

Comparison of Serum Lipid and Thyroid Profiles Before and After Scaling and Root Planning in Periodontitis Subjects

Sania^{1*}, Krishan KC², Rajesh KT³, Mohan L⁴, Anupama B⁵, Sukanya M⁶

¹Post Graduate Trainee, Dept of Periodontics, Kothiwal Dental College & Research Centre, Moradabad, UP, India

²Head of Department, Department of Periodontics, Kothiwal Dental College & Research Centre, Moradabad, UP, India

³Department of Periodontics, Kothiwal Dental College & Research Centre, Moradabad, UP, India

⁴JK Medicity Hospital, Jammu, India

⁵Kothiwal Dental College & Research Centre, Moradabad, UP, India

⁶Department of Periodontics, Kothiwal Dental College & Research Centre, Moradabad, UP, India

*Corresponding author: Sania, Dept of Periodontics, Kothiwal Dental College & Research Centre, Moradabad, UP, India, Tel: 9622022061, E-mail: Saniabds@gmail.com

Received date: January 28, 2017; Accepted date: February 13, 2017; Published date: February 20, 2017

Copyright: © 2017 Sania, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Abstract

Background: Hyperlipidemia and Thyroid disorders are considered to be related with systemic inflammation. Periodontitis has been found to release inflammatory cytokines to systemic circulation. So, it could be related with these two systemic conditions.

Aim: Determination of effect of changes in periodontal status obtained by scaling and root planing on serum lipid and thyroid profiles.

Materials and Methods: The study was conducted on 30 subjects with chronic periodontitis. Subjects with history of periodontal treatment in the past six months, diabetes and on anti hyperlipidemic/thyroid drugs or active tobacco smoking were excluded. Periodontal parameters (gingival index, plaque index, bleeding on probing, probing pocket depth) and metabolic parameters, like, fasting serum lipid profile and thyroid profiles were taken at baseline and 90 days. At baseline, conventional periodontal therapy i.e., full mouth scaling and root planing was performed without any prescription of antibiotics or mouthwashes.

Results: There were significant improvement ($p < 0.05$) in all periodontal parameters. Correspondingly, there were significant ($p < 0.05$) decrease in the levels of very low density lipoprotein (VLDL), Triglycerides and thyroid stimulating hormone (TSH). There was significant ($p < 0.05$) increase in HDL levels, but no significant changes in cholesterol, VLDL and triiodothyronine (T_3) and thyroxine (T_4) levels.

Conclusion: The improvement in periodontal status is reflected in improvement of serum lipid profile. This effect is not very obvious on thyroid status.

Keywords: Periodontitis; Cardiovascular disease; Thyroid; High density lipoprotein; Cholesterol; Triglycerides

Introduction

Periodontitis primarily represents an anaerobic gram negative oral infection that leads to gingival inflammation, destruction of periodontal tissues, loss of alveolar bone, and eventual exfoliation of teeth in severe cases [1]. Lipopolysaccharides and other microbial substances gain access to the gingival tissues, initiate and perpetuate inflammation, resulting in production of high levels of pro-inflammatory cytokines, which lead to the destruction of the periodontal ligament and alveolar bone [2].

There have been several proinflammatory cytokines implicated in the immunopathology of periodontitis; however, some of the most convincing evidences for destruction of periodontium involves Interleukin 1beta (IL-1b) and tumour necrosis factor alpha (TNF-a). These cytokines are significantly elevated in diseased periodontal

ligament sites demonstrating inflammation and during periods of active tissue destruction. Periodontitis has been shown to be associated with increased levels of proatherogenic plasma lipoproteins [3].

Hyperlipidemia is a condition where there is an elevation of the serum levels of total cholesterol (TC) and triglycerides (TG) due to the lipid metabolism alteration, with an increase in the liver lipogenesis and lipolysis in the adipocytes [4]. Proatherogenic role of chronic infection in periodontal disease has not yet been conclusively established but periodontal pathogens as for example, *Tannerella forsythens*, *Porphyromonas gingivalis* and *Prevotella intermedia*, have been identified in atherosclerotic plaques as well as in coronary and aortic endothelium [5,6].

Nevertheless, treatment of poor oral health (periodontal disease) has been shown to improve the systemic and haemostatic situation of coronary heart disease patients [7]. Thus heart disease patients become an important target group where oral health can have a profound effect on their general health.

Thyroid disease is quite difficult to diagnose and it can have a ripple effect throughout the body throwing systems out of balance [8]. Subtle changes in thyroid function can have a significant impact on our health [8]. When the thyroid slows down (hypothyroidism), it also slows down the ability of body to process cholesterol; this processing lag is largely explained by a reduction in the number and activity of what are known as Low Density Lipoproteins (LDL) receptors.

