

Evaluation of Systemic Antibiotic Usage in the Treatment of Periodontal Diseases among Dental Professionals in Turkey: Cross - Sectional Epidemiological Study

SUMMARY

Background/Aim: Systemic antibiotic use in periodontal diseases has increased in recent years. The purpose of this study was to investigate the antibiotic prescribing patterns for systemic antibiotics for the treatment of periodontal diseases. **Material and Methods:** A prepared questionnaire was sent to the e-mail addresses of dentists located in seven different regions of Turkey, who were requested to reply the questions online. In total, 512 emails were sent for the study, which was carried out with the participation of general dentists (GDs), periodontists (PDs), and specialist dentists (SDs). The participants were asked questions about their professional experiences, the institutions that they work for, and their antibiotic training and knowledge, their perspectives on clinical antibiotic use and antibiotic preferences in various clinical situations. **Results:** 65.5% of GDs, 23.3% of PDs, 11.6% of SDs participated in this study. In reviewing the participants' systemic antibiotic use to treat periodontal diseases, most preferred systemic antibiotics to treat acute necrotizing ulcerative gingivitis, aggressive periodontitis, diabetes associated periodontitis. Regarding antibiotic prescriptions, 40.7% of the GDs and 34.8% of the SDs prescribed 1–3 antibiotics per day. Meanwhile, 31.3% of the PDs prescribed 1–3 antibiotics a day and 31.3% 1–4 antibiotics a week ($p < 0.005$). **Conclusions:** Based on the results of this survey, shows that dentists do not have sufficient training for systemic antibiotic use and that their current approach is based on clinical experience alone. Clearer, more specific guidelines and increased post-graduate education can lead to a reduction in the negative consequences of this issue's resultant over-prescribed antibiotics.

Keywords: Antibiotics, Clinical Protocols, Guidelines, Periodontal Diseases

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ORIGINAL PAPER (OP)

Balk J Dent Med, 2022;118-126

Introduction

Antibiotics have an important place in medicine, as the true usage of antibiotics is a primary argument. The unconscious use of antibiotics can cause problems, such as bacterial resistance and infection due to resistance, increased side effects, and economic burden from drug waste¹. According to a report from the World Health Organization Antimicrobial Consumption Network², Turkey is at the top of 11 countries with

the most unconscious antibiotic use at with 40.4 DID (per defined daily doses per 1,000 inhabitants). The most prescribed antibiotics in Turkey are penicillin, cephalosporin, macrolide, and quinolone group drugs, respectively². High patient compliance and the dose applied must be well adjusted to selectively affect the invading pathogens. Although susceptibility testing for the appropriate antibiotic is critical, laboratory results may not give sufficient results, or physicians may not have the opportunity to perform this test³. Dentists must

therefore prescribe antibiotics with dosage regimens based on personal experience rather than evidence-based principles⁴. As in all medical branches, the use of antibiotics has an important place in dentistry. According to retrospective data from the Ministry of Health for the years 2011–2015, 82.4% of the drugs prescribed by dentists are antibacterial drugs⁵.

Periodontitis is a chronic disease that develops due to dental plaque and is characterized by the progressive destruction of periodontal tissues. Removing the organised dental plaque and local damaging factors are the first step of the periodontal treatment. The use of antibiotics is recommended for certain forms of periodontitis because of the infectious nature of periodontal disease and the limited results that can be achieved with conventional mechanical treatments and inadequate host immune response^{6,7}.

The European Society of Periodontology (EFP) published a new classification of periodontal disease in 2017. With the new classification, it is aimed to overcome the diagnostic inaccuracy and application difficulties, since the 1999 classification does not have a clear pathobiology-based distinction between categories. The lack of findings proving that chronic and aggressive periodontitis are two different diseases as a result of clinical, biochemical and microbiological studies conducted in the 2000s is the main factor in the change in classification⁸.

The main treatment of periodontal diseases is the removal of dental plaque and deterioration of the preparative environments, which forms phase 1 of periodontological treatment^{9,10}. This is meant to disrupt organized dental plaque with regular mechanical scaling and root planning. However, mechanical debridement may not produce sufficient antimicrobial effects due to anatomical differences and host immune response^{11,12}.

