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Evaluation of Periodontal Parameters Among Infertile Men Undergoing Periodontitis Treatment: A Retrospective Study

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Abstract

Background and Objectives: Periodontitis has been linked to idiopathic male infertility and impairment of semen values. However, data on the role of periodontal treatment in sperm parameter outcomes as well as the identification of the value of clinical periodontal infection predictors (BOP, PD, and CAL) as composite measures following active periodontitis therapy are limited. This study aimed to evaluate the role of periodontitis treatment in infertile men and its impact on semen quality.

Methods: 58 infertile patients with semen abnormalities underwent treatment of periodontitis. Clinical periodontal and andrological examinations were conducted for all participants. Clinical periodontal parameters (PD, BOP, and CAL) were measured for all participants. The outcome was assessed by improvement in semen parameters.

Results: A significant increase in the median BOP, PD, and CAL of periodontitis patients compared to the observation group was demonstrated ($p < 0.05$). After a follow-up of 34.05 months, a significant change in the median BOP, PD, and CAL was observed after treatment ($p < 0.05$). Moreover, a significant improvement was noted in median sperm concentration, motility, and morphology in 21 (36.2%) patients. Additionally, a significant negative correlation was found between the longer BOP, deeper PD, and higher CAL and treatment outcomes in terms of semen values. Based on multivariate analysis, higher CAL was a significant predictor of semen outcomes.

Conclusions: Treatment of periodontitis can significantly improve seminal parameters in infertile men with semen abnormalities. Moreover, the higher CAL in infertile periodontitis men may be a feature of high risk of infertility.

Keywords: Periodontitis; Parameters; Infertile Men; Semen Abnormalities; Treatment

Abbreviations

BOP: Bleeding on probing, **CAL:** Clinical attachment loss, **PD**: Probing depth

Introduction

Periodontitis is one of the most common chronic inflammatory progressive destructive diseases of the tooth supportive periodontal tissues, with an overall prevalence ranging from 47% to 70% in adults [1, 2]. Periodontitis, if left untreated, may lead to tooth loss in adults and ultimately result in edentulism, which has been found to have a negative impact on an individual's quality of life, overall health, and involvement in a variety of systemic conditions and diseases. Furthermore, periodontal disease can negatively influence fertility outcomes [3-6].

The relationship between untreated periodontal disease (focal oral infections) and male reproductive health, in terms of semen quality, has been investigated [7-11]. Whereas several studies confirmed an association between bacterial colonies in dental foci and idiopathic infertility, reflected by abnormal semen parameters [7]. To date, the number of clinical studies on periodontitis and male infertility is small. Furthermore, the impact of periodontal disease on sperm quality is debatable [11].

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Periodontal treatment aims to control the infection and arrest the progression of the disease. Many procedures have been used for periodontal treatment, such as scaling and root planning, supragingival and subgingival instrumental therapy by hand or powered instruments, and surgical treatment. The clinical benefit of periodontal treatment has been established in the term of eliminating residual pockets through a conservative, resective, or regenerative approach [12-14].

Furthermore, periodontal clinical parameters such as bleeding on probing (BOP), probing depth (PD), and clinical attachment loss (CAL) have emerged as important markers for IVF infertility treatment [8-10, 15-18]. Some authors suggest that there is a clinical correlation between periodontitis, defined as a chronic, progressive, and destructive disease, and periodontal inflammatory activation, which results in increased periodontal parameters [1, 19]. So, periodontal parameters might be useful as a clinical marker for infertile male patients.

To our knowledge, however, the effects of periodontal treatment on sperm quality outcomes in infertile patients have never been studied. The current study aims to investigate the relationship between periodontal parameters and the outcome of periodontitis treatment in infertile patients with sperm abnormalities.

Patients and Methods

Study design

This was a retrospective cohort study based on the medical and dental records of patients referred by their Andrologist for a dental examination before periodontal treatment initiation. This study was followed up at the Oral Medicine and Periodontology Department of British Hospital in Cairo, Egypt, between March 2019 and November 2025.