LDL accumulates in the blood stream, acting to increase both LDL and total cholesterol levels [9]. Due to this controversial data and the rising trend of serum lipid and thyroid levels resulting in consequently unknown complications, this study is undertaken to determine the relation between chronic periodontitis and serum lipid and thyroid profile levels in an Indian population.

Materials and Methods

The present study was carried out in the Department of Periodontology, Kothiwal Dental College and Research Centre, Moradabad, Uttar Pradesh to correlate periodontal therapy and serum lipid and serum thyroid profiles. Total number of 30 subjects aged between 25 years and 70 years having chronic periodontitis and willing for periodontal therapy were selected for the present study. The subjects were briefly explained about the procedure and usefulness of the present study. The study protocol was reviewed and approved by the Institutional Ethics and Review Board (IERB), Kothiwal Dental College and Research Centre, Moradabad.

The inclusion Criteria consisted of subjects suffering from chronic periodontitis, having a minimum of 20 teeth and probing depth of 4 mm or more whereas the exclusion criteria consisted of Subjects with known systemic ailment, smoker or pregnant or those planning pregnancy patients with history of taking any drug for hypercholesterolemia and any other systemic disease which can alter the course of periodontal disease or serum lipids/serum thyroid levels were excluded.

Thorough medical history was recorded from the subjects and no changes were made in the dietary habits. Periodontal parameters (gingival index, plaque index, bleeding on probing, probing pocket depth) and metabolic parameters like fasting serum lipid profile, fasting serum thyroid profile were recorded on day 0 (baseline) and at 90 days. The subjects were recalled in between baseline and 90 days for monitoring the practices of oral hygiene methods and status.

The following parameters for lipid profile were recorded:

- Serum triglycerides
- Serum cholesterol
- HDL (High density lipoproteins)
- LDL (Low density lipoproteins)
- VLDL (very low density lipoproteins)

The following parameters for thyroid profile were recorded:

- T3 (Triiodothyronine)
- T4 (Thyroxine)
- TSH (Thyroid-stimulating hormone)

Laboratory estimation

Estimation of serum lipid levels including levels of triglycerides, cholesterol, high-density lipoprotein (HDL) and low-density lipoprotein (LDL) and very low-density lipoprotein (VLDL) was

carried out by an enzymatic method in biochemistry analyser (SPECTRALAB K). All blood samples (5 ml) were collected in serum separation vials and centrifuged at 3000 rpm for 10 minutes (REMI(R-8C)). Separated serum was collected in specimens and stored at room temperature 18°C to 24°C in stoppered containers to avoid contaminations. Serum levels of triglycerides, cholesterol, high-density lipoprotein (HDL) and low-density lipoprotein (LDL) & very low-density lipoprotein (VLDL) were measured by using biochemistry analyser (SPECTRALAB K) (Figure 1).

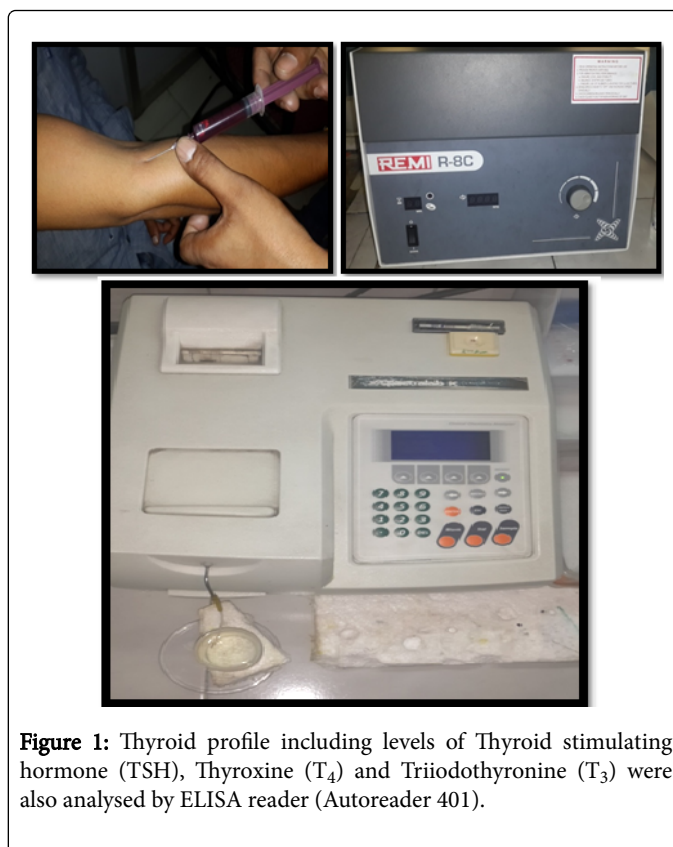


Figure 1: Thyroid profile including levels of Thyroid stimulating hormone (TSH), Thyroxine (T₄) and Triiodothyronine (T₃) were also analysed by ELISA reader (Autoreader 401).