The American Academy of Periodontology (AAP)¹³ suggests the use of systemic antibiotics upon insufficient healing in the nonsurgical periodontal treatment phase. Systemically administered antibiotics have more advantages when compared to local administration, especially in their increased effects on subgingival and supragingival plaques in the saliva and gingival crevicular fluid by dispersing it into other body fluids^{14,15}.

In this study, the amount of antibiotics prescribed daily by the participants of this study and their approaches, the conditions under which they commonly prescribe antibiotics in their clinics, and the antibiotics prescribed were assessed.

Material and Methods

Study sample

A prepared questionnaire was sent to the e-mail addresses of dentists located in seven different regions

of Turkey, who were requested to reply the questions online. Written informed consent was obtained from all participants. The study protocol was conducted in full accordance with the ethical principles established in the World Medical Association Declaration of Helsinki of 1975 as revised in 2000, and approved by the Human Research Ethics Committee of Uşak University (certificate number 2019/202-4).

Questionnaire

In total, 512 e-mails were sent for the study, which was carried out with the participation of general dentists (GDs), periodontists (PDs), and specialist dentists (SDs). Overall, 206 participants were included in the study because the other e-mails were not returned. The questionnaire was created by the researchers based on the "Development of a Classification System for Periodontal Diseases and Conditions"¹⁶. The participants were asked questions about their professional experiences, the institutions that they work for, and their antibiotic training and knowledge. In addition, their perspectives on clinical antibiotic use and antibiotic preferences in various clinical situations were examined.

Data analysis

All participant groups were coded for statistical evaluation. All variables are shown as frequency-percentage. Chi-square analysis was used to determine the difference between the participating dentists' requests for antibiotic susceptibility tests and antibiotic prescriptions. The statistical analyses made were examined with an error margin of 5%. All statistics were carried out with the help of an SPSS software program (Statistical Package for Social Science, Software Version 23, SPSS Inc., Chicago, IL, USA).

Results

Participant Characteristics

65.5% of GDs, 23.3% of PDs, 11.6% of SDs participated in this study. The majority of the GDs were active dentists for more than 10 or less than 5 years, and 56.3% were employed in the private sector. The majority of SDs were active dentists for more than 5 years, and 65.2% of them worked in a health institution affiliated with the Ministry of Health. The participants who were PDs had all been active dentists for more than 5 years, and 62.5% of them worked in a health institution affiliated with the Ministry of Health (Table 1).

Table 1. Participant Characteristics

General Dentist	Graduation	Before 2009	62	45.9%
		2009-2015	15	11.1%
		After 2015	58	43.0%
	Working place	Ministry of Health Dental Centers	13	9.6%
		Private dental practice	76	56.3%
		University	46	34.1%
Specialist Dentist	Graduation	Before 2009	11	47.8%
		2009-2015	10	43.5%
		After 2015	2	8.7%
	Working place	Ministry of Health Dental Centers	15	65.2%
		Private dental practice	4	17.4%
		University	4	17.4%
Periodontist	Graduation	Before 2009	17	35.4%
		2009-2015	20	41.7%
		After 2015	11	22.9%
	Working place	Ministry of Health Dental Centers	30	62.5%
		Private dental practice	7	14.6%
		University	11	22.9%

Table 2. Participant Educational Characteristics

General Dentist	Was the education you received sufficient?	Enough	20	14.8%
		Not enough	114	84.4%
		Other	1	0.7%
	Postgraduate education	At least once	58	43.0%
		Never	77	57.0%
		Drug use for systemic disease	110	42.8%
	Topics to be covered in education	Oral surgery	67	26.1%
		Periodontology	79	30.7%
		Other	1	0.4%
		Total	257	100.0%
	Specialist Dentist	Was the education you received sufficient?	Enough	4
Not enough			19	82.6%
Other			0	0.0%
Postgraduate education		At least once	9	39.1%
		Never	14	60.9%
		Drug use for systemic disease	19	38.8%
Topics to be covered in education		Oral surgery	15	30.6%
		Periodontology	15	30.6%
		Other	1	1.1%
		Total	49	100.0%
Periodontist		Was the education you received sufficient?	Enough	5
	Not enough		43	89.6%
	Other		0	0.0%
	Postgraduate education	At least once	18	37.5%
		Never	30	62.5%
		Drug use for systemic disease	45	49.5%
	Topics to be covered in education	Oral surgery	25	27.5%
		Periodontology	20	22.0%
		Other	1	1.1%
		Total	91	100.0%

Education Characteristics

Upon examining the educational characteristics of most of the GDs, we found that they considered their antibiotics training inadequate and that 57% of the participants had not received antibiotics training again after graduation. Most of the SDs felt the training they were given was insufficient, and 60.9% had not received training at all. The majority of the PDs found their training insufficient, and 62.5% of them did not receive antibiotic training again after graduation (Table 2).

