

PREVALENCE OF DENTAL CARIES AND ORAL HYGIENE HABITS IN PATIENTS WITH CROHN'S DISEASE LIVING IN URBAN AND RURAL REGIONS OF SOUTHERN POLAND

SZCZEKLIK Katarzyna¹, OWCZAREK Danuta², ŻAROW Maciej³,
PYTKO-POLONCZYK Jolanta¹, MACH Tomasz²

- ¹ Department of Integrated Dentistry, Jagiellonian University Medical College, Krakow, Poland
- ² Department of Gastroenterology, Hepatology and Infectious Diseases, Jagiellonian University Medical College, Krakow, Poland
- ³ Private Dental Clinic and Postgraduate Course Centre "NZOZ SPS Dentist", Krakow, Poland

Abstract

Patients with Crohn's disease (CD) prefer carbohydrates and foods, which easy to digest, both risk factors of caries disease. The aim of this study was to evaluate the dental caries prevalence and oral hygiene habits in CD patients who live in urban and rural areas of the southern part of Poland in comparison to controls. Seventy one adult patients with CD and 61 age – and sex – matched volunteers were enrolled; 52% of patients were living in urban areas, 48% in rural regions. We studied: findings on clinical examination, calculation of BMI, blood hemoglobin and serum CRP levels, oral examination according to the WHO recommendations, with assessment of oral hygiene habits, dental history, visits to dentists. Presence of decayed (D), missing (M), filled teeth (F) were assessed, and the "Decayed, Missing, and Filled Teeth Index" (DMF-T) was calculated. Statistical methods included non-parametric tests and Spearman correlation coefficient estimation. Dental caries assessed by DMF-T index was higher in CD patients compared to controls. DMF-T was similar in patients from urban and rural areas (14.2±4.7 vs 15.4±2.1, respectively). M and F scores were comparable in both groups, but D score was higher in CD patients ($p<0.01$). No correlation was found between DMF-T index and place of living. Patients from rural areas less frequently used tooth brushing (68% vs 57%, $p<0.05$) and dental floss (11% vs 5%, $p<0.05$). Patients from urban areas visited dentists more frequently than those from rural regions. The prevalence of dental caries in the middle aged CD patients living in the southern region of Poland is higher in comparison to healthy controls. The prevalence of caries disease and oral hygiene habits in CD patients is comparable between patients living in urban areas and in rural regions.

Keywords:

Crohn's disease, dental caries, DMF-T index, oral hygiene, rural area

Corresponding author:

Tomasz Mach; tmach@su.krakow.pl

Introduction

Crohn's disease (CD) is a chronic inflammatory process of unknown pathogenesis affecting any part of the gastrointestinal tract, including the oral cavity [1,2]. In the pathogenesis of CD the combination of genetic susceptibility, immunologic dysregulation and exposure to environmental factors, such as dietary and microbiota changes, are currently proposed [1,3,4]. Inflammatory lesions are mostly localized to the ileocaecal area but also to small and large intestines, and can lead to serious intraabdominal complications or extraintestinal manifestations [1]. The course of

CD is chronic with characteristic periods of active disease with clinical symptoms and remissions. In the active CD patients suffer from abdominal pain, diarrhea, fever, with various consequences like sideropenic anemia, malnutrition, weight loss [1]. The incidence of CD has been increased during the last decade in many countries and is considered to be caused by "westernized" style of life [1,2,4]. Prior to the start of the treatment based on immunomodulators or biological therapy, patients require a detail oral examination and exclusion of potential infectious foci [1,2,4,5,6].

