Original Article

Evaluation of Periodontal Status among Men Undergoing Infertility Treatment

Chethana Kunthur Chidambar, Shrinidhi Maji Shankar, Raj Kishen Agarwal, Kala S. Bhushan, Soumya Badravalli Gururaj

Department of Periodontics, Sharavathi Dental College and Hospital, Shimoga, Karnataka, India

Abstract

Aims: It has been estimated that >30% of male infertility cases are of idiopathic etiology. Recent studies revealed a positive connection between periodontal pockets and sperm submotility, which proposes that periodontitis may have a role in male infertility and inadequate semen quality. The aim of the present investigation was to inspect the relationship between male fertility parameters and the periodontal status of male patients attending *in vitro* treatment (IVF) clinic. **Materials and Methods:** The study participants comprised 85 men going to the facility for sperm investigation before semen insemination. The nature of sperm was surveyed by the WHO 2010 criteria. On the same day, male patients were examined for periodontal parameters. **Results:** The patients were determined to have either gingivitis (24.7%) or periodontitis (75.3%). Normospermia was credited to 23.5% and oligozoospermia to 43.5%. Sperm submotility was seen in 76.4% of patients. A higher number of sites with clinical attachment loss showed a positive correlation with sperm submotility and sperm count. **Conclusions:** The findings of the present study showed a conceivable relationship between male infertility, decreased semen quality, and periodontal diseases in men visiting IVF centers. Periodontitis may subsequently play a role in male infertility.

Keywords: *Clinical attachment level, fertility, gingival inflammation, periodontitis, sperm motility*

Introduction

Gingivitis and chronic periodontitis are common chronic diseases in adults worldwide.[1] Poor oral hygiene can adversely affect a number of systemic conditions and diseases, such as cardiovascular diseases, diabetes mellitus, respiratory diseases, inflammatory bowel diseases, and can even lead to preterm delivery.[2,3] However, the relationship between periodontal disease and sperm abnormalities have not been adequately investigated.

According to the World Health Organization (WHO) and the International Committee for Monitoring Assisted Reproductive Technology, infertility is a disease of the reproductive system characterized by the failure to achieve a clinical pregnancy after 12 months of regular unprotected sexual intercourse. The evaluated prevalence of infertility among couples of reproductive age is 15%,[4] and almost half of such cases are owing to influence male fertility.[5] Even though the causes of male infertility have been extensively investigated, 25% of male infertility cases are idiopathic.[5]

Studies have hypothesized that periodontitis might have a role in subfertility.[6] A direct causal relationship was suspected between bacterial colonies in dental foci and treatment-resistant bacteriospermia.[6]

The aim of the present study was to examine whether an association exists between infertility and periodontal status in men attending fertility and *in vitro* fertilization (IVF) clinics.

Materials and Methods

Eighty-five male patients seeking infertility evaluation were recruited at the Andrology Outpatient Clinic

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Address for correspondence: Dr. Chethana Kunthur Chidambar, Department of Periodontics, Sharavathi Dental College and Hospital, T.H Road, Alkola, Shimoga, Karnataka, India. E-mail: chethanakcnaik@yahoo.co.in

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in the Department of Obstetrics and Gynaecology in 12-month time period. Sociodemographic information (age, place of residence, education level, and profession) and information on lifestyle factors (smoking, alcohol consumption, and drug abuse) were gathered via a self-reported questionnaire, followed by andrological and periodontal examinations.

The periodontal clinical parameters recorded were Plaque Index, Gingival Index, number of sites with bleeding on probing (BOP), number of sites with probing depth >3 mm, number of sites with recession ≥1 mm, and number of sites with clinical attachment loss (CAL) ≥1 mm. Periodontal diagnosis was classified as either gingivitis (at least two sites with gingival index >0, without attachment loss) or periodontitis (presence of CAL).

The inclusion criteria were: Men in the age group of 21–45 years, nonobese patients enrolled as samples and minimum 16 natural teeth to be present.