Approach to Periodontal Diseases

In reviewing the participants' systemic antibiotic use to treat periodontal diseases, most preferred systemic antibiotics to treat acute necrotizing ulcerative gingivitis, aggressive periodontitis, diabetes-associated periodontitis. The reasons for this systemic antibiotic preference were mostly to increase the effectiveness of cleaning the root surface with antibiotics and increase patient motivation. After examining the reasons for not choosing systemic antibiotics as treatment, the participants reported not preferring antibiotics in pregnancy, when they did not think that the clinical picture required antibiotic use, and when they wanted to avoid bacterial resistance, allergic reactions, or side effects.

Antibiotic prophylaxis is a controversial issue in the case of infective endocarditis. As shown in Table 3, the participants' preferred procedures for antibiotic prophylaxis in infective endocarditis cases were 2 g amoxicillin or 600 mg clindamycin 30–60 minutes before the procedure (43.7%) and to consult with medical doctors (41.7%). Most of the participants stated that in cases of infective endocarditis where prophylaxis is recommended for scaling and root planning, they will refer the patient to a PDs without treatment. The participants also answered the question, "In which situations would you recommend the use of systemic antibiotics?", with the use of systemic antibiotics in patients at risk of infective endocarditis, acute periodontal cases with systemic symptoms, and acute periodontal cases where drainage and debridement cannot be performed (Table 3).

Table 3. also summarizes the antibiotics preferred by the participants according to disease status. The participants mostly preferred metronidazole (39.9%) in necrotizing periodontal diseases, amoxicillin (40.4%) in cases of periodontal abscess, amoxicillin (40.8%) for modified periodontitis with systemic diseases, amoxicillin+metronidazole (34.2%) in periodontal lesions combined with endodontic lesions, and amoxicillin+metronidazole (27.3%) for aggressive periodontitis. In the evaluations made, most of the participants did not request antibiotic sensitivity tests. No statistically significant relationship was found between the request for an antibiotic susceptibility test and the title ($p>0.005$).

Question	N	%	
In which periodontal diagnoses would you recommend the use of systemic antibiotics?	ANUG	115	22.8%
	Chronic periodontitis	10	2.0%
	Aggressive periodontitis	109	21.6%
	Diabetes-associated periodontitis	107	21.2%
	Periodontal abscess	92	18.3%
	Combined periodontic-endodontic lesions	71	14.1%
For what reasons do you use systemic antibiotics in periodontal treatment?	Antibiotic-assisted root planing	90	36.7%
	For economic reason	3	1.2%
	As a new treatment option	22	9.0%
	To eliminate the need for surgical treatment	23	9.4%
	To increase patient satisfaction and motivation for treatment	55	22.4%
Why wouldn't you prefer to use antibiotics in your periodontal treatments?	Other	52	21.2%
	Bacterial resistance, allergic reaction or side effect	136	26.7%
	Socio-economic reasons	16	3.1%
	Due to interaction with other drugs due to general health problems	95	18.7%
	Pregnancy	110	21.6%
If infective endocarditis prophylaxis is indicated in patients who have undergone periodontal therapy;	The clinical picture does not require the use of drugs	148	29.1%
	Other	4	0.8%
	2g amoxicillin or 600 mg clindamycin 30-60 minutes before the procedure	131	43.7%
	30-60 minutes before the procedure 2g IM or IV ampicillin or 1 g cefazolin	33	11.0%
	Oral antiseptic before the procedure	6	2.0%
In case of infective endocarditis prophylaxis in patients undergoing dental calculus cleaning;	Consultation with medical doctor	125	41.7%
	None. I practice.	5	1.7%
	I direct it to a periodontologist without any treatment.	87	42.0%
	I apply tetracycline along with the treatment, I do not give prophylaxis	4	1.9%
	I apply tetracycline along with the treatment, I give prophylaxis on the day of the procedure.	42	20.3%
In which cases would you recommend the use of antibiotics?	Tetracycline is applied for the first 2 weeks after the diagnosis, and I give routine endocarditis prophylaxis on the day of the procedure.	47	22.7%
	None	27	13.0%
	Phase 1 periodontal therapy as an adjunct	25	2.7%
	In acute periodontal cases where drainage and debridement cannot be achieved	141	15.0%
	In acute periodontal cases where the infection spreads locally	70	7.4%
	Acute periodontal conditions with systemic effects	174	18.5%
	Cases at risk of infective endocarditis	174	18.5%
	In chronic periodontal diseases where the oral hygiene level of the individual is insufficient	20	2.1%
	Support for initial or advanced periodontal treatment in tobacco smoking patients	3	0.3%
	Non-surgical treatments for pocket elimination in aggressive periodontitis patients	61	6.5%
If biomaterial will be applied in periodontal surgical treatment or implant treatment	Surgical treatments for pocket elimination in aggressive periodontitis patients	92	9.8%
	In the presence of additional systemic disease predisposing periodontal disease such as diabetes	40	4.3%
	If implant will be applied in a patient who has undergone periodontal treatment	41	4.4%
	Other	2	0.2%