The clinical and laboratory parameters, thus obtained were compiled to prepare the data for statistical analysis (MS Excel and SPSS version 19.0).

Results:

Parameters	Pre-operative (mean/SD)	Post-operative (mean/SD)	t value	p value
Gingival index	1.02 ± 0.36	0.19 ± 0.131	14.08	0.000**
Plaque index	0.098 ± 0.28	0.16 ± 0.17	16.24	0.000**
Bleeding on probing	92.69 ± 19.63	19.72 ± 14.0	16.11	0.000**
Probing pocket depth	24.16 ± 3.07	18.00 ± 5.87	9.3	0.000**

Table 1: Comparison between pre-operative and post-operative periodontal parameters.

Parameters	Pre-operative (mean/SD)	Post-operative (mean/SD)	t value	p value
T3	5.07 ± 18.78	4.0 ± 13.61	1.12	0.27*
T4	7.67 ± 2.06	7.07 ± 2.86	1.52	0.13*
TSH	4.16 ± 3.72	3.72 ± 3.32	2.05	0.04**
Serum triglycerides	130.63 ± 47.7	122.52 ± 49.4	3.55	0.001**
HDL	0.68 ± 0.69	3.96 ± 1.14	16.37	0.029**
VLDL	92.69 ± 19.63	19.72 ± 14.0	16.11	0.000**
LDL	24.16 ± 3.07	18.00 ± 5.87	9.3	0.70*
Serum cholesterol	159.29 ± 34.65	160.53 ± 38.03	-0.145	0.88*

*p>0.05=insignificant difference **p<0.05=significant difference

Table 2: Comparison between pre-operative and post-operative thyroid and lipid parameters.

Discussion:

It is well known that there is a causal relationship between serum lipid levels and systemic health, particularly cardiovascular diseases and diabetes. Similarly, association of various serum proinflammatory cytokines and systemic diseases caused by increased level of serum lipids has also been shown by various investigators [10]. Since, periodontitis is associated with an increased level of serum proinflammatory cytokines, there is a possibility that periodontitis affects the serum cholesterol levels (Katz et al.) [11].

Acute systemic or local chronic infections seem to induce changes in plasma concentration of cytokines and hormones, which determine the alteration in the lipid metabolism. Feingold et al. [12] showed that the administration of low dose of endotoxins in rats resulted in hypertriglyceridemia, suggesting the presence of similar response in local infections such as periodontal disease, in which there is chronic systemic exposure to microorganisms and lipopolysaccharides. Similarly, increased levels of triglycerides in rats have been reported after induction of periodontitis by *P.gingivalis*.

A number of studies stated that subjects affected with chronic periodontal diseases have increased serum triglycerides, total cholesterol and LDL cholesterol and decreased serum levels of HDL cholesterol when compared to subjects without periodontal disease (Cutler et al., Noack et al., Doxey et al., Sharma et al.) and also reduction in these serum levels following periodontal therapy [13].

Subjects affected with systemic diseases were not considered because systemic diseases could be a risk factor for periodontal diseases [14]. Smokers were not considered because smoking is a major risk factor for increasing the prevalence and severity of periodontal destruction as compared to non-smokers. The index used for estimation of gingival health was based on bleeding on probing, considering this as an objective sign of gingival inflammation. Inflamed gingiva bleeds on gentle probing because of the ulcerations in the pocket epithelium and fragility of the underlying vasculature.

The percentage of sites that exhibit bleeding on probing on initial examination prior to the treatment are a clinically useful piece of information since it provides full mouth assessment of the extent of

gingival inflammation prior to therapy. After SRP, significant improvements in all the periodontal parameters were found. The effect of periodontal therapy on PPD was observed to be very highly significant statistically ($p < 0.005$) on comparison between day 0 and day 90. Similar results on PPD following periodontal therapy were observed previously by various investigators (Table 1) [15-19].

Gingival index and bleeding on probing were found to be reduced in subjects after periodontal therapy from day 0 to day 90. Bleeding on probing whose reduction was statistically significant was seen to be negatively correlated with HDL (Table 2).

