The relationship between oral health and irritable bowel syndrome in women referring to hospital

Firoozeh Nilchian MSc, PhD[1], Seyed Mohammad Razavi MSc[2], Sama Sadeghi-Sedeh[3], Bahman Sadeghi-Sedeh MD[4]

Original Article

Abstract

BACKGROUND AND AIM: Irritable bowel syndrome (IBS) is one of the most common functional gastrointestinal (GI) disorders with an unknown etiology. This study aimed to determine the relationship between IBS and oral health status such as the Decayed, Missing, and Filled Teeth (DMFT) index and Simplified Oral Hygiene Index (OHI-S) and related behaviors such as recorded tooth brushing and flossing.

METHODS: In this descriptive cross-sectional study, 240 volunteers who referred to Arvand Hospital in Ahvaz, Iran, and were screened for Manning and Rome criteria as well as IBS were selected. Finally, 130 patients and 110 controls were included in the study. The demographic information questionnaire, DMFT index, and OHI-S were recorded by the researchers. The logistic regression model was used to predict the oral health factors affecting IBS as a multivariate odds ratio (OR) using SPSS software. Statistical significance level was considered at $P < 0.05$.

RESULTS: The descriptive results showed that the mean age of the participants was 28.45 ± 5.40 years and their mean marriage age was 23.70 ± 3.30 years. Irregular brushing, smoking, and history of recurrent oral aphthous or ulcers were found to be related to IBS, and brushing 2-3 times a day had a protective effect. Further, there was a significant relationship between DMFT index [Filled Teeth (FT): OR = 3.40, P = 0.030; Missing Teeth (MT): OR = 2.70, P = 0.029; Decayed Teeth (DT): OR = 3.42, P = 0.001] and IBS. Moreover, the results of OHI-S showed that IBS was associated with poor oral health [OR = 2.42, 95% confidence interval (CI): 2.04-2.60, P = 0.013].

CONCLUSION: Although, based on the data, it is not clear which disease was happened first, the poor oral health or IBS, patients with IBS need special attention with respect to oral health and its related behaviors.

KEYWORDS: Oral Health; Irritable Bowel Syndrome; DMFT Index; Periodontal Index

Irritable bowel syndrome (IBS) is a functional gastrointestinal (GI) disorder that is characterized by altered GI habits and abdominal pain in the absence of detectable structural disorders. Although this disease causes irritation problems for an individual, it does not change the intestinal tissue or increase the incidence of colorectal cancer.[1] However, it makes the patients worried and the physicians helpless. The treatment cost of this disease in the United States (US) has been estimated to be one million dollars annually.[2] It also wastes the patients' time and makes them disabled.[3]

About half of the patients referring to the physicians because of GI complaints suffer from functional disorders, especially IBS.[1] The prevalence of IBS has been reported to be 10%-22% and 25%-50% of outpatients who

1- Associate Professor, Dental Materials Research Center, Dental Research Institute AND Department of Dental Public Health, School of Dentistry, Isfahan University of Medical Sciences, Isfahan, Iran
2- Professor, Implants Research Center, Dental Research Institute AND Department of Oral Pathology, School of Dentistry, Isfahan University of Medical Sciences, Isfahan, Iran
3- School of Dentistry, Student Research Committee, Isfahan University of Medical Sciences, Isfahan, Iran
4- Associate Professor, Department of Social Medicine, School of Medicine, Arak University of Medical Sciences, Arak, Iran
Address for correspondence: Firoozeh Nilchian MSc, PhD; Associate Professor, Dental Materials Research Center, Dental Research Institute AND Department of Dental Public Health, School of Dentistry, Isfahan University of Medical Sciences, Isfahan, Iran
Email: f_nilchian@dnt.mui.ac.ir

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referred to gastroenterologists, suffering from IBS.[4-6] Studies conducted over the past two decades show that 10%-20% of the general population experience symptoms that are indicative of IBS.[7-9] IBS is a disorder mostly found in young people, presenting at age < 45 years. In western societies, IBS is 2-3 times more prevalent in women than in men, and women constitute 80% of the population suffering from severe IBS.[10-12]

Population-based studies have shown that the prevalence of the IBS symptoms in different populations varies from 5% to 20%.[13] Based on the difference in the study populations and diagnostic criteria, the prevalence of IBS has been reported to be 1.1%-25.0% in Iran.[14,15]

The patients with IBS refer to physicians with a wide range of GI and non-GI symptoms, but the symptoms of chronic abdominal pain and altered bowel habits are the most common complaints in these patients.[4] Since there are no definitive symptoms for diagnosis of this disorder, diagnosis is made based on the rejection of other organic causes. To facilitate the diagnosis process, researchers have used diagnostic criteria such as Manning with 58% sensitivity and 85% specificity,[8] Rome with 65% sensitivity, 100% specificity, and 100% positive predictive value (PPV), or both Manning and Rome criteria.