Question		N	%
Please mark the antibiotic group you prefer in necrotizing periodontal diseases.	Amoxicillin	65	21.5%
	Tetracycline	62	20.5%
	Metronidazole	121	39.9%
	Clindamycin	19	6.3%
	Azithromycin	7	2.3%
	Spiramycin	10	3.3%
	Other	19	6.3%
Please mark the antibiotic group you prefer for periodontal abscess.	Amoxicillin	114	40.4%
	Tetracycline	33	11.7%
	Metronidazole	64	22.7%
	Clindamycin	24	8.5%
	Azithromycin	4	1.4%
	Spiramycin	10	3.5%
	Other	33	11.7%
Please mark the antibiotic group you prefer in chronic periodontitis.	Amoxicillin	42	16.9%
	Tetracycline	23	9.2%
	Metronidazole	24	9.6%
	Clindamycin	16	6.4%
	Azithromycin	4	1.6%
	Spiramycin	5	2.0%
	Other	135	54.2%
Please mark the antibiotic group you prefer in periodontitis modified by systemic disease.	Amoxicillin	115	40.8%
	Tetracycline	27	9.6%
	Metronidazole	35	12.4%
	Clindamycin	23	8.2%
	Azithromycin	8	2.8%
	Spiramycin	8	2.8%
	Other	66	23.4%
Please mark the antibiotic group you prefer in combined periodontic-endodontic lesion.	Amoxicillin	55	20.4%
	Tetracycline	13	4.8%
	Metronidazole	19	7.1%
	Clindamycin	11	4.1%
	Amoxicillin+Metronidazole	92	34.2%
	Metronidazole+ Ciprofloxacin	9	3.3%
	Spiramycin+Metronidazole	11	4.1%
Other	59	21.9%	
Please mark the antibiotic group you prefer in aggressive periodontitis	Amoxicillin	28	10.3%
	Tetracycline	66	24.4%
	Metronidazole	34	12.5%
	Clindamycin	12	4.4%
	Azithromycin	7	2.6%
	Spiramycin	5	1.8%
	Amoxicillin+Metronidazole	74	27.3%
	Metronidazole+ Ciprofloxacin	9	3.3%
Other	36	13.3%	

Table 4. Characteristic of Dentists to Prescribe Antibiotics

	None	1-3 per day	>4 PER DAY	1-4 PER WEEK	1-4 PER MONTH
General dentist	1 (0.8%)	55 (40.7%)	49 (36.3%)	20 (14.8%)	10 (7.4%)
Specialist dentist	0 (0.0%)	8 (34.8%)	5 (21.7%)	7 (30.4%)	3 (13.0%)
Periodontist	1 (2.1%)	15 (31.3%)	6 (12.5%)	15 (31.3%)	11 (22.9%)

Pearson's chi-square test = 22.512; $p = 0.004$

Amount of Antibiotics Prescribed

Regarding antibiotic prescriptions, 40.7% of the GDs and 34.8% of the SDs prescribed 1–3 antibiotics per day. Meanwhile, 31.3% of the PDs prescribed 1–3 antibiotics a day and 31.3% 1–4 antibiotics a week. There is thus a statistically significant relationship between dentistry specialty and antibiotic prescription. When examined according to dentistry specialty, the rate of GDs prescribing 4 or more antibiotics per day was higher than that of SDs ($p < 0.005$; Table 4).