The reduction in Gingival index after periodontal therapy is in support of various investigators [20,21]. The present study showed positive relation with TSH and PPD. With SRP, the higher levels of triglycerides and VLDL showed reduction.

The present study showed significant reduction in serum triglycerides, VLDL. This is in accordance with Morita et al. who reported a significant relation between elevated triglycerides and periodontal disease. After periodontal therapy, the serum HDL, cholesterol levels were found to be increased and statistically significant. However, it is to be noted that HDL is beneficial to the host, as it considered as antiatherogenic lipoprotein because of its direct role in neutralizing lipopolysaccharides in circulation, protecting LDL against oxidation as well as its role in reverse cholesterol transport (Pussinen et al.) [22].

It has long been recognized that some of the most characteristic and common signs and symptoms of thyroid disease are those that result from the effects of thyroid hormone on the heart and cardiovascular system [23]. Both hyperthyroidism and hypothyroidism produce changes in cardiac contractility, myocardial oxygen consumption, cardiac output, blood pressure, and systemic vascular resistance (SVR).

Although it is well known that hyperthyroidism can produce atrial fibrillation, it is less well recognized that hypothyroidism can predispose to ventricular dysrhythmias [24]. In almost all cases these cardiovascular changes are reversible when the underlying thyroid disorder is recognized and treated.

It is estimated that as many as 7% to 10% of older women have subclinical hypothyroidism. Although subclinical disease is frequently "asymptomatic," many patients have symptoms of thyroid hormone deficiency.

Lipid metabolism is altered in subclinical hypothyroidism. Patients have increased serum lipid levels, and cholesterol levels appear to rise in parallel with serum TSH which is in accordance with the present study where the levels of TSH has been decreased with decreasing lipid parameters and is statistically significant ($p < 0.005$). TSH has not previously been connected to periodontal disease, but is reported to be enhanced in serum in obese subject. In the study GI has a positive effect on TSH and is correlated with triglycerides and HDL.

In the present study though the values of T₃ (Triiodothyronine) and T₄ have decreased postoperatively, but the results are not statistically significant. Due to inflammation the levels of T₃ and T₄ were raised which got postoperatively reduced after the absence of inflammation. Subclinical hyperthyroidism is characterized by a low or undetectable serum TSH concentration in the presence of normal levels of serum T₄ and T₃ [25]. Though TSH was within the normal limits, but a significant decrease was observed with TSH which could suggest that thyroid had some effect on pituitary also.

Limitations

As many studies haven't been done to relate the association of thyroid with periodontitis, so a research in this aspect relating thyroid as a part of systemic disease and its link with periodontal disease with increased sample size and long follow up is required. It is noted that there are certain variables like food habits, socioeconomic conditions and lifestyle, which are difficult to control and may influence the results.

There are certain other shortcomings in the present study such as small sample size and short duration. It is therefore required for long term effects. Hence, long term studies with larger size samples at multiple centers are recommended to determine the effect of periodontal therapy on serum lipid levels.

Conclusion

The findings of the present study are as follows:

- Gingival health was found to be improved significantly in all the subjects after periodontal therapy.
- Probing pocket depth was found to be reduced significantly after periodontal therapy in all the subjects.
- All the subjects showed significant reduction in bleeding on probing.
- Plaque index has substantially reduced.
- Serum triglycerides, VLDL, TSH were reduced significantly in subjects after periodontal therapy.
- Reduction in T₃ and T₄ levels were seen postoperatively but it was not reflected statistically.
- Serum HDL was found to be increased after periodontal therapy.
- With decrease in bleeding on probing there was increase in HDL.

Within the limitations of this study we may conclude from the findings of the present study that periodontal therapy plays an important role in the regulation of serum lipid and serum thyroid levels.

In terms of medical economics, understanding the relationship between periodontitis and systemic diseases has the potential to change health policy, ensuring economic benefits. Furthermore, the medical community should be aware of the potential negative effects of periodontal infections on systemic health. Periodontal medicine promotes strong collaboration between dental and medical professionals, which implies better communication and an effective team approach in clinical practice. Moreover, periodontal patients should be referred to medical specialists, which might improve not only systemic diseases but also the oral environment, including periodontitis.

