according to the nationality. The level of oral hygiene was determined using the Simplified Oral Hygiene and Silness-Loe indices and the rate of salivation was assessed with sialometry method by Pozharitskaya. Oral hygiene instructions were given to the participants. They were to apply moisturizing foams with lactoferrin, lactoperoxidase, and aloe vera, two–three times during the day for 3 weeks. A set of statistical programs was used (Microsoft Excel [2007] and the Statistical Package for the Social Sciences [SPSS], version 23) to perform Kolmogorov–Smirnov, Shapiro–Wilk, Kruskal–Wallis, and Wilcoxon tests. **Results:** A statistically significant improvement in oral hygiene was observed in all study participants. A significant increase was detected in the rate of salivation in students from Russia ($P = 0.005$), Transcaucasian countries ($P = 0.006$), and Arab countries ($P = 0.005$). **Conclusion:** It has been established that the use of moisturizing foam has a positive effect on the rate of salivation and improves the level of oral hygiene, thereby improving the quality of life for patients.

KEYWORDS: Dental status, hyposalivation, salivation rate, xerostomia

INTRODUCTION

It has been established that the prevalence of xerostomia reaches 40%, but this is permanent and is associated with concomitant diseases in only 2.5% cases.^[1,3-7] Xerostomia syndrome is a significant medical and social problem. It is manifested by objective and subjective symptoms of a “dry mouth” and a decrease in sialometry.^[5-8] Every fifth patient presenting at dental clinics complains of dryness in the oral cavity and unfortunately, the number of patients with this problem continues to grow.^[1-6] This is due to the living conditions in the modern metropolis, including stress and ecology.

Saliva plays a vital role in the human body and performs many functions, its insufficient quantity leads to a number of problems that decrease the patient's quality of life.^[2,9-14] Xerostomia can be divided into true and false, the latter was assessed in this study. False xerostomia refers to a condition in which a subjective feeling of dryness in the oral cavity is associated with autonomic neurosis.^[1-7,12,13] False xerostomia is common in women

Address for correspondence: Dr. Marianna G Arakelyan, I. M. Sechenov First Moscow State Medical University (Sechenov University), 8-2 Trubetskaya Street, Moscow 119991, Russia. E-mail: maristom87@inbox.ru

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

How to cite this article: Arakelyan MG, Polyakova MA, Babina KS, Novozhilova NE, Margaryan EG, Doroshina VY, *et al.* Qualitative and quantitative evaluation of the efficiency of the application of foams with false xerostomia. J Int Soc Prevent Communit Dent 2019;9:403-8.

Access this article online

Quick Response Code:



Website: www.jispcd.org

DOI: 10.4103/jispcd.JISPCD_191_19

during menopause (18.8%), in patients undergoing severe nervous shock or in constant stress (22.5%), in patients taking drugs (37.5%), and in patients with galvanic syndrome (18.8%).^[1-6]

In 60% of false xerostomia cases, a greater than 50% decrease in the amount of oral fluid was observed, requiring replacement therapy to control the level of oral hygiene.^[1-7]

Saliva supports the normal functional state of the teeth and oral cavity. Insufficient salivation leads to dryness of oral mucosa and discomfort, which reduces the quality of life of patients.^[1-4,7-11] Constant stress, chronic depression, and anxiety can lead to false xerostomia, thereby causing difficulty in eating, swallowing, and talking; excessive formation of dental plaque; increased risk of dental caries; inflammatory periodontal and oral mucosa diseases; and halitosis.^[2-6]

Another serious consequence of dryness of oral mucosa is that it becomes thinner, rough, and prone to microdamages that can provoke inflammation. The situation is worsened by aggressive and improper cleaning of the teeth, bad habits (habitual biting of lips and cheeks), sharp edges of the teeth, and elements of orthodontic and prosthetic appliances. This leads to a so-called vicious circle: proper toothbrushing is difficult due to pain, this leads to an increase of mature biofilm and an increase in inflammation.^[2-6]

The aim of our study was to identify false xerostomia among students of different nationalities, determine their dental status, and evaluate the effectiveness of moisturizing foams in xerostomia induced against a background of stress.

