



## Medication Use, Xerostomia and the Risk of Dental Caries in People with Empty Nose Syndrome

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### Abstract

**Aims:** The aim of this study is to explore subjective prevalence of xerostomia and xerogenic drug use among people with empty nose syndrome (ENS).

**Methods:** Participants were recruited from a restricted group on Facebook. Participants with at least one turbinate reduction procedure done prior to developing signs and symptoms of ENS responded to the self-report online questionnaire. Data were analysed for descriptive statistics.

**Results:** The prevalence of subjective feeling of dry mouth was 60%. More than two third of the respondents were identified to be using medication that can impact on the salivary flow rate and cause xerostomia. Many young adults with frequent dry mouth reported taking medication for some type of depressive disorder. Around half of those who had previous experience of tooth decay reported mouth breathing.

**Conclusion:** The reporting of xerostomia and xerogenic medication use is particularly high making the syndrome sufferers at increased risk of tooth decay.

**Keywords:** Antidepressants; Dental Caries; Psychiatric; Turbinates; Xerostomia

### Introduction

Empty nose syndrome (ENS) is a rare devastating iatrogenic condition following aggressive resection of the inferior or middle turbinates. It is most notable for paradoxical nasal obstruction and extreme sensation of dryness in the nasal cavities [1]. Other psychological problems as described by Houser and often reported by ENS patient include; chronic fatigue, difficulty concentrating, frustration, irritability, anger and anxiety eventually leading to clinical depression [1-4].

Since, ENS being regarded as a rare complication of nasal surgical procedure related to turbinate reduction, the actual incidence and prevalence of this condition is largely unknown [2]. Few studies that followed up patients post turbinate reduction surgery have

dissimilar views on the incidence of ENS. Passali et al noted that the incidence of atrophy and risk of ENS following turbinectomy to be little over 20% [5]. However, long term follow up of patients with total inferior turbinate resection failed to demonstrate any severe adverse effect that is synonymous to ENS [6]. Further, some researchers acknowledge that a significant number of their patients show little or no improvement in nasal function following turbinate reduction [7,8].

Those with suspected ENS were often found to be complicated with significant level of psychiatric comorbidity [1]. Frequent observation of such findings have paved the way for depression to be included as one of the common presenting symptoms in the diagnosis of ENS and further suggesting the need for long-term follow-up and treatment of depressive disorders [3,9].

Individuals with depressive disorders are often identified to be having less than optimal oral hygiene and increased incidence of xerostomia, dental caries (DC) and periodontal disease [10-12]. Perception of dry mouth is known to impact oral health related quality of life [13]. Affected individuals have problems with swallowing, eating, speaking and wearing denture prosthesis [14]. In addition, prolonged use of medication for psychiatric disorders, hypertension and allergic rhinitis have been attributed to be some of the leading cause for salivary gland hypo function [15-18]. Studies have shown that people who take three or more prescription medication had higher incidence of DC and this was found to be highest among those on antidepressants [19,20]. Also, the prevalence of dental disease among opioid and multiple injection drug users was strikingly high compared to the general population [21,22] and evidence is supportive of cause effect relationship between non-medicinal or illicit drug use and dental caries [22,23]. Some of the plausible reasons for the psychiatric drug dependence among ENS sufferers may be due to the sense of dyspnoea, reduced concentration capacity, accompanied with chronic fatigue leading to frustration, irritability, anger, anxiety, and depression [2].

Population studies on the prevalence of xerostomia in the community range between 0.9% to 46%, and majority of the cases being reported in the elderly and institutionalized [24]. Studies on the prevalence of xerostomia in young adults are limited. However, estimates suggest prevalence in the range of 10 to 20% with little or no significant gender difference [19,25].

Currently, there is no published information available on the oral health of those identified or suspected to be at risk of ENS. In view of the observed co-morbidity and chronic nature of the condition is suggestive of significant xerostomia related oral health impact. Hence, it is important to understand the nature of the problem and how best to treat and prevent oral health issues in this group. As such, the objective of this study is to identify self-perceived reporting of xerostomia and xerogenic drug use among those identified or suspected to be at risk of ENS.