Patients were excluded if the accompanying conditions were observed: Presence of complicating systemic conditions, smoking, periodontal therapy undertaken within the previous 6 months, and use of systemic antibiotics or nonsteroidal anti-inflammatory drugs in 3 months prior to enrolment in the study.

Semen was collected, analyzed, and classified according to the criteria of the WHO (2009). Semen was obtained by masturbation into sterile plastic containers following 3–5 days of abstinence. Semen analysis were performed within 30 min. of sample arrival in the laboratory. Sperm parameters recorded were ejaculate volume, sperm cell concentration, motility (overall), morphology, and the presence of white cells. Patients were asked to report the existence of familial infertility. Smoking and antibiotic intake during the past year were also recorded. Fertility was classified as either fertile or subfertile, according to three main parameters: sperm cell concentration, sperm cell motility, and sperm cell morphology. Normozoospermia is attributed to normal ejaculate as defined by the WHO reference values. Normal ejaculate constitutes a sperm cell concentration of 20 million sperm/ml or greater, with at least 25% rapid progressive motility and 30% or more normal morphology. Oligozoospermia occurs when the sperm concentration is less than the reference value of 20 × 106/ml; azoospermia occurs when there are no spermatozoa in the ejaculate. Sperm submotility is sperm pathology when <25% spermatozoa are classified as having a rapid progressive motility.

It is widely accepted that patients having abnormal values in one of the sperm measurement parameters also have 2–3-fold higher odds of being infertile. In patients with abnormal values of two of the tested parameters, the odds of infertility increase by 5–7-fold, while patients having abnormal values of three parameters have 16-fold chances of being infertile (Guzick *et al*. 2001).[7]

The study protocol was approved by the ethical committee of the institution. Informed consent was obtained from all the study participants. Since this was a preliminary study, control group was not recruited.

Statistical analysis

Chi-square test, Mann–Whitney U-test, and Yates test were used for examining a possible association between the tested periodontal and fertility parameters. Controlling for confounding factors such as age, smoking, familial infertility, and antibiotic intake during the past year was performed. The primary outcome measure of the present study was a positive association between periodontitis and diminished sperm counts. The secondary outcome measure is positive associations between periodontal parameters and sperm submotility.

Results

During the study period, 85 men were recruited into the study. The proportion of patients with periodontitis was 64/85, representing 75.3% of the examined patients, surprisingly higher than those with gingivitis 21/85 (24.7%). Normospermia was diagnosed in 20/85 of patients and oligospermia in 37/85. Sperm submotility was diagnosed in 65/85 patients.

Figure 1 shows the overall distribution of the study participants according to their periodontal diagnosis and sperm count. Most of the patients examined were diagnosed with periodontitis and were either normospermic or oligospermic. Normal range of sperm cell concentration is >20 ms/mL; intergroup comparison showed that a higher percentage of patients with periodontitis were oligospermic (*P* value).

Figure 2 shows the distribution of the study participants according to their periodontal diagnosis and motility. Normal range of sperm motility is >40%. Intergroup comparison showed that a higher percentage of patients with periodontitis were having sperm submotility (*P* value).

Figure 3 shows comparison of chronic generalized gingivitis (CGG) and CGG with localized periodontitis (L. P) group with respect to ejaculation volume (ml). Normal range of ejaculation volume is 1.5 ml–5.5 ml, whereas intergroup comparison showed that mean value of ejaculation volume is less than normal in CGG with L. P group (*P* value).

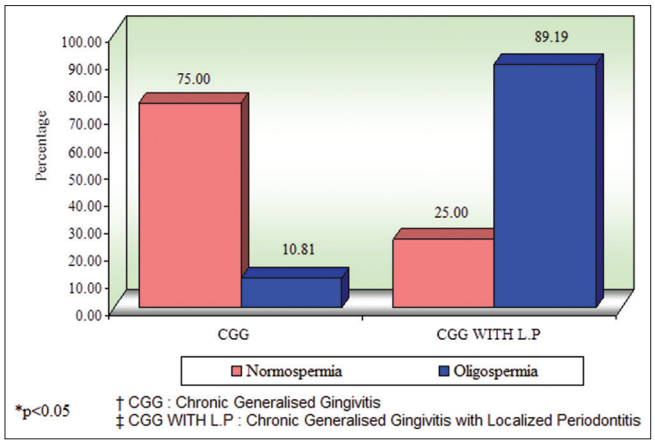

Figure 1: The distribution of the study participants according to their periodontal diagnosis and sperm counts