Table 1. Demographic and clinical characteristics of patients with Crohn's disease and the control group

Variable	Crohn's disease			Control group			p - value
	Urban areas	Rural areas	Total	Urban areas	Rural areas	Total	
Number	37	34	71	32	29	61	NS
Gender; female/ male	11/26	13/21	24/47	12/20	12/17	24/37	NS
Age (years)	32.5 ± 3.5	34.1 ± 3.2	33.4 ± 3.1	35.2 ± 4.6	37.2 ± 3.3	36.2 ± 2.8	NS
BMI (kg/m ²)	22.5 ± 2.1	21.4 ± 1.9	22.0 ± 1.7	24.6 ± 2.3	23.6 ± 2.1	24.1 ± 2.1	<0,05
Disease duration (years)	8.4 ± 1.5	7.2 ± 1.9	7.8 ± 1.6	-	-	-	-
Previous resective surgery	6/16%	9 /26%	15/21.1%	-	-	-	-
Hemoglobin (g/dl)	13.3 ± 0.9	12.9 ± 0.6	13.0 ± 0.6	14.2 ± 0.9	13.6 ± 1.0	14.0 ± 0.9	<0,05
CRP (mg/l)	25.2 ± 1.1	21.9 ± 1.6	23.9 ± 0.9	2.4 ± 0.2	3.0 ± 0.5	2.8 ± 0.4	<0,001
Location of lesions (%)							
Ileo-cecal region	46%	41%	43%				
Small intestine	19%	22%	21%				
Large intestine	12%	15%	15%				
Perianal lesions	13%	10%	12%				
CDAI (points)	202.4 ± 15.2	195.6 ± 13.9	201.7 ± 15.1				

Data are presented as mean ± SD, or number/percentage. Abbreviations: p – significance calculated with the Mann-Whitney U test; NS – not significant; CDAI – Crohn's disease activity index; BMI – body mass index; CRP – C- reactive protein.

Extraintestinal manifestations of CD can involve any organ [1,2,7]. Oral lesions occur in 20-50% of adult patients, and might be the first clinical symptoms of CD [7,8,9,10]. Oral CD are divided into lesions characterized by noncaseous granulomas in the mucosa and nonspecific

ones [2,11,12]. The specific lesions like polypoid tag lesions, cobblestoning, gingivitis, diffuse lip and buccal swelling are less common [11,12]. The nonspecific oral manifestations are deep ulcers or aphthous ulcers, angular cheilitis, atrophic glossitis, middleline lip fissuring, white coated

Table 2. Dental status as measured by the DMF-T index (DT – decayed, MT – missed, FT - filled teeth) in patients with Crohn's disease and controls living in urban and rural areas.

Index of teeth status	Crohn's disease			Control group			P - value CD vs controls
	Urban areas (n = 37)	Rural areas (n = 34)	p	Urban areas (n = 32)	Rural areas (n = 29)	p	
DMF-T	14.2 ± 4.7	15.4 ± 2.1	NS	12.5 ± 2.6	13.6 ± 2.3	NS	0.04
DT	5.5 ± 0.8	6.1 ± 0.9	NS	4.0 ± 0.5	4.5 ± 0.9	NS	0.01
MT	1.8 ± 0.4	2.2 ± 0.7	NS	2.1 ± 0.5	2.0 ± 0.8	NS	NS
FT	7.9 ± 2.1	7.2 ± 1.3	NS	6.3 ± 1.6	6.7 ± 1.3	NS	NS

Data are presented as mean ± SD, p - significance calculated with Mann-Whitney U test, NS – not significant. Abbreviations: DMF-T – decayed, missed, filled teeth; DT – decayed teeth, MT – missed teeth, FT – filled teeth.

tongue, and others which can occur in patients with other diseases as well as in normal population [8,10,11,13].

Table 3. Correlation between dental caries assessed by DMF-T index and place of residence (urban or rural areas) of patients with Crohn's disease

Paired parameters	Spearman's correlation			
	N	R	t(N-2)	p
DMF-T index and urban areas	37	-0.018	-0.141	0.887
DMF-T index and rural areas	34	-0.026	-0.196	0.695

Several studies from various countries have reported higher prevalence of dental caries and poor oral health in patients with CD in comparison to people without CD [6,14,15,16]. Except few observations on the small groups of patients, the dental studies and assessment of oral hygiene in CD patients living in Poland have not been evaluated [17,18]. We have accepted the hypothesis that environmental factors such as urbanization affect dental health in patients with CD.