MATERIALS AND METHODS

A prospective cohort study survey (Fox test) of 100 students of the dental faculty was conducted to detect false xerostomia. The study was performed from January 2019 to March 2019. The study was approved by the institutional ethics committee (protocol number 12–13). The inclusion of patients in the study was carried out based on the availability of written informed consent to participate in the study, 18–22 years of age irrespective of sex, and with positive Fox test.^[7]

Patients with allergic reactions to the components of the foam, uncontrolled systemic diseases, somatic pathology, or negative Fox test were not included in this study.

After a survey was conducted to identify the presence of xerostomia using the Fox test, from 100 students questioned, we randomly selected 60 people for further

study (15 of each assessed nationality). They were respectively divided into four groups, depending on nationality: first group, students from Russia; second group, students from the countries of Transcaucasia; third group, students from Arab countries; and fourth group, students from Namibia (Africa).

Oral hygiene instructions were given to the participants; moisturizing foam was used as an additional means of oral hygiene for 3 weeks.

The composition of the foam included Japanese licorice extract, lactoferrin, lactoperoxidase, glucose oxidase, aloe vera gel, pomegranate extract, Altai sea buckthorn extract, sodium lauroyl sarcosinate, and polydon. The main active ingredients (lactoferrin, lactoperoxidase, and aloe vera) have a moisturizing, anti-inflammatory, emollient, and regenerating effect. They also have pronounced antibacterial properties against *Streptococcus mutans*, and they inhibit the formation of plaque, thereby reducing the risk of caries.

Medical and disease history were recorded for each patient. Oral hygiene was evaluated using the Simplified Oral Hygiene (OHI-S) and Silness-Loe (SL) indices at the beginning of the study and after 3 weeks.^[16]

At the beginning of the study and after 3 weeks, each student underwent sialometry measurements, according to the method by Pozharitskaya^[2] to determine the rate of mixed unstimulated salivation (in mL/min). The collection of saliva was carried out in the morning, in fasting condition, using a graduated tube for 2–3 min for three times. The average value of the individual salivation of each examined student was calculated, and the degree of xerostomia was determined. Normally, the rate of salivation is 0.4–0.5 mL/min.

Statistical analysis was performed using Microsoft Excel (2007) and the Statistical Package for the Social Sciences (SPSS), version 23 (IBM, Chicago, IL). Kolmogorov–Smirnov and Shapiro–Wilk criteria were used to assess the normality of distribution across groups. The comparisons between groups were performed using Kruskal–Wallis test. The results in the same group before and after the study were assessed using Wilcoxon test. Mean (*M*) and standard deviation (*m*) were calculated in each group.

RESULTS

Fox test showed that 72% of respondents complained of periodically experiencing xerostomia associated with stress. At the beginning of the study, the rate of salivation in the students from Russia, Transcaucasian countries, and Arab countries corresponded to the hyposalivation,

whereas sialometry values in the students from Namibia (Africa) corresponded to normal values, despite the subjective feeling of dryness. Before the research, the salivation rate values differed significantly between groups: students from Transcaucasian countries and those from Namibia ($P = 0.000$) and students from Arab countries and those from Namibia ($P = 0.000$) [Table 1]. After 3 weeks, the rates of salivation in each group increased and significantly differed from each other [Figure 1]. The rates of salivation after the research differed significantly between groups: students from Transcaucasian countries and those from Namibia ($P = 0.000$), students from Arab countries and those from Namibia ($P = 0.000$), and students from Arab countries and those from Russia ($P = 0.048$). During the study, it was noted that in the students from Russia, Transcaucasian countries, and Arab countries, the moisturizing foam kept their mouth moist for more than 30 min, whereas the students from Namibia did not notice any special changes.

Table 1: Sialometry data before and after the research

Nationality	Salivary flow rate		P between values before and after the study
	Before research	After 3 weeks	
Russian	0.22 ± 0.05 ^{ab}	0.32 ± 0.04 ^{cb}	$P = 0.005^*$
Transcaucasian	0.15 ± 0.05 ^a	0.22 ± 0.05 ^{ac}	$P = 0.006$
Arabian	0.14 ± 0.039 ^a	0.22 ± 0.048 ^a	$P = 0.005$
Africa (Namibian)	0.34 ± 0.055 ^b	0.4 ± 0.04 ^b	$P = 0.012^*$

$P =$ the level of significance (between groups)

*Differences are statistically significant compared with the previous measurement