## Materials and Methods

Participants were recruited from a closed group on Facebook called "Empty Nose Syndrome Awareness". The group is a mix of people with ENS and those who perceive to be at risk of ENS and several other interested in knowing about this condition. Most

of the members in the group perceive poor treatment outcome following turbinate reduction procedure.

A quantitative self-report questionnaire was designed specifically for this study to record socio-demographic characteristics, turbinate reduction surgical history, subjective xerostomia and medication use. Participants were encouraged to complete an online survey tool provided by Survey Monkey. This allowed invitation to be sent and response obtained securely. All the participants were informed that the results of the study were to be published. No monetary benefits or gifts as incentives were offered and participation was at their own will.

Participants were considered eligible if they had at least one nasal surgical procedure for allergic or non-allergic rhinitis prior to developing signs and symptoms of ENS. Data was collected from the 5<sup>th</sup> of May 2014 until 20<sup>th</sup> of Dec 2014.

The e-survey consist a mix of sociodemographic, xerostomia related questions using the original Xerostomia Inventory (XI) [26], medication use and the number of surgical procedure related to allergic or non-allergic rhinitis in closed-ended questions. The original Xerostomia Inventory (XI) is an 11-item rating scale used to determine the severity of chronic xerostomia. It combines the participant's response to the 5-point Likert scale for the 11 individual items into a single continuous scale score. Higher scores represent more severe symptoms. Each item in the inventory has a scoring range of 1 to 5, corresponding with "never", "hardly ever", "occasionally", "fairly often" and "very often. Individual's responses are scored and summed to give a single XI score.

The sum scores for XI were derived from individual respondents to form a scale variable. To predict if number of filled teeth were influenced by XI, a linear regression was conducted. All the analyses were performed using Statistical Package for the Social Sciences Software (SPSS for Windows, Version 24, Chicago, IL).

## Results

The socio-demographic distribution of the participants is presented in Table 1. Respondents were aged between 18-64 years from 19 countries. Fifty-one per cent of the respondents were males and 43 of the total 51 respondents were young and middle-aged adults. Approximately, 60% of the entire response came from Non-Hispanic White or Euro-Americans of them 60% were from North America.

Variables		n (%)
Gender		
	Female	25 (49)
	Male	26 (51)
Age		
	18 to 24	06 (12)
	25 to 34	14 (27)
	35 to 44	12 (24)
	45 to 54	11 (22)
	55 to 64	08 (16)
Region		
	North America	28 (55)
	South America	03 (06)
	Europe	12 (24)
	Asia	06 (12)
	Australia	01 (02)
	Others	01 (02)
Ethnicity		
	Non-Hispanic White or Euro-American	29 (57)
	Latino or Hispanic American	10 (20)
	East Asian or Asian American	02 (04)
	South Asian or Indian American	01 (02)
	Middle Eastern or Arab American	04 (08)
	Others	04 (08)

**Table 1:** Socio-Demographic Characteristics. *Xerostomia Inventory (XI)*

Table 2 presents the individuals response to the XI. Summated mean for the XI was 3.00. Those who responded, “fairly often” or “very often” to each of the 11-item questions were regarded as giving an affirmative answer or increased expression of the

condition. Overall, 86.3% of respondents gave an affirmative response for “dry nose” followed by “dry mouth” 58.8% and “dry eyes” 52.9%. Mean response value for the XI was higher for female (M = 3.27, SD= 1.34) compared to the males (M = 2.86, SD= 1.33).