The aim of this study was to evaluate the dental caries prevalence and oral hygiene habits in patients with CD living in urban and rural areas of southern part of Poland (Malopolska province) in comparison to healthy subjects.

Material and Methods

In this prospective study conducted between June 2010 and November 2012 we enrolled 71 adult patients with established diagnosis of CD. We studied 24 women and 47 men, aged from 18 to 60 years (mean 33.4 ± 3.1 years). The control group consisted of 61 volunteers without CD, 24 women and 37 men, aged 18-57 (mean 36.2 ± 2.8 years). Diagnosis of CD was based on clinical, endoscopic, histological and radiological criteria [1].

All studied patients were living in the Malopolska province and in Krakow, the province capital city. Fifty two percent of patients with CD were urban patients defined as coming from cities with over 5.000 inhabitants (Krakow and other cities), and 48% of rural patients lived in places with less than 5.000 inhabitants (Table 1). Patients were attending the outpatient clinic of gastroenterology department of the University Hospital in Krakow, which is a leading CD center

in Malopolska province of southern Poland. All participants completed a questionnaire that covered place of residence, demographic and medical history data. Clinical activity of CD was classified according to the CD activity index (CAI), which is a composite scoring system based on selected clinical symptoms [19]. CAI values of 150 or less are associated with remission, values above 150 indicate active disease; values 150 to 219, as mild activity, 220 to 450, moderate activity, and above 450, as severe activity [19]. Exclusion criteria were: severe chronic disease, diabetes, alcoholism, tobacco smoking. The study involved careful clinical examination, calculation of body mass index (BMI) and laboratory analyses of blood samples (serum hemoglobin and CRP levels). Patients were on the therapy with azathioprine (2 mg/kg/day), and those with inflammatory process in the colon were additionally on mesalazine (2 g/day) according to the ECCO guidelines [1].

Oral examination involved detailed medical history and careful systematic assessment of the oral cavity, and was performed according to the World Health Organization recommendations by the dentists (KS, MŻ) who were blind to study groups [20]. The anamnesis was related to the oral hygiene habit, dental history, frequency of tooth brushing, use of supplementary means of oral hygiene, visits to the dentists. Oral examination was conducted in a dental office according to sanitary requirements, under artificial light, using a disposable dental mirror and explorer [20].

Dental examination included the number of total teeth present and the presence of decayed teeth (DT), missing teeth due to caries (MT) and filled teeth (FT) [20,21]. DMF-T index with the total numbers of DT, MT and FT was calculated, and the DMF-T value above zero indicates the present or past caries [20,21].

The study protocol was approved by the Bioethics Committee at the Jagiellonian University in Krakow, Poland (KBET/88/B/2010). The study was conducted in full adherence with good clinical practice and the ethical principles of the Declaration of Helsinki. The informed consent was obtained from each participant before entering the study.

The results were analyzed using the Statistica software version 10.0 (StatSoft, Inc., Tulsa, Oklahoma, USA). The results were expressed as means and standard deviation (SD). The Shapiro-Wilk test was applied to assess the concordance between the distribution of continuous variables

Table 4. Oral hygiene habits in patients with Crohn's disease and controls depending on the place of living (urban areas or rural areas).