Sample Size

The sample size was calculated using the formula, n=2(Za + Zb)2 [s]2/d2, where Za is the z variate of alpha error i.e. a constant with value 1.96, Zb has a value of 0.82, considering the mean and standard deviation from the literature. Based on these data and with an alpha =0.05, it was estimated that 32 subjects per group were necessary to achieve 95% statistical power of the study.

Study participants

The data of a total of 413 infertile patients were retrospectively analyzed. From these infertile men, only subjects with periodontal disease were selected. From this periodontal infertile group, fifty-eight (58) patients were diagnosed with abnormal sperm values and underwent periodontal treatment for periodontitis. Forty-five (45) periodontal disease patients with abnormal sperm values who did not undergo any surgical intervention or medical treatment were included as controls. Control subjects were randomly selected from a group of untreated infertile periodontal patients. Age was similar between the previous two groups. The control group had the same exclusion criteria as the case group.

All participants underwent completed clinical examination, followed by a clinical periodontal examination without performing X-rays. In addition, all patients underwent andrological examinations. The Scrotal Doppler Ultrasonography examination of the testis was performed. No information about the andrological status of the patient was known to the dentist at the time of the dental examination.

Inclusion criteria

Patients (aged 19-46) with complaints of idiopathic infertility and abnormal semen values were initially enrolled in the study. Patients with periodontal disease were recruited as samples, and a minimum of 16 natural teeth were required. Patients were included after exclusion of periodontal therapy administered within the previous 3 months, as well as the use of systemic antibiotics, steroids, or nonsteroidal anti-inflammatory medicines within 30 days of study enrollment. Also, those who would require antibiotic coverage for periodontal examinations were not enrolled.

Exclusion criteria

Infertile patients were included after excluding varicocele, other urogenital diseases (undescended testes, testicular microlithiasis, hypogonadism, genital infection), erectile dysfunction medications, genetic disorders, chronic infectious disease, exposure to gonadotoxins, smoking, sperm antibodies, vascular diseases, obesity, endocrinological (e.g., diabetes) and internal diseases. Patients with azoospermia and sperm concentration $<1 \times 10^6$/mL were also excluded. Patients who refused physical examination and other testing were also excluded. The female's partners were also investigated for exclusion of the others causes of infertility, such as ovulatory problems, or tubal obstruction.

Laboratory analysis

Semen analysis was performed according to WHO criteria (2010) [20]. The total sperm concentration (million/mL), the percentage of motile sperm, and the percentage of abnormal forms were assessed. Semen parameters were evaluated before and at least 6 months after periodontitis treatment.

Clinical dental and periodontal examination

The presence of caries, radices, missing teeth, and fillings were recorded. No X-rays were taken. All subjects had full-mouth (except third molars) periodontal probing and charting using a plane mirror and manual periodontal probe (Hu-Friedy PCP2™). The wisdom teeth and those radices were removed from periodontal charting when probing depth (PD) could not be measured [18].

The diagnosis of periodontitis was based on the Centers for Disease Control (CDC)/American Academy of Periodontology (AAP) case definitions for the surveillance of periodontitis [21]. The periodontal clinical parameters recorded were bleeding on probing (BOP), probing depth (PD), and clinical attachment loss (CAL). BOP was determined to be positive if bleeding occurred within 15 seconds after probing at any site of the tooth and was recorded dichotomously [15]. At six sites on each tooth, PD was measured from the gingival margin to the most apical penetration of the probe (mesiobuccal, midbuccal, distobuccal, mesiolingual, midlingual, and distolingual). The PD measurements were recorded in millimeters and were rounded down to the nearest full millimeter. CAL parameter recorded was the number of sites with CAL ≥1 mm. CAL was measured at six sites per tooth (mesiobuccal, buccal, distobuccal, distolingual, lingual, and mesiolingual). Both PD and CAL parameters were recorded using a millimeters-scale Michigan periodontal probe (Hu-Friedy, Chicago, IL, USA) [22]. One examiner (RG), who is experienced in periodontal charting and is blinded to the fertility of patients with periodontitis, performed all dental examinations.

Outcome Measures

The primary outcome measure was the improvements in seminal reference values during follow-up. The secondary outcome examined

the correlation of periodontal clinical parameters (PD, BOP, CAL) values in infertile patients with periodontitis clinical findings and considered the patients' data from the medical reports, which included the following: the severity of periodontitis, the site of periodontitis and other periodontitis clinical findings.