	Never	Hardly ever	Occasionally	Fairly often	Very often	Mean	SD
Do you sip liquids to aid in swallowing food?	15 (29.4)	7 (13.7)	13 (25.5)	7 (13.7)	9 (17.6)	2.7	1.4
Does your mouth feel dry when eating a meal?	19 (37.3)	9 (17.6)	11 (21.6)	6 (11.8)	6 (11.8)	2.4	1.4
Do you get up at night to drink?	15 (29.4)	13 (25.5)	6 (11.8)	8 (15.7)	9 (17.6)	2.6	1.4
Does your mouth feel dry?	5 (10.0)	3 (6.0)	12 (24.0)	13 (26.0)	17 (34.0)	3.6	1.2
Do you have difficulty in eating dry foods?	17 (33.3)	8 (15.7)	11 (21.6)	7 (13.7)	8 (15.7)	2.6	1.4
Do you suck sweets or cough lollies to relieve dry mouth?	19 (37.3)	5 (9.8)	15 (29.4)	3 (5.9)	9 (17.6)	2.5	1.4
Do you have difficulties swallowing certain foods?	20 (39.2)	8 (15.7)	13 (25.5)	4 (7.8)	6 (11.8)	2.3	1.3
Does your skin of your face feel dry?	11 (22.0)	5 (10.0)	12 (24.0)	12 (24.0)	10 (20.0)	3.1	1.4
Does your eyes feel dry?	9 (18)	3 (6)	11 (22)	10 (20)	17 (34)	3.4	1.4
Does your lips feel dry?	6 (12.2)	6 (12.2)	11 (22.4)	11 (22.4)	15 (30.6)	3.4	1.3
Does the inside of my nose feel dry?	-	2 (3.9)	5 (9.8)	8 (15.7)	36 (70.6)	4.5	0.8

**Table 2:** Participant’s response to the xerostomia inventory

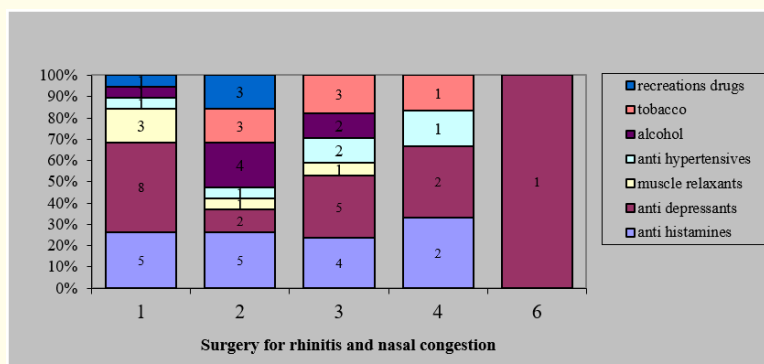
**Xerogenic drug use**

Table 3 shows xerogenic drug use among ENS sufferers. More number of non-Hispanic White or Euro American origin (82%) reported using anti-depressants. Little over 70% of the respondents who used anti-depressants, 80% of those on muscle relaxant and all those who used antihypertensive reported frequent xerostomia.

Antidepressants was identified as a single most commonly used drug in those who had 1, 3, 4 and 6 surgical procedures for allergic or non-allergic rhinitis (Figure 1). Little over one-third of the entire respondents reported using other medication that are not included in the xerogenic group of drugs, eg: Strong analgesics, Medical Marijuana (MMJ), Sleeping pills, Proton pump inhibitors, Anti-platelets, Hydro-codeine, Miniville, Blaxitec.

Xerogenic drug use	N (%)	Reporting frequent dry mouth N (%)	Filled teeth N (%)	Missing teeth N (%)
1. Anti-histamines	16 (29)	9 (26)	68 (31)	7 (16)
2. Anti-depressants (any type)	18 (33)	13 (37)	88 (40)	15 (33)
3. Muscle relaxant	5 (09)	4 (11)	15 (7)	8 (18)
4. Antihypertensive (BP)	5 (09)	5 (14)	23 (11)	6 (13)
5. Alcohol	7 (13)	3 (09)	17 (8)	2 (4)
6. Recreational drugs (narcotics)	4 (07)	1 (03)	7 (3)	7 (16)
Total	36 (100)	35 (100)	218 (100)	45 (100)

**Table 3:** xerogenic drug use.



**Figure 1:** Number of nasal surgery and medication use.

**Dental visits and treatment needs**

More than half of all respondents come from an area where the water is fluoridated, and a significant proportion of those respondents reside in North and South America. 42 of the 50 responded that they made a dental visit in the previous 12 months and two third reported regular dental visit. Another, 25% reported visiting a dentist for dental pain and discomfort during in the one year period.