Variable	Crohn's disease			Control group			P - value CD vs controls
	Urban areas (n = 37)	Rural areas (n = 34)	p	Urban areas (n = 32)	Rural areas (n = 29)	p	
Frequency of tooth brushing							
Irregular	6%	10%	NS	10%	14%	NS	NS
Once per day	15%	24%	NS	19%	23%	NS	NS
Two times daily	68%	57%	0.05	62%	58%	NS	NS
Three times daily	11%	9%	NS	9%	5%	NS	NS
Complementary measures of oral hygiene and prevention							
not applicable	85%	93%	NS	83%	88%	NS	NS
dental thread	11%	5%	0.05	9%	7%	NS	NS
mouthwash solution	4%	2%	NS	8%	6%	NS	NS
The frequency of dental visits							
less than 1 time per year	24%	47%	0.01	43%	54%	NS	NS (*)
1 visit per year	57%	43%	0.05	41%	32%	NS	<0,01
1 visit per half a year	11%	8%	NS	13%	10%	NS	NS
1 visit per 3 months	8%	2%	NS	3%	4%	NS	NS

NS (*) = CD patients vs controls with exception of CD patients from urban areas.

with normal distribution, and showed a significant deviation from normality. The nonparametric Mann-Whitney U test was used to compare variables between different groups. The relationship between parameters was examined by non-parametric Spearman's correlation coefficient. Pvalues less than 0.05 were considered statistically significant.

Results

The characteristic of patient with CD and the control groups is presented in Table 1. Study groups did not differ in terms of number, age and sex and hemoglobin levels. CD patients had a significantly lower BMI, lower hemoglobin levels and higher CRP levels in serum compared with controls. However, the results of BMI values, hemoglobin and CRP levels were not significantly different between CD patients from urban and rural areas (Table 1). The average CDAI score of the CD patients was 201.7 ± 15.1 points, indicating a mild activity of the disease [1,19].

The frequency of dental caries assessed by the DMF-T index was significantly higher in CD patients compared to controls. The DMF-T index

in patients with CD and in control group is presented in Table 2. Statistical analysis showed that the intensity of dental caries was similar in CD patients living in urban areas compared to patients living in rural areas. There were no differences between the values of DMF-T index depending on the living environment of CD patients. The average value of DMF-T in patients with CD living in urban areas was 14.2 ± 4.7 and living in rural areas was 15.4 ± 2.1 ($p > 0.05$; Mann-Whitney U test), and in control groups was 12.5 ± 2.6 and 13.6 ± 2.3 , respectively ($p > 0.05$). However, the results of DMF-T indexes were significantly higher in CD patients from urban and rural regions in comparison with controls ($p < 0.04$) (Table 2). The DMF-T index mainly depended on the number of tooth decay and in lesser degree of the number of missed or filled teeth. No significant differences were found between CD and control groups regarding missing and filled teeth score values, except of decayed teeth (DT) score which was higher in the whole group of CD patients (both urban and rural regions) compared to controls ($p < 0.01$) (Table 2). Again, analysis of the DMF-T values

and its components (DT, MT, FT) did not reveal any significant differences among CD patients living in both environmental regions of southern Poland; similar relations was observed in control groups. Moreover, Spearman's correlations did not present any relationship between DMF-T index and place of living of patients with CD (Table 3).

The results of the careful dental history taken from the CD patients and controls living in urban and rural areas are presented in Table 4. They have shown the compliance with the general guidelines of oral hygiene in the patients. In this respect, group of patients with CD was not practically different from control group. However, there were observed differences between the frequency of dental visits and some hygienic procedures including tooth brushing and usage of complimentary measures in CD patients living in urban compared to rural areas (Table 4). Patients with CD living in rural region less frequently used tooth brushing (68% versus 57%, $p < 0.05$) and dental floss (11% versus 5%, $p < 0.05$).

Patients with CD visited more frequently the dentists compared to controls. CD patients from urban areas visited dentists at least one time per year but more frequently than patients from rural regions (Table 4). This might be a result of careful medical care of these patients, and regular dentist examination to exclude any infection foci in the oral cavity. In addition we observed that patients living in the city of Krakow (capital of Malopolska province) visited dentists more often compared to patients living in small towns and villages (Table 4).