Data Analysis

IBM SPSS version 24.0 (Armonk, NY) was used to analyze the data. Continuous variables were tested for the normality of distribution with the Kolmogorov-Smirnov test. Depending on the distribution state, data were reported as means (with standard deviation [SD] or medians (interquartile range [IQR]). Differences in the intergroup means data were compared using the student's t-test, when the data was normally distributed. For parameters with an abnormal distribution, the non-parametric Mann-Whitney U test was used for comparing intergroup medians data. Categorical variables with groups were analyzed using Chi-squared testing. The correlation between the sperm parameters and periodontal clinical parameters was determined by using Spearman rank correlations. The data were presented using the odds ratio (OR) and a 95% confidence interval. A univariate analysis was initially utilized for the detection of the predictors, and the log rank test was performed. Multivariate analysis was also done using Cox's proportional hazards model to identify the independent predictors. A p-value of 0.05 was the level for a statistically significant difference.

Results

General characteristics

The demographic data of fifty-eight (58) patients is summarized in Table 1. The median [interquartile range] age in the periodontal disease group and observation groups was 34.71 (IQR: 31.21-35.69) years vs. 35.67 (IQR: 31.26-36.93) years, respectively. Ten (17.2%) and 48 (82.8%) patients had moderate and severe periodontitis, respectively. In addition, 49 (84.5%) were classified as having localized periodontitis and 9 (15.5%) had generalized periodontitis.

All the patients underwent periodontal treatment (19 flap surgery, 26 soft tissue grafts, 11 bone grafting, and 2 conservative treatment). The median postoperative follow-up period was 34.05 (IQR: 29.75-37.74) months (Table 1).

Clinical periodontal parameters

In periodontitis patients, the medians of BOP, PD, and CAL were 17 (IQR: 3.0-9.0) mm, 3.20 (IQR: 2.9-3.70) mm, and 5.7 (IQR: 3.9-6.3) mm, respectively. Patients with periodontitis showed significantly higher BOP, PD, and CAL medians than the control group ($p < 0.05$).

A significant change in the median BOP, PD, and CAL was observed following periodontal treatment during the follow-up period (p = 0.002, p = 0.018; and p = 0.000, respectively).

Semen analysis characteristics

Table 2 shows the periodontal clinical parameters and seminal parameters before and after treatment. Semen analysis after periodontitis treatment showed a significant improvement in sperm concentration (26.56 *vs.* 13.96 x 10^6 /mL, p <0.009), progressive motility (32 *vs.* 29%, p< 0.022), and normal sperm morphology (9 *vs.* 3, p< 0.001) (Table 1). Semen parameters were significantly increased in 21 (36.2%) patients.

Significant correlation between the severity of periodontitis, site of periodontitis, periodontal parameters (BOP, PD, and CAL), and abnormal semen values (p=0.017, p= 0.050; p= 0.000, p= 0.000, p= 0.002, p= 0.000).

Table 1: Patient's demographic and clinical data.

	Patient group	Control group
Numbers of patients	58	45
Age at presentation, yrs*	34.71 (31.21-35.69)	35.67 (31.26-36.93)
Follow-up, months*	34.05 (29.75-37.74)	
Severity of periodontitis		
Mild	-	50 (86.2%)
Moderate	10 (17.2%)	6 (10.3%)
Severe	48 (82.8%)	2 (3.4%)
Site of Periodontitis		
Localized	49 (84.5)	44 (97.8%)
Generalized	9 (15.5%)	1 (2.2%)
PD (probing depth)		
<3 mm	11 (19%)	29 (64.4%)
≥3 mm	47 (81%)	16 (35.6%)
BOP (bleeding on probing)		
< 15s	12 (20.7%)	34 (75.6%)
≥ 15s	46 (79.3%)	11 (24.4%)
CAL (clinical attachment loss)		
< 4 mm	20 (34.5%)	37 (82.2%)
≥4 mm	38 (65.5%)	8 (17.8%)
Treatment approaches		
Flap surgery	19 (32.7%)	-
Soft tissues grafts	26 (44.8%)	-
Bone grafting	11 (19 %)	-
Conservative treatment	2 (3.5%)	-

Values are presented as median (interquartile range, IQR)

Improvement of the semen parameters is negatively correlated with longer BOP, deeper PD, and higher CAL (r = -0.617, p <0.001; r = -0.382, p <0.003; r = -0.336, p <0.007; respectively).