^{a,b,c}Homogenous subsets to indicate significant differences between groups

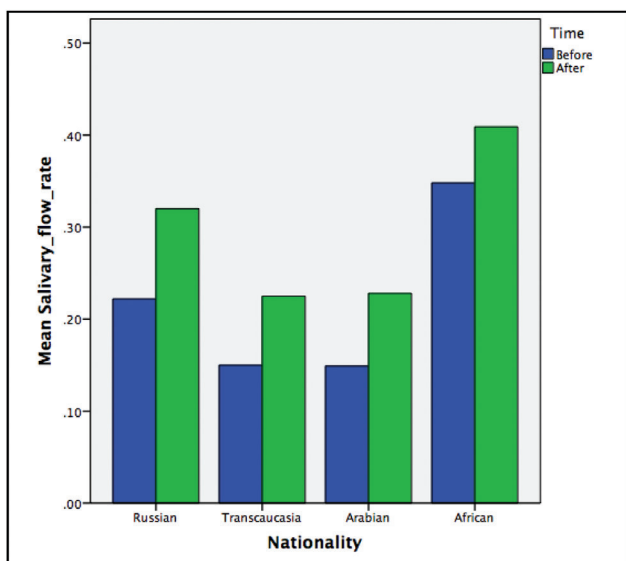


Figure 1: Salivation rates before the study and after 3 weeks

The level of oral hygiene among the students of all groups, except for students from Namibia, was unsatisfactory. The OHI-S values differed significantly between groups: students from Russia and those from Namibia ($P = 0.022$), students from Transcaucasian countries and those from Namibia ($P = 0.002$), and students from Arab countries and those from Namibia ($P = 0.000$). It was established that as a result of training in oral hygiene and the use of foam, the OHI-S values significantly decreased in all study participants and they were 1.48 ± 0.25 ($P = 0.005$), 1.48 ± 0.25 ($P = 0.005$), 1.59 ± 0.18 ($P = 0.005$), and 0.51 ± 0.21 ($P = 0.007$) in the respective groups [Figure 2].

The values of the OHI-S after the study differed significantly between groups: students from Russia and those from Namibia ($P = 0.015$), students from Transcaucasian countries and those from Namibia ($P = 0.001$), and students from Arab countries and those from Namibia ($P = 0.000$).

The results of the assessment of the oral hygiene are presented in Figure 2.

SL index values were unsatisfactory in groups of students from Russia, Transcaucasian countries, and Arab countries before the study, whereas for students from Namibia, they corresponded to satisfactory oral hygiene [Table 2]. The values of the SL index before the study differed significantly between groups: students from Russia and those from Namibia ($P = 0.000$), students from Transcaucasian countries and those from Namibia ($P = 0.000$), and students from Arab countries and those from Namibia ($P = 0.000$).

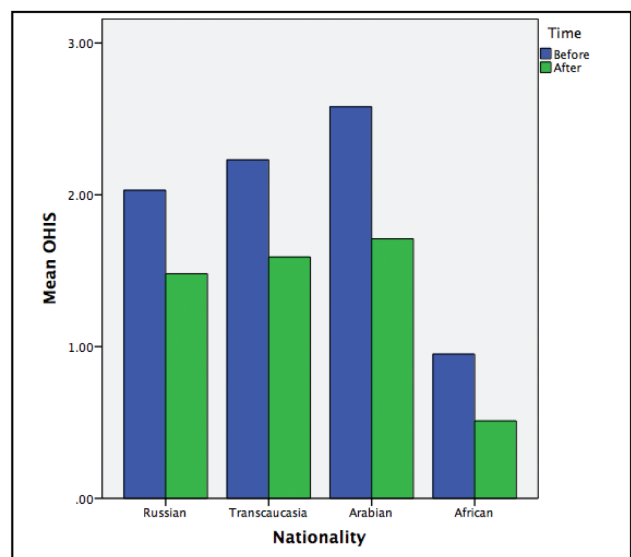


Figure 2: Simplified Oral Hygiene Index before the study and after 3 weeks

After 3 weeks, in the groups of students from Russia, Transcaucasian countries, and Arab countries, the SL index values corresponded to a satisfactory oral hygiene, whereas for the students from Namibia, it was 1.0 ± 0.00 ($P = 0.083$), which corresponded to a good oral hygiene [Figure 3]. The values of the SL index at the end of the study differed significantly between groups: students from Russia and those from Namibia ($P = 0.028$), students from the Transcaucasian countries and those from Namibia ($P = 0.003$), and students from Arab countries and those from Namibia ($P = 0.001$).