Discussion

In patients with CD the dental caries could be a major clinical problem because of the relatively commonly used insufficient nutrition and diet mostly based on easy digestible carbohydrate products and possible limited adherence to oral hygiene measures [14,15,16,22]. Examining the caries incidence in patients with CD, some authors have confirmed that the intensity of caries disease was significantly higher than in healthy controls [14,15,23].

In this study we have shown that the frequency of dental caries assessed by the DMF-T index was slightly higher in patients with CD in comparison to controls. The average value of DMF-T in CD patients was 14.1 and in controls this score reached insignificantly lower value of 10.4.

Moreover, we have not observed any differences between CD patients and controls regarding decayed, missing and filled teeth scores. There were also no differences between the values of DMF-T index depending on the living environment of CD patients. Thus, the intensity of dental caries in CD patients from urban areas was comparable to DMF-T indexes of patients living in rural areas of Malopolska province in southern Poland. Moreover, we did not reveal any significant correlations between DMF-T index and place of living of CD patients and controls.

In the study concerning the oral hygiene status of CD patients living in urban areas and rural areas we have shown the compliance with the general guidelines of oral hygiene. In this respect, CD patients were practically not significantly different from controls. However, CD patients from urban areas declared more frequent visits in dental offices and some hygienic procedures including tooth brushing and usage of complimentary measure in comparison with patients living in rural areas. Moreover, concerning the patients living in urban areas the results suggest a better access to dentists in towns. In general, the results of this study might be explained by a careful medical care of CD patients in southern Poland and adherence to recommendations for regular dentist examination to exclude any dental problems and potential infection foci in the oral cavity. Surprisingly, the analysis of results has shown that CD patients living in the city of Krakow (capital of Malopolska province) visited dentists more often compared to patients living in small towns and villages.

Dental caries is the most common chronic oral disease in many populations. It is well established that intake of dietary sugars is the most important risk factor for caries [2,6,16]. CD patients with exacerbation of symptoms usually change their diet which mostly consists of carbohydrates and easy to digest foods [9,14,16]. The high prevalence of dental caries in CD patients may be caused by several factors. In this respect it should be taken into consideration a specific diet, malabsorption, adverse effects of drugs, and changes in oral microbiota. [2,16,25,26].

Dietary factors play an underestimated role in the etiopathogenesis and course of CD. In CD patients is advised a diversified and well balanced diet which may facilitate achieving or prolonging stages of remission and improve comfort and quality of life. Dietary recommendations are

addressed for patients depending on the course of the disease, past surgical procedures and type of pharmacotherapy used. Patients after resective intestinal surgery should avoid restricted diet rich of carbohydrates in order to maintain a good nutritional status. Supplementation with well-absorbed monounsaturated fats and vitamin B12 is advised in those after resection of ileo-cecal region (27).

Halme et al. observed in 53 patients with active CD more frequent dental caries and periodontal infectious foci in comparison to CD with inactive disease [24]. The authors showed in a radiologic study the high incidence of inflammatory foci within the oral cavity in patients with active CD and they drew attention to the fact that dental health should be taken into account in the assessment of patients with active CD, as they may pose a potential source of infection [24].

Szymanska et al. have recently published that CD patients living in Sweden have a higher prevalence and risk for dental caries compared to people without CD [14]. They observed that CD patients reported a more frequent consumption of sweetened drinks between meals. Moreover, these and other authors observed that CD patients who had resective surgery and changes in diet with increased consumption of sugar had a higher DMFT score, higher counts of Lactobacilli and Streptococcus mutans in saliva, and more dental plaque compared to the controls [14,15,23,25].