Overall, 43% reported that the condition of tooth and gums to be fair or poor and another 30% acknowledged that they have gum disease. Overall, 70% of the entire respondent reported previous experience of tooth decay and half of them reported frequent mouth breathing. Majority of participants (42) reported having a filling or restorative work done on their teeth in the past (Mean FT = 3.3) but only a third reported missing teeth with a mean of 3.37

Only 10 of the participants complaining of tooth pain or mouth breathing were advised to take on dental office based preventive intervention like Fissure Sealant or Fluoride Varnish to protect and arrest the progression of DC and another 2 participants reported using high fluoride tooth paste (2000 to 5000 ppm) prescribed by the dentist.

Results of the linear regression analysis (Table 4) were significant,  $F(1,46) = 4.27, p < .044, R^2 = 0.08$ , indicating that approximately 8% of the variance in number of fillings/ restorations is explainable by XI. The sum XI significantly predicted the number of fillings / restoration,  $B = 0.10, t(46) = 2.07, p = .044$ . This indicates that on average, a one-unit increase of XI sum score will increase the number of fillings by 0.10 units.

Variable	B	SE	95% CI	$\beta$	t	p
(Intercept)	1.69	1.65	[-1.63, 5.01]	0.00	1.03	.311
XI sum scores	0.10	0.05	[0.00, 0.19]	0.29	2.07	.044

**Table 4:** XI sum scores predicting number of fillings/ restorations

Note. Results:  $F(1,46) = 4.27, p = .044, R^2 = 0.08$ . Unstandardized Regression Equation:  $q0033 = 1.69 + 0.10 * XI \text{ sum scores}$

Xerostomia Inventory (XI)	Gender	N	Mean	Std. Deviation	*Affirmative response n (%)
Sip liquids to aid in swallowing food?	Female	25	2.9600	1.48549	09 (36)
	Male	26	2.5769	1.44701	07 (27)
Mouths feel dry when eating a meal?	Female	25	2.6800	1.40594	08 (32)
	Male	26	2.1923	1.38620	04 (16)
Get up at night to drink?	Female	25	2.5200	1.44684	08 (32)
	Male	26	2.8077	1.54969	09 (35)
Mouths feel dry?	Female	25	3.8400	1.17898	15 (60)
	Male	25	3.5200	1.38804	15 (60)
Have difficulty in eating dry foods?	Female	25	2.7600	1.56205	09 (36)
	Male	25	2.5000	1.39284	06 (24)
Suck sweets or cough lollies to relieve dry mouth?	Female	25	3.0000	1.68325	10 (40)
	Male	26	2.1538	1.15559	02 (08)
Have difficulties swallowing certain foods?	Female	25	2.4400	1.41657	05 (20)
	Male	26	2.3077	1.37896	05 (19)
Skin of your face feel dry?	Female	24	3.5000	1.38313	12 (48)
	Male	26	2.7308	1.40165	10 (38)
Eyes feel dry?	Female	25	3.7200	1.24231	14 (56)
	Male	25	3.2000	1.65831	13 (52)
Your lips feel dry?	Female	24	4.0417	1.12208	17 (68)
	Male	25	4.0417	1.12208	09 (36)
Inside of my nose feel dry?	Female	25	4.6000	.86603	21 (84)
	Male	26	4.4615	.81146	23 (88)

**Table 5:** Participant’s response to the (XI) including the affirmative response.

\*Affirmative answers were defined as “fairly often,” or “very often”.