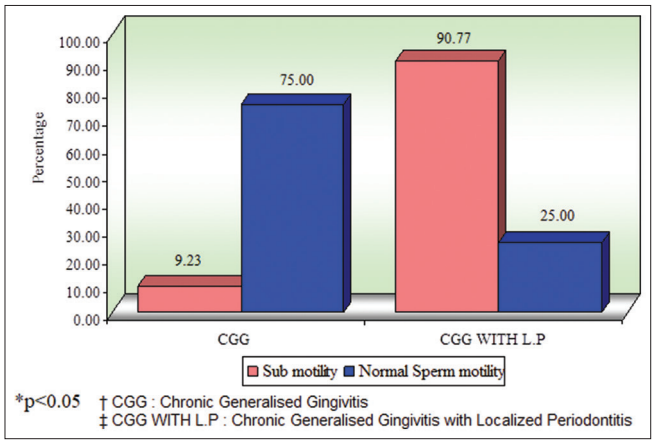

Figure 2: The distribution of the study participants according to their periodontal diagnosis and sperm motility status

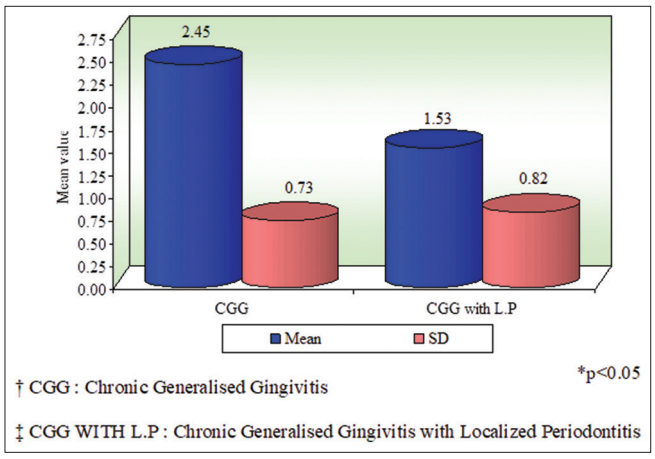

Figure 3: Comparison of chronic generalized gingivitis and chronic generalized gingivitis with localized periodontitis groups with respect to ejaculation volume (ml) scores

Figure 4 shows comparison of CGG and CGG with L. P group with respect to sperm morphology (%). Normal range of sperm morphology is 5% or more. Intergroup comparison showed that mean value of sperm morphology is less than normal in CGG with L. P group.

Table 1 shows correlations among different variables in total samples. This showed that attachment loss (mm) is significantly correlated with various semen parameters such as ejaculation volume (ml), sperm motility, and sperm morphology.

Gingival Index is significantly correlated with semen variables such as sperm cell concentration, sperm motility, and sperm morphology along with periodontal parameters such as attachment loss and number of sites with BOP. Similarly, the Plaque Index was significantly correlating with attachment loss, number of sites with BOP, and sperm morphology.

In this study, number of sites with BOP significantly correlated with sperm motility. Furthermore, ejaculation volume significantly correlates with sperm cell concentration, sperm motility, and sperm morphology.

Discussion

There was a positive correlation between poor periodontal status and male infertility in the current study. Poor periodontal status had significant effect on semen quality and quantity. In the present study, we assessed the BOP and CAL as the main periodontal parameters, since BOP and CAL are significant factors in assessing the risk of periodontitis recurrence and activity.[8] In this study, we chose to record plaque indices on the Ramfjord teeth only, as Löe *et al*. have reported that plaque is not the only factor associated with progression of chronic periodontitis.[9]

Smoking is one of the most common lifestyle factors that adversely affect periodontal and andrological characteristics. It is a main risk factor for periodontal disease[10] and may have a negative impact on fertility. Tobacco exposure detrimentally affects on sperm production and motility[11] and induces sperm DNA damage.[12] Hence, smokers or tobacco chewers were excluded.