DISCUSSION

The aim of this study was to determine the dental status of students of different nationalities, to identify stress-induced xerostomia, and to assess the effectiveness of moisturizing foams in alleviating xerostomia. Oral hygiene instruction and control together with the use of moisturizing foams allowed to improve the level of

oral hygiene and salivary flow rate as well as subjective feeling of salivation.

Saliva is an important component for maintaining oral health, and a decrease in the amount or an absence of saliva directly affects the patient’s quality of life. With constant dryness of the oral mucosa, it is more difficult for a patient with xerostomia to speak, chew, and swallow. Patients also experience pain when consuming hot and hard foods, a burning sensation and roughness of the mucous membrane, and violation of taste. As a result, a quality of life decreases and a psychological disorder may develop: a person becomes withdrawn, unconfident, and have difficulties in communication.^[8-12] According to Vaillancourt *et al.*,^[15] impaired saliva secretion can occur at any age. Consequently, an unstable psychological state of health (e.g., stress and anxiety) as well as violations of salivation rate and the composition of the saliva can be observed at early ages, as was shown in the study examining children in chronic stress.^[15] In our study, the participants were medical university students who were in chronic stress due to fatigue and lack of sleep (especially during the exam week). Many of these students noted anxiety, isolation in communication, lack of self-confidence, and difficulties in learning as they were constantly distracted by xerostomia. This confirms the effect of xerostomia on the quality of life.

Nederfors^[17] and Carramolino-Cuéllar *et al.*^[18] reported that chronic hyposalivation is an unfavorable state of health, reduces the quality of human life, may indicate systemic dehydration of the body, and contribute to the emergence of a number of pathologies such as impaired protection of the oral cavity, chronic infections, and inflammatory processes in the mucous membrane oral cavity, impaired voice, and digestive disorders. Chronic hyposalivation can be an indicator for a more in-depth diagnosis of both coexisting and intensely increasing symptoms. Nederfors^[17] suggests that dry eye or mouth syndrome may be more indicative of the diagnosis of depression than Sjogren syndrome itself.^[18]

According to LeBlanc and Abernethy,^[19] the patient’s opinion, complaints, and subjective feelings play a crucial role in diagnosing and treating xerostomia. Many dentists do not pay attention to the initial complaints of patients about dry mouth. As a result, the patients miss the initial xerostomia onset, thereby complicating and aggravating the course of xerostomia. Therefore, considering the patient’s opinion and subjective feelings is the key to successful treatment.^[19]

In our study, we first evaluated the subjective feelings of patients; despite the normal values of salivation rate,

Table 2: Silness-Loe index before and after the study

Nationality	SL index		P between values before and after the study
	Before research	After 3 weeks	
Russian	2.9 ± 0.31 ^a	1.8 ± 0.63 ^{ac}	P = 0.004*
Transcaucasian	2.9 ± 0.31 ^a	2.0 ± 0.66 ^{ac}	P = 0.005*
Arabian	2.9 ± 0.31 ^a	2.1 ± 0.56 ^{ac}	P = 0.014*
African (Namibian)	1.3 ± 0.48 ^b	1.0 ± 0.00 ^b	P = 0.083

P = the level of significance (between groups)

*Differences are statistically significant compared with the previous measurement