Multivariable logistic regression analysis

A multivariable logistic regression model for the outcome was constructed and included all 5 predictors (periodontal parameters (BOP, PD, and CAL), severity, and site of periodontitis). Based on this model, CAL (p = 0.001, odds ratio (OR) = 10.424, 95% confidence interval (CI): 1.710–8.981) was a significant predictor of the improvement of semen parameters.

Discussions

Although periodontitis has been linked to the significant impairment of semen parameters, particularly decreased sperm concentration and motility in 19-25% of infertile men [18], previously published reports have not clarified the role of treatment and periodontal parameters (BOP, PD, and CAL) in periodontitis patients and their correlation with semen parameters in infertile patients with abnormal semen values. In the current study, BOP, PD, and CAL parameters have proved to have a role in terms of their correlation with the improvement of the semen parameters following periodontitis treatment.

Moreover, in this study population, poor semen values were

Table 2: Changes in semen parameters and periodontal clinical parameters of the studied group before and after periodontal treatment.

	Patient group			Control group	
	Before treatment	After treatment	‡P-value		*P-value
Sperm concentration (million/mL)	13.96 (12.6-27.1)	26.56 (15.12-34.82)	0.009	22.26 (18.22-32.95)	0.006
Progressive sperm Motility (%)	29 (20-29.50)	32 (30-54)	0.022	31 (31-75)	0.047
Sperm morphology (% of normal)	3 (3-25.50)	9 (3-14.50)	0.001	13 (3-19)	0.000
PD (probing depth)	3.20 (2.9-3.70)	2.10 (1.2-3.1)	0.018	2 (1.0-3.1)	0.032
BOP (Bleeding on probing)	17 (3.0-9.0)	7 (3-9)	0.002	5 (3-12)	0.041
CAL (Clinical attachment loss)	5.7 (3.9-6.3)	2 (1.3-4.2)	0.000	0.9 (0.25-3.8)	0.036

‡P-value (Comparison between two patient groups)
*P-value (Comparison between patient group before treatment and control group
Values are presented as median (interquartile range, IQR)

Table 3: Univariate analysis of prognostic factors.

Variable	X^2	*P value
BOP (Bleeding on probing)	9.283	0.002
PD (Probing depth)	6.184	0.013
CAL (Clinical attachment loss)	12.143	0.000
Severity of periodontitis	0.010	0.921
Site of periodontitis	1.478	0.224

*Logrank test

found to be significantly correlated with periodontal parameters (BOP ≥15s, PD ≥3 mm, and CAL ≥4 mm at least at one site), as well as the severity and position of periodontitis. Furthermore, the results of this study confirmed that BOP, PD, and CAL are the most important periodontal parameters, as BOP is a predictor of periodontal inflammation [23], and a PD (deep periodontal pockets) is considered a "critical probing depth" [24], while CAL is a marker of periodontal inflammatory damage [10, 18]. Similarly, a previous study found that patients with oligo-asthenozoospermia had a significantly higher average number of teeth with calculus than patients with normospermia [11], However, Klinger et al [9] found no such association with oligozoospermia or normozoospermia. Moreover, urban residency and a history of gingival bleeding when brushing teeth were predictors of sperm impairment [15].