The patients with CD are in immunocompromised conditions because of chronic immunomodulatory therapy. Therefore, early diagnosis of dental caries and potential infectious foci and outbreaks of oral infections with subsequent appropriate treatment are particularly important in order to prevent the bacteria spread. Scheper and co-authors presented a recommendation for dental patients with CD for the early diagnosis of any pathology and therapeutic implementation [11]. They emphasized the importance of frequent inspection of the oral cavity towards the possible manifestations of CD, and early diagnosis and treatment of any hot spots in the mouth. They also recommended carrying out frequent check-ups with an emphasis on prevention of dental caries and proper oral hygiene instruction [11].

The results of the study in CD patients living in various regions of southern Poland have also other aspects. They might suggest the important role of the oral hygiene measures in CD

patients which can modify the gastrointestinal microbiota and influence on the course of CD. However, these relations might be elucidated in the further study.

There are some limitations to the study that should be mentioned. First, we did not analyze other parameters which might be important in dental caries development, like e.g. saliva flow rate and saliva components. The other limitations of our study are: lack of assessment of both diet and medication effects on the dental caries and lack of radiographic examination of dental status of patients.

Conclusions

The study highlights the higher prevalence of dental caries in the middle age patients with CD living in the southern region of Poland in comparison to the healthy persons. However, the prevalence of caries disease and oral hygiene habits in CD patients were generally comparable between patients living in urban areas and in rural regions.

Acknowledgements

The study was supported by the grants from the Jagiellonian University Medical College in Krakow (K/ZDS/002284 and K/DSC/000019).

Resumo

Pacientoj kun la malsano de Crohn (CD) preferas karbohidratojn kaj facile digesteblajn nutraĵojn, kiuj estas risiko-faktoroj de kario-malsano. La celo de ĉi tiu studo estis taksati la damaĝojn de dentaj karioj kaj higienaj kutimoj en CD-pacientoj vivantaj en urbaj kaj kamparaj regionoj de suda parto de Pollando kompare kun kontrolgrupoj. Oni invitis sepdek plenkreskajn pacientojn kun CD kaj 61 volontuloj egaligitaj laŭ aĝo kaj sekso; 52% de pacientoj loĝis en urbaj terenoj, 48% en kamparaj regionoj. Ni pristudis: rezultojn de la klinikaj ekzamenoj, kalkulon de BMI indekso, koncentritecon de hemoglobino en sango kaj nivelo de CRP en serumo, la buŝekzamenon laŭ la rekomendoj de la OMS, kun pritakso de higienaj kutimoj de la buŝo, stomatologian anamnezon, vizitojn ĉe dentkuracistoj. Oni pritaksis la ĉeeston de difektitaj (D), mankantaj (M), riparitaj dentoj (F) kaj kalkulis la indekson de la malapero, manko kaj riparitaj dentoj (DMF-T). Statistikaj metodoj inkluzivis ne-parametrajn provojn, kaj Spearman-korelacian koeficientan taksadon. Dentaj karioj taksitaj per DMF-T-indekso estis pli altaj ĉe pacientoj kun CD kompare kun kontrolgrupo. DMF-T estis simila ĉe pacientoj de urbaj kaj kamparaj regionoj (14.2 ± 4.7 vs 15.4 ± 2.1 , respektive). La rezultoj M kaj F

estis kompareblaj en ambaŭ grupoj, sed D-poentaro estis pli alta ĉe pacientoj kun CD ($p < 0.01$). Neniu korelacio estis trovita inter DMF-T-indekso kaj loĝloko. Pacientoj de kamparaj regionoj malpli ofte uzis dentbroŝojn (68% kontraŭ 57%, $p < 0.05$) kaj dentpurigajn fadenojn (11% vs 5%, $p < 0.05$). Pacientoj de urbaj regionoj vizitis dentkucariston pli ofte ol de kamparaj regionoj.

La ofteco de dentaj karioj en la mezaĝaj pacientoj en la suda regiono de Pollando estas pli alta kompare al sanaj kontrolgrupoj. La ofteco de kario kaj kutima higieno de buŝa kavo ĉe pacientoj kun CD estas kompareblaj inter pacientoj loĝantaj en urbaj regionoj kaj en kamparaj regionoj.