^{a,b,c}Homogenous subsets to indicate significant differences between groups

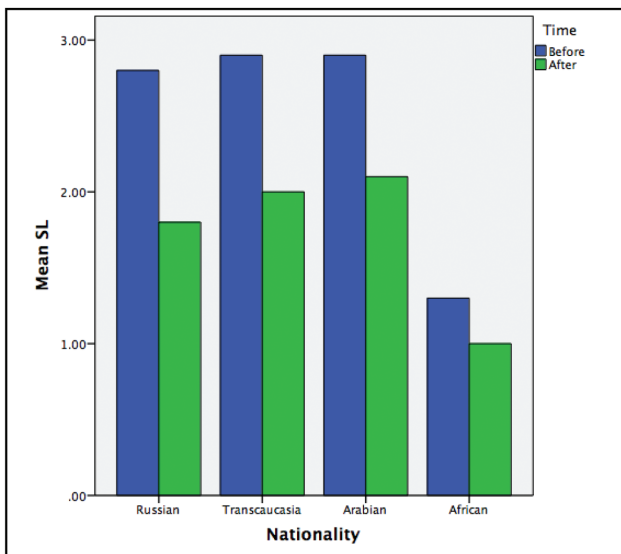


Figure 3: Silness-Loe index before and after the study

the students from Namibia complained of subjective feeling of dry mouth. During applying moisturizing foams, subjective sensations of patients were also considered. Ideally, saliva substitutes should be soothing, biocompatible, and should have a favorable moisturizing ability.

Plant extracts have been used in replacement therapy of false xerostomia.^[20-22,27] Aloe vera is a traditional remedy for the treatment of dry mouth as it has a strong moisturizing effect and it helps protect the sensitive oral mucosa.^[20-22] Bhat *et al.*^[22] also recommended regular drinking of aloe vera juice or using it to moisten the oral cavity. Both methods were shown to be effective in the natural treatment of dry mouth. Subramaniam *et al.*^[21] noted the softening effect, healing properties and antibacterial activity, antifungal, antiviral, and moisturizing effects of aloe vera, which further support its use as a substitute of saliva. The results of this study confirmed that aloe vera can be efficient for treating xerostomia. Because of the use of moisturizing foam, all students noted a significant improvement in the condition of the oral cavity not only in terms of subjective feelings but also in terms of sialometry. Consequently, moisturizing foams with aloe vera confirm the effectiveness of their use to alleviate the symptoms of xerostomia, which arose against the background of stress.

The difference of the oral hygiene among different populations and a predisposition to the manifestation of hyposalivation are also important. Dental caries, periodontitis, oral mucosa, and periodontal diseases might be associated with an imbalance in the composition of the microflora of the oral cavity. Blekhan *et al.*^[23] observed the association between the oral hygiene and the genetic characteristics of the examined patients when they compared different populations (Africans, Americans, Europeans, and Asians). Similarly, Li *et al.*^[25] and Mason *et al.*^[24] showed that the salivary microbiome of the Alaskan, German, and African populations differed significantly. The different composition of the microflora of the oral cavity and susceptibility to certain pathological processes could be due to differences in teeth morphology in different ethnic populations and due to innate immune responses to infectious agents.^[26] This study allows to assume that despite the fact that students who participated in the study live and study in one country and consume similar food, the difference in the microflora of the oral cavity and individual ethnic characteristics are genetically laid down.

The limitation of the study is that it was population specific and that these findings may not translate to

patients of other ethnicities. Besides, the number of patients was limited by the number of students with false xerostomia. Therefore, future studies should include samples from wider geographic area and include greater number of participants.

CONCLUSION

The use of moisturizing foam significantly improved the subjective feelings of students with false xerostomia. The rate of salivation among students from Russia, Transcaucasian countries, and Arab countries increased significantly and approached normal values with the use of moisturizing foam.

FINANCIAL SUPPORT AND SPONSORSHIP

Nil.

CONFLICTS OF INTEREST

There are no conflicts of interest.