There are a limited number of publications that indicate a correlation between the treatment of poor oral health status and male fertility problems [7]. They found that patients who received antibiotic treatment had an effect on the spermiogram through the elimination of bacteriospermia [15, 17]. In these previously published reports, they found a significant improvement in bacteriospermia levels and sperm parameters (motility, density, and morphology) after dental and periodontal treatment in the patient group compared with the untreated controls, in accordance with our results. These studies suggested that oral periodontal pathogens could penetrate the epithelial barrier of periodontal tissue and enter the blood circulation, causing bacteraemia and bacteriospermia. Furthermore, a previous study found a link between antibiotic-resistant bacteriospermia and the presence of localized dental bacterial colonies caused by oral bacteriaemia [7]. Another study, however, demonstrated no link between the presence of bacteria in semen and sperm parameters [25]. Moreover, in this report, we found that significant improvement in post-treatment sperm parameters is negatively correlated with longer BOP, deeper PD, and higher CAL. So, BOP, PD, and CAL represented a significantly higher risk of unexplained male infertility, which is a novel finding in the literature. Furthermore, BOP and PD are important predictors in assessing the risk of periodontitis recurrence and activity [26]. Plaque amount is another factor associated with the progression of chronic periodontitis [27].

Additionally, CAL was shown as an independent risk factor for sperm quality. Those patients with a higher CAL had a very low chance of improving their sperm parameters. CAL primarily reflects many previous periodontal processes and may have a noninfectious origin (e.g., improper brushing and flossing technique). Based on this finding, we provide another evidence for the role of periodontal parameters, induced by periodontitis destructive damage, in the pathophysiology of infertility [18]. It is noteworthy that higher CAL values have a correlation with periodontitis severity and localization in this study. Therefore, there may be a pathological link between the outcome of periodontitis treatment and high CAL. Consequently, the CAL can play a role as a clinical marker for the severity of periodontitis. However, several published reports have documented that PD is a predictive factor for developing periodontal diseases such as infertility.

In addition to the aforementioned direct pathogenesis mechanism via bacteriemia, several pathological mechanisms have been postulated to explain how periodontal inflammation influences the impairment of semen quality. Periodontal oral pathogens can have a remote pathogenic effect by inducing the production of several circulating cytokines (TNF-α, interferon-γ, and interleukin (IL)-1b) [28], by activating macrophages in periodontal tissues and releasing numerous cytokines into the circulatory system [29].

Similar inflammatory molecules, including tumor necrosis factor-alpha (TNF-a), transforming growth factor-β3, interferon (IFN-g), and interleukin-1 and 6, have also been found in infertile periodontal males. These molecules can disturb the dynamics of the blood-testis barrier by inhibiting protein degradation, which impacts the function of Sertoli cells [25]. In addition, immunoinfertility is one of several causes of human infertility. The immunological response to heat shock proteins (HSPs) and antisperm antibodies (ASA) in cases of silent male genital tract infection and infertility has also been shown in seminal plasma that might affect sperm motility [30].

Despite the relatively low numbers (12%) of non-improvement semen parameters after periodontal treatment in our study, this value should be considered as acceptable positive result for statistical correlation with periodontal parameters.

Nevertheless, it is important to acknowledge the limits of this study. The number of participants might have been larger. Unlike the other articles, which included and investigated patients with

bacteriospermia in their analyses, we selected patients in this study who had idiopathic infertility. Therefore, further longitudinal cohort studies and well-designed randomized control trials are required to investigate the link between these factors. The study did not address the common risk factors associated with male infertility and periodontal disease, such as smoking, caries status, alcohol consumption, and general diseases like diabetes. As a result, the findings must be evaluated with caution and interpreted carefully.

This report lacked radiographs, which would have allowed for more accurate measurement of periodontal parameters including chronic periapical lesions and CAL [18]. Moreover, there is a need to adjust the slightly different normal ranges for the values of the clinical periodontal parameters. Also, other markers of inflammatory circulating cytokine levels (e.g., TNF-α, IFN-γ, Il-1, and IL-6), which can impact blood–testis permeability, may also be investigated and evaluated in future studies with CAL [27].

Despite these limitations, we explore in this study the relationship between semen abnormalities and periodontitis. Thus, it can be concluded that certain periodontal health conditions (BOP, PD, and CAL) are linked to men's semen parameters, particularly semen concentration, motility, and morphology. Another important factor that may be associated with impaired sperm quality is the severity and localization of periodontitis. In addition, our findings also indicate that a higher CAL level in the group with periodontitis is a bad prognostic factor, which is linked to the spermiogram parameters. Therefore, CAL was recorded as one of the periodontal health parameters.