Two previous studies reported evidence of a possible connection between periodontal characteristics and sperm pathology.[13,14] Klinger *et al*.[13] examined 75 men attending an IVF clinic, found that deep periodontal pockets and CAL were significantly correlated with sperm submotility. A similar study by Nwhator *et al*.,[14] investigated 76 infertile men and found a significant correlation between deeper periodontal pockets and suboptimal sperm count in men aged 33–38 years, and an association between poor oral hygiene and low sperm concentration.

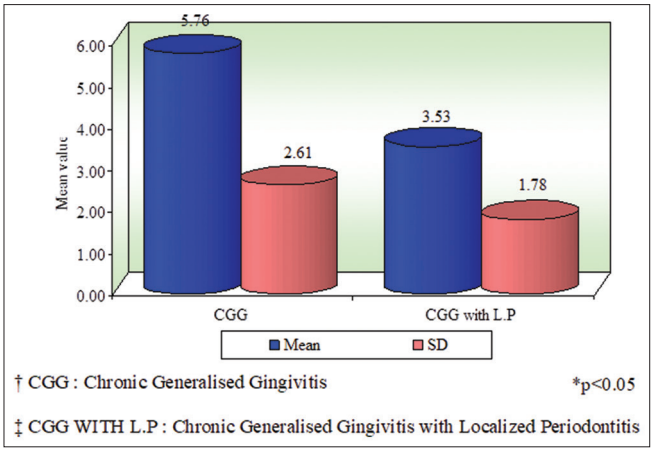

Figure 4: Comparison of chronic generalized gingivitis and chronic generalized gingivitis with localized periodontitis groups with respect to morphology (%) scores

Various pathological mechanisms, by which periodontal inflammation influences semen quality have been proposed. A previous study showed an association between antibiotic-resistant bacteriospermia and the presence of focal dental bacterial colonies resulting from bacteriemia in the oral cavity.[6] Bacteriospermia was eliminated by dental treatment, and posttreatment sperm parameters were superior to those in a control group. Conversely, another study found no relationship between the presence of bacteria in semen and sperm parameters.[15]

Pathogens can cause a remote pathogenic impact by direct activity by means of bacteremia and by inducing production of several circulating cytokines.[16] Increased levels of circulating cytokines, caused by periodontal disease, can trigger C-reactive protein production in the liver.[17] Similar inflammatory molecules are important in regulating the blood–testis barrier, which affects the function of Sertoli cells. Tumor necrosis factor-alpha (TNF-α), transforming growth factor-β3,[18] and interleukin (IL)-1 can disturb blood–testis barrier dynamics.[19] IL-6 alters blood–testis barrier function by inhibiting protein degradation.[20] Eberhard *et al*.[21] found a systemic increment in pro-inflammatory markers, while a recent study by Kinane *et al*.[22] did not demonstrate a similar correlation between short-term experimentally induced gingivitis, bacteremia, and systemic cytokine levels.

Naz and Kaplan[23] demonstrated the presence of various cytokines, namely, TNF-α, interferon-γ, and IL-1b, in seminal plasma of fertile, infertile, and immune infertile men using specific immune radiometric assays. IL-6 was identified in seminal plasma with significantly elevated levels in infertile men compared with those of fertile men. IL-6 was likewise present in the sera,

Table 1: Correlations among different variables in total samples by Spearman's rank correlation coefficient method