References

- Gomollón, F.; Dignass, A.; Annese, V.; Tilg, H.; Van Assche, G.; Lindsay, J. O.; Peyrin-Biroulet, L.; Cullen, G. J.; Daperno, M.; Kucharzik, T.; Rieder, F.; Almer, S.; Armuzzi, A.; Harbord, M.; Langhorst, J.; Sans, M.; Chowers, Y.; Fiorino, G.; Juillerat, P.; Mantzaris, G. J.; Rizzello, F.; Vavricka, S.; Gionchetti, P.; ECCO. 3rd European Evidence-based Consensus on the Diagnosis and Management of Crohn's Disease 2016: Part 1: Diagnosis and Medical Management. *J. Crohns Colitis*. 2017, 11, 3-25.
- Lankarani, K. B.; Sivandzadeh, G. R.; Hassanpour, S. Oral Manifestation in Inflammatory Bowel Disease: a Review. *World J. Gastroenterol*. 2013, 19, 8571-8579.
- Brown, S. J.; Mayer, L. The Immune Response in Inflammatory Bowel Disease. *Am. J. Gastroenterol*. 2007, 102, 20582069.
- Hou, J. K.; Abraham, B.; El-Serag, H. Dietary Intake and Risk of Developing Inflammatory Bowel Disease: a Systematic Review of the Literature. *Am. J. Gastroenterol*. 2011, 106, 563-573.
- Singhal, S.; Dian, D.; Keshavarzian, A.; Fogg, L.; Fields, J. Z.; Farhadi, A. The Role of Oral Hygiene in Inflammatory Bowel Disease. *Dig. Dis. Sci*. 2011, 56, 170-175.
- Rikardsson, S.; Jonsson, J.; Hultin, M.; Gustafsson, A.; Johannsen, A. Perceived Oral Health in Patients with Crohn's Disease. *Oral Health Prev. Dent*. 2009, 7, 277-282.
- Greenstein, A. J.; Janowitz, H. D.; Sachar, D. B. The Extra-intestinal Complications of Crohn's Disease and Ulcerative Colitis: a Study of 700 Patients. *Medicine (Baltimore)*. 1976, 55, 401-402.
- Rowland, M.; Fleming, P.; Bourke, B. Looking in the Mouth for Crohn's Disease. *Inflamm. Bowel Dis*. 2010, 16, 332-337.
- Harty, S.; Fleming, P.; Rowland, M.; Crushell, E.; McDermott, M.; Drumm, B.; Bourke, B. A Prospective Study of the Oral Manifestations of Crohn's Disease. *Clin. Gastroenterol. Hepatol*. 2005, 3, 886-891.
- Szczeklik, K.; Owczarek, D.; Pytko-Polonczyk, J.; Kesek, B.; Mach, T. H. Proinflammatory Cytokines in the Saliva of Patients with Active and Non-active Crohn's Disease. *Pol. Arch. Med. Wewn*. 2012, 122, 200-208.
- Scheper, H. J.; Brand, H. S. Oral Aspects of Crohn's Disease. *Internat. Dental J*. 2002, 52, 163-172.
- Zervou, F.; Gikas, A.; Merikas, E.; Peros, G. Oral Manifestations of Patients with Inflammatory Bowel Disease. *Am. Gastroenterol*. 2004, 17, 395-401.
- Mays, J.W.; Sarmadi, M.; Moutsopoulos, N.M. Oral Manifestations of Systemic Autoimmune and Inflammatory Diseases: Diagnosis and Clinical Management. *J. Evid. Based Dent. Pract*. 2012, 12 (Suppl), 265-282.
- Szymanska, S.; Lördal, M.; Rathnayake, N.; Gustafsson, A.; Johannsen, A. Dental Caries, Prevalence and Risk Factors in Patients with Crohn's Disease. *PLoS One*. 2014, 9e, 91059.
- Rooney, T. P. Dental Caries Prevalence in Patients with Crohn's Disease. *Oral Surg. Oral Med. Oral Pathol*. 1984, 57, 623-624.
- Schütz, T.; Drude, C.; Paulisch, E.; Lange, K. P.; Lochs, H. Sugar Intake, Taste Changes and Dental Health in Crohn's Disease. *Dig. Dis*. 2003, 21, 252-257.
- Waško-Czopnik, D.; Karczmarek, U.; Sołtan, E.; Cader, J.; Paradowski, L. Oral Condition and Some Salivary Parameters in Patients with Crohn's Disease. *Polish J. Environ. Stud*. 2007, 16, 15-19.
- Kłaniecka, B.; Kaczmarek, U. Oral Cavity Condition and Selected Salivary Parameters in Children and Adolescents Suffering from Inflammatory Bowel Diseases. *Dent. Med. Probl*. 2016, 53, 210-215.
- Best, W. R.; BecketlHYPERLINK "http://www.ncbi.nlm.nih.gov/pubmed?term=%22Becketl%20JM%22%5BAuthor%5D", J. M.; Singleton, J. W.; Kern, F. Jr. Development of a Crohn's Disease Activity Index. National Cooperative Crohn's Disease Study. *GastroenterologyHYPERLINK "http://www.ncbi.nlm.nih.gov/pubmed/1248701"*. 1976, 70, 439-444.
- World Health Organization. *Oral Health Surveys: Basic Methods*. 5th ed. Geneva WHO, 2013.