Conclusions

In conclusion, this study shows that periodontal treatment is an effective procedure, which is associated with improvement in sperm parameters in infertile men with periodontitis. Based on our results, it is emphasized that dental specialists and general practitioners detecting oral periodontal diseases in infertile males should refer the patient to an andrologist for further evaluation and treatment. Therefore, patients undergoing andrological examination while attempting to conceive should receive a comprehensive oral evaluation.

Conflict of Interest

None of the contributing authors have any conflict of interest, including specific financial interests or relationships and affiliation relevant to the subject matter or materials discussed in the manuscript.

Approval of the Study

The Institutional Review Board of the British University in Egypt's Faculty of Dentistry authorized the research procedure, which was conducted in accordance with the Helsinki Declaration's tenets (24-060). As per the reference methodology, this research involves human subjects and is non-interventional. Additionally, at enrollment, each participant provided written, informed consent.

Contribution of Each Co-author

Rim M. Ghanem and Mazen A. Ghanem contributed to the design, data curation, writing (original draft), validation, and coordination of the study. **Ahmed M Ghanem and Dalia M. Ghalwash** performed project administration, data collection, methodology, supervision, and writing. **Manal A. Safan** was responsible for investigation especially laboratory analysis, data curation, supervision, and writing. All authors read, edited, and approved the final manuscript.

References

1. D'Aiuto F, Nibali L, Parkar M, Patel K, Suvan J, Donos N. Oxidative stress, systemic inflammation, and severe periodontitis. J Dent Res. 2010; 89: 1241–1246.
2. Demmer RT, Papapanou PN. Epidemiologic patterns of chronic and aggressive periodontitis. Periodontol. 2000. 2010; 53: 28–44.
3. Vavricka SR, Manser CN, Hediger S, Vögelin M, Scharl M, Biedermann L, et al. Periodontitis and gingivitis in inflammatory bowel disease: a case-control study. Inflamm Bowel Dis. 2013: 19; 2768-2777.
4. França LFC, Vasconcelos ACCG, da Silva FRP, Alves EHP, Carvalho JS, Lenardo DD, et al. Periodontitis changes renal structures by oxidative stress and lipid peroxidation. J Clin Periodontol. 2017; 44(6): 568–576.
5. Botelho J, Machado V, Proença L, Bellini D, Chambrone L, Alcoforado G, et al. The impact of nonsurgical periodontal treatment on oral health-related quality of life: A systematic review and meta-analysis. Clin Oral Investig. 2020; 24(2): 585-596.
6. Ricci E, Ciccarelli S, Agnese Mauri P, Gerli S, Favilli A, Cipriani S, et al. Periodontitis, female fertility and conception (Review). Biomed Rep. 2022 Sep 13; 17(5): 86. doi: 10.3892/br.2022.1569. eCollection 2022 Nov.
7. Bieniek KW, Riedel HH. Bacterial foci in the teeth, oral cavity, and jaw–Secondary effects (remote action) of bacterial colonies with respect to bacteriospermia and subfertility in males. Andrologia. 1993; 25(3): 159–162.
8. Zhu C, Qin Z, Huang H, Xiangguang LI, Feng Y. The correlation study between male infertility and chronic periodontitis. China Modern Medicine. 2010; 29: 8.
9. Klinger A, Hain B, Yaffe H, Schonberger O. Periodontal status of males attending an *in vitro* fertilization clinic. J Clin Periodontol. 2011; 38(6): 542–546.
10. Nwhator SO, Umeizudike KA, Ayanbadejo PO, Opeodu OI, Olamijulo JA, Sorsa T. Another reason for impeccable oral hygiene: Oral hygiene-sperm count link. J Contemp Dent Pract. 2014; 15(3): 352–358.
11. Pásztor N, Kárpáti K, Szöllősi J, Keresztúri M, Kozinszky Z, Gorzó I, et al. Association between periodontal status and idiopathic male infertility. J Oral Sci. 2016; 58(2): 247–253.
12. Heitz-Mayfield LJ, Trombelli L, Heitz F, Needleman I, Moles D. A systematic review of the effect of surgical debridement vs non-surgical debridement for the treatment of chronic periodontitis. J Clin Periodontol. 2002; 29 (suppl 3): 92-102; discussion 60-2.
13. Chambrone L, Faggion CM Jr, Pannuti CM, Chambrone LA. Evidence-based periodontal plastic surgery: an assessment of quality of systematic reviews in the treatment of recession-type defects. J Clin Periodontol. 2010; 37: 1110-1118.
14. Pradeep AR, Priyanka N, Kalra N, Naik SB, Singh SP, Martande S. Clinical efficacy of subgingivally delivered 1.2-mg simvastatin in the treatment of individuals with Class II furcation defects: a randomized controlled clinical trial. J Periodontol. 2012; 83: 1472-1479.
15. Práger N, Pásztor N, Várnagy Á, Kozinszky Z, Baráth Z, Gorzó I, et al. Idiopathic male infertility related to periodontal and caries status. J Clin Periodontol. 2017; 44(9): 872–880.
16. Kellesarian SV, Yunker M, Malmstrom H, Almas K, Romanos GE, Javed F. Male infertility and dental health status: A systematic review. Am J Mens Health. 2018; 12(6): 1976–1984.
17. Chidambar CK, Shankar SM, Agarwal RK, Bhushan KS, Gururaj SB. Evaluation of Periodontal status among men undergoing infertility treatment. J Hum Reprod Sci. 2019; Apr-Jun; 12(2): 130-135.
18. Tao DY, Zhu JL, Xie CY, Kuang YP, Chai WR, Lo ECM, et al. Relationship