Answer choice	Xerogenic drug use N(%)	N (%) Reporting frequent dry mouth	No(%) of teeth filled or restored
1. Anti-histamines	16 (44.44)	9(56)	68(29)
2. Anti-depressants (any type)	18 (50.00)	13(72)	88(37)
3. Muscle relaxant	5 (13.89)	4(80)	15(6)
4. Antihypertensive (BP)	5 (13.89)	5(100)	23(10)
5. Alcohol	7 (19.44)	3(43)	17(7)
6. Tobacco	7 (19.44)	5(71)	17(7)
7. Recreational drugs (narcotics)	4 (11.11)	1(25)	7(3)
Total respondents	36	40	33

**Table 6:** Xerogenic drug use and xerostomia.

## Discussion

The study identified people with ENS at increased risk of dry mouth and DC. The reporting of antidepressants was noticeably high making it by far the most common drug used.

The results identified that those with suspected ENS show high risk of DC with 70% of them reporting previous experience of DC. When we compared the missing tooth (MT) for the young (Mean = 3.25) and middle-aged (Mean = 4.33) against the 1999-2004, National Health and Nutrition Examination Survey (NHANES) findings we identified those with suspected ENS expressed nearly two- and five-times higher values than the average US adults. However, this difference was not observed for the filled tooth (FT) component for the young and middle-aged adults.

As population-based studies on xerostomia in young and middle-aged adults are limited direct comparison of the ENS group with well-known individual studies was undertaken. This study identified xerostomia among the ENS sufferers is at least two and half times higher compared to the prevalence of 20% reported in the community [24]. The prevalence was 2-6 times higher for the young and middle-aged adults when compared with the Swedish and New Zealand xerostomia study estimate [19,25].

It may be that Otolaryngologist restrict themselves not to look beyond physical signs of atrophy and dryness following turbinate reduction procedures. Specific symptoms of nasal obstruction or breathlessness are often overlooked and mistaken for other

psychological manifestation [27]. In spite of ENS being recognized as an uncommon byproduct of turbinate reduction, surgeons are still not certain on the exact cause and management of this complicated condition. With the lack of unified consensus on the clinical definition of ENS, doctors are unsure as to what extent to disclose to their patient with certainty on their condition fearing further distress. Moreover, any attempt in giving a diagnosis on a complicated condition as ENS can involve the practitioner at some undesirable risk of litigation. For all these reasons the condition goes unnoticed and remains a hidden iceberg.

It is not uncommon to have ENS patients with psychiatric comorbidity [1], otolaryngologist may have initiated the referral for psychiatric evaluation, subject to intranasal abnormality being ruled out. This may well be one of the plausible reasons for initiating the use of anti-depressive agent's. Although it is easier said than done to estimate the prevalence of this rare entity, some researchers based on personal experience and examination of the literature suggest a 20% chance of patient reporting full blown ENS following resection of the inferior turbinates [9].

Since the study lacks clinical assessment for decayed, missing, filled teeth and oral dryness the results need to be interpreted with caution. Having said that, recruiting sample for clinical dental assessment is not practical as the condition itself is regarded rare and only a few specialized ENT centers around the world treat ENS patient.

This study is the first of its kind to look into oral health risks associated with xerogenic drug use among ENS sufferers. As such, it opens avenues and will provide some insight into how otolaryngologist and dental health care professionals should respond to some of the oral health treatment needs of the ENS sufferers.

The findings from this study suggest dental treatment needs; particularly the risk of DC due to xerostomia and SGH is likely to be high. In light of the chronic nature of this illness, identifying and managing these conditions is critically important in this population. An aggressive approach can reduce the DC burden, minimize damage due to lack of saliva and improve patient's oral health related quality of life. Oral health preventive approach (eg: salivary stimulant, high fluoride or remineralizing tooth pastes, mouth rinses, pit and fissure sealants and fluoride varnishes) in isolation or in combination can be extremely beneficial in preventing further damage.

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