Although IBS has a high prevalence rate, there is still little understanding of its complex and multifactorial etiology and pathology. Research findings have indicated no detectable structural disorders for this disease. However, some studies have reported many factors to be associated with this disease, including some biomarkers such as GI bacterial infections,[6] altered bowel movements and excretory habits such as visceral tenderness,[7] environmental and psychosocial factors,[5] depression, anxiety, and physical symptoms,[16] the use of analgesics like acetaminophen, aspirin, and non-steroidal anti-inflammatory drugs (NSAIDs),[17] socioeconomic level and environmental

factors,[18] history of stressful events in life such as death of close relatives, divorce and sexual or physical abuse,[19] termination of very close relationships, separation and leaving home by a family member,[20] personality characteristics and neuroticism,[21] depression,[22,23] factors related to childhood,[20,24] lower education level, low parental income, job dissatisfaction, diet, occupational and sexual relations,[25,26] cultural factors such as beliefs, ideology, decision-making, economic and education level, sex interactions, urban or rural life,[27] and many other factors.

The World Health Organization (WHO) regards oral health as a necessity and a part of public health in whole life and states that poor oral hygiene and untreated oral diseases can remarkably affect the quality of life (QOL). In addition, some chronic diseases like diabetes, cardiac diseases, and some psychological characteristics such as positive self-image, and consequently, mental health are associated with oral hygiene.[28]

Recently, a study by Saneei et al. has investigated the relationship between tooth loss and IBS,[29] which to the best of our knowledge, is the first study that has evaluated such an issue. Moreover, numerous studies have examined the effect of oral disorders and various GI diseases such as early satiety, reflux, heartburn,[30] helicobacter pylori (H. pylori) infection and peptic ulcer,[30-33] risk of GI malignancy,[34] constipation and diarrhea,[35] dyspepsia,[36] etc. Hence, it seems that oral health and its various related factors play a critical role in the pathology of IBS. Therefore, the aim of this study was to determine the relationship between IBS and oral health status such as the Decayed, Missing, and Filled Teeth (DMFT) index, Simplified Oral Hygiene Index (OHI-S), and related behaviors such as recorded tooth brushing and flossing.

Methods

This study was approved by the Ethics Committee of Vice-Chancellor for Research, Isfahan University of Medical

Sciences, Isfahan, Iran (Ethical code: IR.MUI.RESEARCH.REC.1398.540). In this descriptive cross-sectional study, which is a part of a research project on the social factors affecting IBS, 714 people, either patients or companions, who referred to Arvand Hospital in Ahvaz, Iran, were selected by convenience sampling, among whom 312 people met the inclusion criteria, and finally, 240 people (130 in patient group and 110 companions) filled the consent form.

People with suspected IBS referred to the hospital with abdominal pain, bloating, and bowel changes as constipation and diarrhea or both. Patients also needed to meet the Rome criteria, which includes recurrent abdominal pain at least three times a month in the past three months, as well as two or more of the following criteria:

1. Improvement of abdominal pain with defecation
2. Onset of abdominal pain with a change in the frequency of defecations
3. Onset of abdominal pain with a change in stool consistency

These criteria had to be completed at least in the past three months, complaints had to be started at least from the past six months, and a family history of the disease had to be negative.

In the next stage, 312 participants who were suspected of IBS based on the initial screening and were willing to continue their cooperation were referred to a specialized GI clinic for clinical examinations. If necessary, common tests such as complete blood count (CBS), erythrocyte sedimentation rate (ESR), cardiopulmonary resuscitation (CPR), stool exam (S/E), Stool culture (S/C), and radiologic control were performed to reject other causes. Ultrasound of the liver, pancreas, gallbladder, and barium enema or endoscopy during the routine course of diagnosis were also considered for those who were strongly suspected of other diseases in order to be included in the study after rejecting other organic diseases and making a definite diagnosis of IBS. Finally, 130 patients

and 110 controls with Manning and Rome criteria, confirmed clinical diagnosis of IBS by a gastroenterologist, age range of 15-60 years, lack of doubt about lactase deficiency or other metabolic diseases, the absence of psychotic or neurotic disorders, and the absence of any long-term use of drugs were included in the study. All of them completed the demographic questionnaire, DMFT index, and OHI-S in a quiet environment and were visited by a dental student through observation and examination.