REFERENCES

1. Makeeva IM, Doroshina VIu, Arakelian MG. [Xerostomia and means that facilitate its symptoms]. *Stomatologiya (Mosk)* 2013;92:12-3.
2. Pozharitskaya MM. Role of the saliva in the physiology and the development of the pathological processes of hard and soft tissues of the mouth cavity. *Xerostomia. Salivation stimulation. Clin Dent* 2005;3:42-5.
3. Komarova KV, Ratkina NN. The prevalence of xerostomia among patients of outpatient dental admission. *Med Sci* 2014;2:82-4.
4. Makeeva IM, Volkov AG, Arakelyan MG, Makarenko NV. [Factors aggravating symptoms of xerostomia]. *Stomatologiya (Mosk)* 2017;96:25-7.
5. Daurova FYu. Stress as a risk factor of the development of periodontal diseases in foreign students. *Russian Dent J* 2011;4:37-40.
6. Fox PC. Xerostomia: Recognition and management. *Dent Assist* 2008;77:18-20.
7. Nair R, Chiu SE, Chua YK, Dhillon IK, Li J, Yee Ting Fai R. Should short-term use of alcohol-containing mouthrinse be avoided for fear of worsening xerostomia? *J Oral Rehabil* 2018;45:140-6.
8. Frydrych AM. Dry mouth: Xerostomia and salivary gland hypofunction. *Aust Fam Physician* 2016;45:488-92.
9. Gileva OC, Khalilaeva EV, Libik TV, Podgorny RV, Khalyavina IV, Gileva ES. Multistage validation of the international questionnaire of quality of life "Profile of the impact of dental health" OHIP-49-RU. *Ural Medical J* 2009;8:104-9.
10. Park B, Noh H, Choi DJ. Herbal medicine for xerostomia in cancer patients: A systematic review of randomized controlled trials. *Integr Cancer Ther* 2018;17:179-91.
11. Pakpour AH, Lin CY, Kumar S, Fridlund B, Jansson H. Predictors of oral health-related quality of life in Iranian adolescents: A prospective study. *J Investig Clin Dent* 2018;9:1-9.
12. Bulthuis MS, Jan Jager DH, Brand HS. Relationship among perceived stress, xerostomia, and salivary flow rate in patients visiting a saliva clinic. *Clin Oral Invest* 2018;22:3121-7.
13. Niklander S, Fuentes F, Sanchez D, Araya V, Chiappini G, Martinez R, *et al.* Impact of 1% malic acid spray on the oral

- health-related quality of life of patients with xerostomia. *J Oral Sci* 2018;60:278-84.
14. Kunin A, Polivka J Jr, Moiseeva N, Golubnitschaja O. “Dry mouth” and “flammer” syndromes—Neglected risks in adolescents and new concepts by predictive, preventive and personalised approach. *EPMA J* 2018;9:307-17.
 15. Vaillancourt T, Duku E, Decatanzaro D, Macmillan H, Muir C, Schmidt LA. Variation in hypothalamic-pituitary-adrenal axis activity among bullied and non-bullied children. *Aggress Behav* 2008;34:294-305.
 16. Makeeva IM, Polyakova MA, Doroshina VY, Turkina AY, Babina KS, Arakelyan MG. [Comparative effectiveness of therapeutic toothpastes with fluoride and hydroxyapatite]. *Stomatologiya (Mosk)* 2018;97:34-40.
 17. Nederfors T. Xerostomia and hyposalivation. *Adv Dent Res* 2000;14:48-56.
 18. Carramolino-Cuellar E, Lauritano D, Silvestre FJ, Carinci F, Lucchese A, Silvestre-Rangil J. Salivary flow and xerostomia in patients with type 2 diabetes. *J Oral Pathol Med* 2018;47:526-30.
 19. LeBlanc TW, Abernethy AP. Patient-reported outcomes in cancer care—Hearing the patient voice at greater volume. *Nat Rev Clin Oncol* 2017;14:763-72.
 20. Surjushe A, Vasani R, Saple D. Aloe vera: A short review. *Indian J Dermatol* 2008;53:163-6.
 21. Subramaniam T, Subramaniam A, Chowdhery A, Das S, Gil M. Versatility of aloe vera in dentistry. *J Dent Med Sci* 2014;13:98-102.
 22. Bhat G, Kudva P, Dodwad V. Aloe vera: Nature’s soothing healer to periodontal disease. *J Indian Soc Periodontol* 2011;15:205-9.
 23. Blekhman R, Goodrich JK, Huang K, Sun Q, Bukowski R, Bell JT, *et al.* Host genetic variation impacts microbiome composition across human body sites. *Genome Biol* 2015;16:191.
 24. Mason MR, Nagaraja HN, Camerlengo T, Joshi V, Kumar PS. Deep sequencing identifies ethnicity-specific bacterial signatures in the oral microbiome. *PLoS One* 2013;8:e77287.
 25. Li J, Quinque D, Horz HP, Li M, Rzhetskaya M, Raff JA, *et al.* Comparative analysis of the human saliva microbiome from different climate zones: Alaska, Germany, and Africa. *BMC Microbiol* 2014;14:316.
 26. Millsop JW, Wang EA, Fazel N. Etiology, evaluation, and management of xerostomia. *Clin Dermatol* 2017;35:468-76.
 27. Bhattarai KR, *et al.* Potential application of Ixeris dentate in the prevention and treatment of aging-induced dry mouth. *Nutrients* 2018;10:1989.