Discussion

Systemic antibiotic use in periodontal diseases has increased in recent years^{17,18}. However, correct and effective antibiotic use has not yet been standardized. So, it is currently based on clinical experience. This is because of limited information and data about antibiotic procedures¹⁸. In general, upon analyzing our participants' education levels, we discovered that they found their training insufficient. The participants who received antibiotic training after their undergraduate education also constituted a minority. This approach can be interpreted as an insufficiency of educational programs and dentists' lack of interest in existing programs.

The possibility of bacteremia in dental procedures and routine daily activities should be kept in mind. According to a report published by the American Heart Association (AHA)¹⁹ and the European Society of Cardiology²⁰ prophylactic antibiotic administration is recommended for high-risk patients. However, the UK Ministry of Health's National Institute for Health and Care Excellence advised halting antibiotic administration for all patients and procedure¹⁸. Accordingly, antibiotic prophylaxis is a controversial issue²¹, as the opinion that the negative effects of antibiotic use will be greater than its potential benefits is often questioned. The AHA¹⁹ further recommended infective endocarditis prophylaxis with 2 g of amoxicillin 30–60 minutes before the procedure for high-risk groups and 600 mg of clindamycin 30–60 minutes before the procedure for patients with a penicillin allergy. Our participants' general approach to antibiotic prophylaxis was administering 2 g of amoxicillin or 600 mg of clindamycin (43.7%) 30–60 minutes before the procedure. In addition, 41.7% of the participants preferred to consult with medical doctors. This situation was interpreted as the participants preferring to administer prophylaxis to minimize the risk of possible bacteremia.

Necrotizing periodontal disease features destructive lesions characterized by punch-hole ulcers,

pseudomembrane formation and necrotic papillae. Its predisposing factors are systemic diseases, malnutrition, smoking, poor oral hygiene, and stress. The disease is usually associated with suppressed host resistance and some studies reports that necrotizing periodontal disease may be the first sign of Human Immunodeficiency Virus (HIV)^{22,23}. Acquired immunodeficiency syndrome (AIDS) is a disease that causes a decrease in CD4+ T lymphocytes as a result of HIV infection and seriously depletes the immune system²⁴.

The aim of the disease's treatment is primarily a palliative approach to eliminate painful and disruptive general conditions that prevent the patient from eating. Treatment of necrotizing periodontal diseases should be done gradually. First of all, acute phase treatment should be done. The aim of this treatment is to stop the disease process and tissue destruction and to eliminate the general discomfort and pain that interferes with nutrition. For this purpose, ultrasonic debridement and cleaning of necrotic lesions with local application of oxygen should be ensured. It can heal without sequelae with mechanical debridement and effective medical treatment. Antimicrobial agents can be used for systemic effects where debridement is insufficient²⁵. According to one study, metronidazole is an effective antibiotic option against spirochetes and considered the first choice for necrotizing periodontal diseases²⁶. Our participants also preferred metronidazole for the treatment of necrotizing periodontal disease. This approach is interpreted as the participating dentists preferring agent-based treatment.

Periodontal abscesses as seen in patients with periodontitis are an indicator of acute tissue destruction. Periodontal abscesses may occur after foreign body reactions, mechanical treatments, or antibiotic use without mechanical treatment. The use of antibiotics in periodontal pockets is controversial. First, mechanical debridement and drainage are usually sufficient to heal periodontal abscesses. Researchers recommend the use of systemic antibiotics if there are signs of systemic involvement such as lymphadenopathy, fever, malaise, or if the infection is not well localized²⁷. Herrera *et al.*²⁸ compared amoxicillin and azithromycin in the treatment of periodontal abscesses and reported positive results in both groups. Smith and Davies²⁹ also suggested systemic metronidazole as a treatment protocol, stating that it should be supported by mechanical treatment after the dissolution of the acute phase. Our participants preferred prescribing amoxicillin for acute periodontal abscesses. This preference was evaluated as the prevalence of an empirical approach to abscess treatments. The differential diagnosis of endodontic and periodontal diseases can sometimes be difficult, but accurate diagnosis is very important to provide appropriate treatment. Treatment should be based on the primary source of the lesion. If the primary lesion originates from endodontics, for

instance, the patient should undergo a root canal, but if the primary lesion is of periodontal origin, periodontal treatment must be completed first. The approach to true combined lesions should resemble a primary endodontic lesion³⁰. Our study participants' antibiotic approach was generally in favor of the combined use of amoxicillin and metronidazole. The reason for this is thought to be that the participants were directed to combined therapies to expand the spectrum of antibiotics used.