In this study, the DMFT index involved the following criteria:

A. Decayed: teeth with decay (discoloration) on their surface or lesions inside the points and grooves where under the enamel is vacant or the floor or the surroundings of the lesion are soft.
B. Missed: teeth extracted or missed due to caries
C. Filled: teeth filled or restored

In this study, dental caries was diagnosed by a trained researcher using dental probe and dental mirror under natural light using observation and touching after drying each tooth by a sterile gauze in a room with adequate light, according to the method recommended by the WHO.

The OHI-S was used for assessment of the oral hygiene status and amount of debris on permanent teeth.[37] Finally, based on the participants' mean score, oral hygiene level was reported as good (0-1.2), moderate (1.3-3), or poor (3.1-6).[38] Gingival health was evaluated by the Gingival Index using a mirror and probe. The same teeth used for OHI-S were chosen for the procedure and gingival inflammation, and bleeding levels were calculated for four areas of each tooth. In the end, for the Gingival Index, a score from 0 to 3 was computed for each person. Clinical interpretation of the results was made based on the mean scores obtained for each participant as mild (0-1), moderate (1.1-2), and severe (2.1-3) gingival inflammation.[39]

To confirm the diagnostic accuracy, the examiner (a colleague dental student) was

trained by one of the faculty members of the community-oriented department and a periodontist. The required calibration was also performed on 28 patients in a pilot study, and the coefficient of the agreement was computed. The performance checklist also included items about various aspects such as brushing, flossing, regular referral to dentist, the use of fluoride mouthwash after nausea and vomiting, recurrent aphthous ulcers, round or oval, painful, frequent, and recurrent ulcers with definite margin and erythematosus and gray or yellow background, white lesions, atrophic glossitis, and cheilosis. The first two cases were examined by direct observation of the researcher on the oral molasses along with recorded tooth brushing and flossing and the rest of the items were assessed via self-report. In the performance checklist, a correct behavior was given score 1 and an incorrect behavior was given score 0.

The presence or absence of IBS was regarded as a dependent variable in the logistic regression model, and univariate (unadjusted) and multivariate (adjusted) regression coefficients were calculated as multivariate odds ratios (ORs) for age, gender, and marital status in order to predict the oral hygiene-related factors affecting IBS. Furthermore, OR at 95% confidence interval (CI) was calculated by SPSS software (version 22, IBM Corporation, Armonk, NY, USA). Statistical significance level was considered at P < 0.05.

Results

The descriptive results showed that the mean age of the participants was 28.45 ± 5.40 years. The most frequent age group (33%) among all participants was the age group of 21-30 years. Furthermore, 34% of the participants were in the weight range of 61-70 kg. In terms of marital status, 58% of them were married. Regarding education, the participants mostly had middle school education. Symptoms such as constipation, stomachache, diarrhea, and gas excretion were prominent in 43% of the patients. In all participants, the onset of disease was reported to be gradual. A family history of the disease or similar situations was positive in 31% of the participants.

As for comorbidities, cystitis (urinary irritation, recurrence, change of odor and color of urine) was reported in 38% of the cases, dysmenorrhea in 21.2% of the cases, asthma and allergy in 26.7% of the cases, dyspareunia in 6.5% of the cases, and history of cholecystectomy, appendectomy, or hysterectomy in 7.6% of the cases. With respect to the demographic factors affecting IBS, similar results were found for all samples (Table 1).

Table 1. Univariate and multivariate analysis of irritable bowel syndrome (IBS) and demographic risk factors

Variable	N	IBS+	IBS-
		OR (95% CI)	OR (95% CI)
Age (m = 5)	235	1.48 (0.74-1.54)	1.21 (0.78-1.36)
Weight (m = 9)	231	1.33 (0.85-1.47)	1.52 (0.79-1.69)
Education (m = 5)	235	1.20 (0.44-1.39)	1.26 (0.43-1.66)

M: Missing; IBS: Irritable bowel syndrome; OR: Odds ratio; CI: Confidence interval

The percentage of single patients was 15.9%, and 25.6% of the patients had no experience of pregnancy.