Variables	*n*	Spearman *R*	*t*	*P* level
Gingival index				
Plaque Index	85	−0.3394	−3.2868	0.0015*
Attachment loss (mm)	85	0.4615	4.7390	0.0001*
Number of sites of BOP	85	0.4913	5.1392	0.0001*
Ejaculation volume (ml)	85	−0.1827	−1.6932	0.0942
Sperm cell concentration	85	0.0206	0.1876	0.8516
Motility	85	−0.3376	−3.2677	0.0016*
Morphology	85	−0.2678	−2.5324	0.0132*
Plaque index				
Attachment loss (mm)	85	−0.3047	−2.9148	0.0046*
Number of sites of bop	85	−0.3028	−2.8942	0.0049*
Ejaculation volume (ml)	85	0.1666	1.5392	0.1276
Sperm cell concentration	85	0.2271	2.1245	0.0366*
Motility	85	0.2241	2.0944	0.0393*
Morphology	85	0.3076	2.9449	0.0042*
Attachment loss (mm)				
Number of sites of BOP	85	0.4826	5.0204	0.0001*
Ejaculation volume (ml)	85	−0.3429	−3.3254	0.0013*
Sperm cell concentration	85	−0.1507	−1.3893	0.1685
Motility	85	−0.3841	−3.7905	0.0003*
Morphology	85	−0.3020	−2.8865	0.0050*
Number of sites of BOP				
Ejaculation volume (ml)	85	−0.3693	−3.6202	0.0005*
Sperm cell concentration	85	−0.1624	−1.4993	0.1376
Motility	85	−0.4411	−4.4776	0.0001*
Morphology	85	−0.3513	−3.4183	0.0010*
Ejaculation volume (ml)				
Sperm cell concentration	85	0.5749	6.4008	0.0001*
Motility	85	0.5298	5.6912	0.0001*
Morphology	85	0.6577	7.9551	0.0001*
Sperm cell concentration				
Motility	85	0.6475	7.7411	0.0001*
Morphology	85	0.7064	9.0930	0.0001*
Motility				
Morphology	85	0.8504	14.7225	0.0001*

**P* value <0.05, highly significant. BOP=Bleeding on probing

and strangely, the levels in the sera were lower than those in seminal plasma. IL-6 levels in seminal plasma significantly associated with some sperm parameters and penetration rates in the human sperm penetration assay. These findings suggested that IL-6 is associated with infertility and might be of significance in the specific diagnosis and treatment of male (Naz and Kaplan 1994, Huleihel *et al*. 1996, Camejo *et al*. 2001, Matalliotakis *et al*. 2006) or female (Kavoussi *et al*. 2009) infertility.

Heat shock proteins (HSPs) are proteins presented on vascular endothelium in response to hoisted body temperature, oxidizing agents, and lipids. Likeness in the antigenicity of bacterial and human HSPs has been demonstrated. Maeda *et al*.,[24] showed

that *Porphyromonas gingivalis* possesses a HSP. Antibodies (Ab) against this HSP are cross-reactive with a human HSP.

Eggert-Kruse *et al*.[25] investigated the role of sensitization to HSP, and its potential role in the etiology of male infertility. The potential relationship of immunoglobulin (Ig) AAb with the human HSP 60 with several parameters of subclinical male genital tract disease with semen quality and sperm fertilizing capacity were analyzed in a prospective study. IgA-Ab to human HSP 60 was determined in seminal plasma of randomly chosen subfertile men with a median duration of infertility of 4 years, who were asymptomatic for genital tract infection. They showed that the presence of HSP 60 IgA-Ab in the seminal fluid was significantly associated with leukocytospermia and also with high IL levels in seminal plasma. Their findings suggest a potential role of the immune reaction to HSP in cases of male genital tract infection and infertility. Bohring *et al*.[26] have likewise demonstrated that antisperm antibodies (ASA) might affect sperm motility. They found that immunofluorescence may be a significant tool in the diagnosis of immune infertility. Immunoinfertility is to be sure one of several causes of infertility in humans. Even though progress on antisperm immunity and infertility has occurred during the past three decades, the nature of a real ASA is still inadequately understood.

Conclusions

Considering the limitations of this study, there seems to be a positive association between male infertility and periodontal status. However, further longitudinal studies and well-designed randomized control trials assessing confounders are required. It is emphasized that dental specialists and general practitioners ought to know that periodontitis can influence the systemic health, including men's reproductive health. Therefore, patients undergoing andrological examination and attempting to conceive should receive a comprehensive oral evaluation.

Physicians detecting oral disease should refer the patient to a dentist for further evaluation and treatment.

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Conflicts of interest

There are no conflicts of interest.

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