Many researchers have evaluated systemic antibiotic use in patients with advanced periodontal destruction. Herrera *et al.*³¹ showed that combined amoxicillin-metronidazole use and only spiramycin as an additive to phase I treatment are very meaningful in decreasing periodontal pocket depth. In a systemic review by Haffajee *et al.*³² the researchers observed that the combination amoxicillin-metronidazole, only metronidazole, and only tetracycline gave good results. These researchers' indirect evidence also suggested that antibiotic intake should begin on the day debridement is completed and stop in a short time; however, the dosage and duration of antibiotic use are still uncertain³³. When we evaluated the approach to chronic periodontal patients in our study, we observed that most of the participants did not prefer antibiotic use. Those who did favor antibiotic use preferred amoxicillin, metronidazole, and tetracycline, respectively. For patients diagnosed with aggressive periodontitis, the systemic antibiotic preference was an amoxicillin-metronidazole combination, tetracycline, and metronidazole, respectively. This situation was associated with the participating dentists' preference for a broad spectrum of antibiotics to treat aggressive periodontitis.

The use of systemic antibiotics is not essential for all periodontitis patients, and a case-based approach should be utilized in addition to phase I treatment^{34,35}. Our participants preferred the use of systemic antibiotics in acute conditions with systemic symptoms, for patients at risk of infective endocarditis, and acute periodontal cases where drainage and debridement cannot be performed; however, they were cautious about using systemic antibiotics due to bacterial resistance, allergic reactions, or side effects.

Today, the irrational use of antibiotics causes biological and economic damage. The detection of the pathogen and the correct selection of antibiotic procedures should be based on laboratory findings for proper treatment planning^{36,37}. In our study, 87.4% of the participants did not request an antibiotic sensitivity test. When we examined this distribution according to profession, there was no statistically significant relationship between the branches of dentistry. The participants' preference in this regard is thus associated with difficulty in accessing the kits required for sensitivity testing.

Antibiotic use has an important place in dentistry. The Ministry of Health conducted a retrospective study in Turkey, of which the results were antibacterial drugs constituting 82.4% of prescriptions in dentistry. In addition, the number of antibacterial drugs per prescription was given as 1.01 in another published report⁵. In our study, we found that the participating dentists prescribed 1–3 antibacterial medications a day. However, when we examined the distribution by profession, the rate of GDs prescribing 4 or more antibiotics per day was higher than that of dentists with specialist training. This situation is attributed to the fact that the dentists who followed specialist training formed their clinical experiences with supporting scientific data. The distribution of the dentistry groups was not homogenous, which proved a limitation of this study. In addition, not being able to fully determine the attitudes and prejudices of the participants in the online study is among its other limitations.

Our study illustrates dentists' use of systemic antibiotics to treat periodontal disease and form treatment approaches in Turkey. It also shows that dentists do not have sufficient training for systemic antibiotic use and that their current approach is based on clinical experience alone. It should not be forgotten that a rational antibiotic approach can be achieved with sufficient education for dentists. In addition, the absence of a comprehensive professional guidelines for dentist antibiotic selection may take the dentist to use randomized or uncertain antibiotic.

Conclusions

Based on the results of this survey, shows that dentists do not have sufficient training for systemic antibiotic use and that their current approach is based on clinical experience alone. Clearer, more specific guidelines and increased post-graduate education can lead to a reduction in the negative consequences of this issue's resultant over-prescribed antibiotics.

Acknowledgments. The authors report no conflicts of interest related to this study.

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Conflict of Interests: Nothing to declare.

Financial Disclosure Statement: Nothing to declare.

Human Rights Statement: All the procedures on humans were conducted in accordance with the Helsinki Declaration of 1975, as revised 2000. Consent was obtained from the patient/s and approved for the current study by national ethical committee.

Animal Rights Statement: None required.

Received on May 26, 2021.

Revised on September 19, 2021.

Accepted on September 24, 2021.

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