The results of examinations and self-reports showed that tooth brushing occasionally or less than once a week, smoking or drug abuse, and history of recurrent aphthous or oral ulcer were associated with IBS; conversely, tooth brushing 2-3 times a day had a protective effect. It was also found that flossing, regular dental visit, brushing time, dental crown, implant, mouthwash, type of health insurance, oral white lesions, gingivitis, cheilosis, and atrophic glossitis were not associated with IBS (Table 2).

Univariate (unadjusted) and multivariate (adjusted) regression coefficients for age, gender, and marital status showed a significant relationship between IBS and DMFT index as one decayed tooth (DT), three or more missing teeth (MT), and three or more filled teeth (FT).

Table 2. Univariate and multivariate analysis of irritable bowel syndrome (IBS) and oral health performance

Variable	Number	IBS+	IBS-
		OR (95% CI)	OR (95% CI)
Tooth brushing (m = 3)	237		
Never	43	1.0	1.0
2-3 times a day	103	0.42 (0.84-1.09)	0.31 (0.78-1.06)
Once a day	37	1.20 (0.93-132)	0.36 (0.83-1.00)
2-3 times a week	31	1.42 (0.90-1.59)[*]	1.31 (0.78-1.46)
Less than once a week	15	1.92 (1.76-2.63)[*]	1.80 (1.50-2.37)
Sometimes	8	2.42 (1.76-2.63)[*]	2.80 (1.50-2.97)
Last dental visit (m = 18)	222		
No referral	56	1.0	1.0
During 12 past months	101	1.02 (0.90-1.19)	1.21 (0.88-1.56)
More than 12 past months	65	1.10 (0.94-1.22)	1.16 (0.83-1.20)
Smoking or drug abuse (m = 20)	220		
No	198	1.0	1.0
Yes	22	1.80 (1.04-1.99)[*]	1.45 (0.88-1.93)[*]
Insurance and social security (m = 13)	227		
No	133	1.0	1.0
Yes	94	1.60 (0.91-1.72)	1.55 (0.53-1.80)
History of recurrent aphthous and ulcer (m = 76)	164		
No	53	1.0	1.0
Yes	111	2.20 (1.93-2.52)	2.36 (1.83-2.60)
History of white lesions (m = 121)	119		
No	89	1.0	1.0
Yes	30	0.90 (0.73-1.32)	1.30 (0.83-1.40)
Cheilosis (m = 23)	217		
No	148	1.0	1.0
Yes	69	1.00 (0.93-1.12)	1.16 (0.89-1.23)
Atrophic glossitis (m = 14)	226		
No	181	1.0	1.0
Yes	45	1.00 (0.93-1.02)	1.16 (0.93-1.34)

[*]Statistically significant differences at $P \leq 0.05$, odds ratio (OR), and 95% confidence interval (CI)
M: Missing; OR: Odds ratio; CI: Confidence interval; IBS: Irritable bowel syndrome

Moreover, the results of OHI-S indicated a significant association between oral hygiene and IBS but not between gingivitis and IBS (Table 3).

Table 1. Univariate and multivariate analysis of irritable bowel syndrome (IBS) and oral health indices

Variable	Number	IBS+	IBS-
		OR (95% CI)	OR (95% CI)
DT index (m = 0)	240		
Teeth (1-2)	61	2.42 (1.94-2.99)[*]	2.31 (2.20-2.86)[*]
Teeth (< 5)	17	3.42 (2.44-3.99)[*]	3.12 (2.48-3.76)
MT index (m = 0)			
Teeth (1-2)	73	1.44 (0.94-1.72)	1.56 (0.83-1.90)
Teeth (< 5)	13	2.70 (1.84-2.87)[*]	2.70 (1.84-2.87)[*]
FT index (m = 0)			
Teeth (1-2)	71	1.40 (0.94-1.22)	1.36 (0.83-1.90)
Teeth (< 5)	32	3.40 (2.94-4.22)[*]	3.40 (2.94-4.22)[*]
OHI-S index (m = 3)	237	1.0	1.0
Good	67	1.20 (0.94-1.32)[*]	1.16 (0.83-1.27)
Average	131	1.40 (1.11-1.52)	0.96 (0.83-1.19)[*]
Poor	39	1.50 (0.94-1.92)	1.16 (0.88-1.70)