21. Brito, F.; de Barros, F. C.; Zaltman, C.; Carvalho, A. T.; Carneiro, A. J.; Fischer, R. G.; et al. Prevalence of Periodontitis and DMFT Index in Patients with Crohn's Disease and Ulcerative Colitis. *J. Clin. Periodontol.* 2008, 35, 555-560.
22. Cosnes, A.; Dupuy, A.; Revuz, J. Longterm Evolution of Oral Localisation of Crohn's Disease. *Gastroenterology.* 1998, 114, A 956.
23. Scully, C.; Cochran, K. M.; Russell, R. I.; Ferguson, M. M.; Ghouri, M. A.; Lee F. D.; MacDonald, D. G.; McIntyre, P. B. Crohn's disease of the mouth: an indicator of intestinal involvement. *Gut.* 1982, 23, 198-201.
24. Halme, L.; Meurman, J. H.; Laine, P.; von Smitten, K.; Syrjänen, S.; Lindqvist, C.; Strand-Pettinen, I. Oral Findings in Patients with Active or Inactive Crohn's Disease. *Oral Surg. Oral Med. Oral Pathol.* 1993, 76, 175-181.
25. Sundh, B.; Emilson, C. G. Salivary and Microbial Conditions and Dental Health in Patients with Crohn's Disease: a 3-year Study. *Oral. Surg. Oral Med. Oral. Pathol.* 1989, 67, 286-290.
26. Stein, J. M.; LammerthHYPERLINK "<http://www.ncbi.nlm.nih.gov/pubmed?term=%22Lammer%20F%22%5BAuthor%5D>", F.; Zimmer, V.; Granzow, M.; Reichert, S.; Schulz, S.; Ocklenburg, C.; Conrads, G. Clinical Periodontal and Microbiologic Parameters in Patients with Crohn's Disease with Consideration of the CARD15 Genotype. *J. HYPERLINK "<http://www.ncbi.nlm.nih.gov/pubmed/20373538>"*PeriodontolHYPERLINK "<http://www.ncbi.nlm.nih.gov/pubmed/20373538>". 2010, 81, 535-545.
27. Owczarek D, Rodacki T, Domagała-Rodacka R, Cibor D, Mach T. Diet and nutritional factors in inflammatory bowel diseases. *World J Gastroenterol* 2016 January 21; 22(3): 895-905