between periodontal disease and male infertility: A case-control study. Oral Dis. 2021; Apr; 27(3): 624-631.

19. Eberhard J, Grote K, Luchtefeld M, Heuer W, Schuett H, Divchev D, et al. Experimental gingivitis induces systemic inflammatory markers in young healthy individuals: A single-subject interventional study. PLoS One. 2013; 8(2): e55265.

20. World Health Organization. WHO laboratory manual for the examination and processing of human semen, Fifth edition, 2010.

21. Eke PI, Page RC, Wei L, Thornton-Evans G, Genco RJ. Update of the case definitions for population-based surveillance of periodontitis. J Periodontol. 2012; 83(12): 1449–1454.

22. Machado V, Botelho J, Proença L, Mendes JJ. Comparisons of periodontal status between females referenced for fertility treatment and fertile counterparts: A pilot case- Control study. Int J Enviro Res Public Health. 2020; Jul 22; 17(15): 5281.

23. Lang NP, Joss A, Orsanic T, Gusberti FA, Siegrist BE. Bleeding on probing. A predictor for the progression of periodontal disease? J Clin Periodontol. 1986; 13(6): 590–596.

24. Lindhe J, Socransky SS, Nyman S, Haffajee A, Westfelt E. Critical probing depths' in periodontal therapy. J Clin Periodontol. 1982; 9(4): 323–336.

25. Xia W, Wong EW, Mruk DD, Cheng CY. TGF-beta3 and TNF alpha perturb blood-testis barrier (BTB) dynamics by accelerating the clathrin-mediated endocytosis of integral membrane proteins: A new concept of BTB regulation during spermatogenesis. Dev Biol. 2009; 327: 48-61.

26. Lang NP, Tonetti MS. Periodontal risk assessment (PRA) for patients in supportive periodontal therapy (SPT). Oral Health Prev Dent. 2003; 1: 7-16.

27. Armitage GC. Diagnosis of periodontal diseases. J Periodontol. 2003; 74(8): 1237–1247.

28. Andrukhov O, Ulm C, Reischl H, Nguyen PQ, Matejka M, Rausch-Fan X. Serum cytokine levels in periodontitis patients in relation to the bacterial load. J Periodontol. 2011; 82(6): 885–892.

29. Zhang H, Yin Y, Wang G, Liu Z, Liu L, Sun F. Interleukin-6 disrupts blood-testis barrier through inhibiting protein degradation or activating phosphorylated ERK in Sertoli Cells. Sci Rep. 2014; 4: 4260.

30. Eggert-Kruse W, Neuer A, Clussmann C, Boit R, Geissler W, Rohr G, et al. Seminal antibodies to human 60kd heat shock protein (HSP 60) in male partners of subfertile couples. Hum Reprod. 2002; 17(3): 726-735.