[*]Statistically significant differences at $P \leq 0.05$, odds ratio (OR), and 95% confidence interval (CI)
M: Missing; OR: Odds ratio; CI: Confidence interval; IBS: Irritable bowel syndrome; OHI-S: Simplified Oral Hygiene Index; DT: Decayed teeth; MT: Missing teeth; FT: Filled teeth

Discussion

The results of this descriptive study showed that there was a significant relationship between DMFT index and IBS. Moreover, the results of OHI-S showed that IBS was associated with poor oral health (P ≤ 0.05).

The most prevalent age range for IBS in numerous studies has been reported to be in the age range of 17-38 years. It has also been found that psychological stress has a critical role in the occurrence and intensification of IBS.[37,40-43] More importantly, perception and evaluation of stress and coping styles adopted play a role,[44,45] so that early marriage leads to the adoption of psychological withdrawal coping style and late marriage or divorce results in the adoption of self-blame defensive style, both of which influence the prevalence of IBS.[46]

Smoking affects the GI system via various mechanisms such as increasing the production of oxygen free radicals[47] and the density of H. pylori.[48,49] Some studies have also reported the effect of smoking on IBS.[50-52]

Moreover, some clinical trials have used oil compounds to decrease the symptoms or to treat IBS.[53-55] Compounds such as menthol, cineol, and menthone have been used in the formulation of many kinds of toothpaste, especially mint toothpaste.[56] In addition, many kinds of toothpaste contain antibacterial and antioxidant compounds.[57] Brushing with such a mechanism has probably protective effects against IBS.

Numerous studies have been done on the relationship between oral health and other GI disorders, while no study has ever been conducted to investigate the association between IBS and oral health. Tosello et al. reported an increased prevalence of GI disorders such as heartburn, reflux, early satiety, gastric disorders, epigastric pain, mass formation, pancreatitis, and vomiting in partially edentulous patients. They have shown that people with their natural teeth have fewer GI disorders than others.[30]

In another study by Sierpinska et al., a group of researchers compared the partially edentulous and full edentulous people suffering from masticatory weakness and those with good dental conditions in terms of the gastric mucosa of patients with dyspepsia.[58] The results of this study showed high levels of inflammation and infection with H. pylori in the gastric mucosa of patients with seriously disturbed dental conditions. Moreover, the MT have been reported to increase the risk of upper GI cancer.[34] Several studies have also explored the association between masticatory ability and GI disorders.[32,33] A cross-sectional study in four nursing homes in Germany reported a significant relationship between masticatory ability and a number of GI disorders such as constipation, diarrhea, flatulence, heartburn, anorexia, nausea, and vomiting.[59] Inadequate mastication has also been reported to be linked with GI disorders such as diarrhea and constipation in the elderly.[34]

In a cross-sectional study, Saneei et al. divided 4012 Iranian adults into three main groups: one with full teeth, one with 1-5 MT, and one with more than 5 MT. After controlling the confounding variables, the OR of developing IBS was 1.33 times greater in participants with 1-5 MT than those with complete teeth. In addition, the OR of developing IBS by overcoming constipation was 35% higher in participants with 1-5 MT than in those with complete teeth. No significant relationship was found between dental status and other subgroups of IBS both in the raw and adjusted models. Moreover, no relationship was observed between the prevalence of IBS and more than 5 MT.[29]

Proff also reported that GI excretion rate was influenced by chewing efficiency.[31] Sufficient mastication reduces the time of food grinding and makes it easier to pass through the pyloric sphincter. Unfortunately, very few studies have examined the relationship between oral disorders and IBS. The results of this study showed a significant association between IBS and oral health. However, it is not clear whether oral diseases

affect IBS or IBS leads to the incidence of oral diseases. Several studies have shown that chewing efficiency affects food selection under the influence of factors such as the presence of teeth, the number of effective teeth, and the application of prosthesis.[60-63] People suffering from oral problems may prefer industrial foods, which have fewer fibers and nutrients and are softer, to organic foods and eliminate raw vegetables and fresh fruits from their diet.[64,65]

Conclusion

Although the prevalence of poor oral hygiene and IBS cannot be determined, it is necessary to pay more attention to oral health and oral health-related behaviors in patients with IBS.

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