References

1. Socransky SS, Haffajee AD (1992) The bacterial etiology of destructive periodontal disease: current concepts. *J Periodontol* 63: 322-331.
2. Lösche W, Karapetow F, Pohl A, Pohl C, Kocher T (2000) Plasma lipid and blood glucose levels in patients with destructive periodontal disease. *J Clin Periodontol* 27: 537-541.
3. Cutler CW, Shinedling EA, Nunn M, Jotwani R, Kim BO, et al. (1999) Association between periodontitis and hyperlipidemia: cause or effect? *J Periodontol* 70: 1429-1434.
4. Saxlin T, Suominen-Taipale L, Kattainen A, Marniemi J, Knuutila M, et al. (2008) Association between serum lipid levels and periodontal infection. *J Clin Periodontol* 35: 1040-1047.
5. Chiu B (1999) Multiple infections in carotid atherosclerotic plaques. *Am Heart J* 138: S534-536.
6. Haraszthy VI, Zambon JJ, Trevisan M, Zeid M, Genco RJ (2000) Identification of periodontal pathogens in atheromatous plaques. *J Periodontol* 71: 1554-1560.
7. Roivainen M, Viik-Kajander M, Palosuo T, Toivanen P, Leinonen M, et al. (2000) Infections, inflammation, and the risk of coronary heart disease. *Circulation* 101: 252-257.
8. Toledo S, Bozo L, Nascimento A, Sallum (1979) Changes of thyroid gland and periodontal tissues of marmosets related to experimental hypothyroidism. *Rev Bras Pesqui Med Biol* 12: 141-146.
9. Fadel BM, Ellahham S, Ringel MD, Lindsay J Jr, Wartofsky L, et al. (2000) Hyperthyroid heart disease. *Clin Cardiol* 23: 402-408.
10. Noack B, Genco RJ, Trevisan M, Grossi S, Zambon JJ, et al (2001) Periodontal infections contribute to elevated systemic c-reactive protein level. *J Periodontol* 72: 1221-1227.
11. Katz J, Flugelman MY, Goldberg A, Heft M (2002) Association between periodontal pockets and elevated cholesterol and low density lipoprotein cholesterol levels. *J Periodontol* 73: 494-500.
12. Feingold KR, Grunfeld C (1987) Tumor necrosis factor- α stimulates hepatic lipogenesis in the rat in vivo. *J Clin Invest* 80: 184-190.
13. Sangwan A, Tewari S, Singh H, Sharma RK, Narula SC (2013) Periodontal status and hyperlipidemia: statin users versus non-users. *J Periodontol* 84: 3-12.
14. Valentaviciene G, Paipaliene P, Nedzelskiene I, Zilinskas J, Anuseviciene OV (2005) The relationship between blood serum lipids and periodontal conditions. *Stomatologia* 8: 96-100.
15. Badersten A, Nilvéus R, Egelberg J (1981) Effect of nonsurgical periodontal therapy. I. Moderately advanced periodontitis. *J Clin Periodontol* 8: 57-72.
16. D'Aiuto F, Parkar M, Andreou G, Suvan J, Brett PM, et al. (2004) Periodontitis and systemic inflammation: control of the local infection is associated with a reduction in serum inflammatory markers. *Journal of Dental Research* 83: 156-160.
17. Offenbacher S, Lin D, Strauss R, McKaig R, Irving J, et al. (2006) Effects of periodontal therapy during pregnancy on periodontal status, biologic parameters, and pregnancy outcomes: a pilot study. *J Periodontol* 77: 2011-2024.
18. Duan JY, Ou-Yang XY, Zhou YX (2009) Effect of periodontal initial therapy on the serum level of lipid in the patients with both periodontitis and Hyperlipidemia. *Beijing Da Xue Xue Bao* 41: 36-39.
19. Rao NS, Bajaj P, Naik SB, Pradeep AR (2011) Effect of non-surgical periodontal therapy on serum lipid levels in chronic periodontitis. *Archives of Oral Sciences And Research* 1: 60-64.
20. Radafshar G, Torab F, Mirfarhad N (2012) Short-term effects of intensive non-surgical periodontal therapy and low-dose doxycycline on serum levels of il-6, tnf- α And lipid profile in advanced periodontitis. *Afr J Microbiol*. 6: 355-360
21. Taleghani F, Shamaei M, Shamaei M (2010) Association between chronic periodontitis and serum lipid levels. *Acta Med Iran* 48: 47-50.
22. Pussinen PJ, Vilkkuna-Rautiainen T, Alftan G, Palosuo T, Jauhiainen M, et al. (2004) Severe periodontitis enhances macrophage activation via increased serum lipopolysaccharide. *Arterioscler Thromb Vasc Biol* 24: 2174-80.
23. Klein I, Ojamaa K (2001) Thyroid hormone and the cardiovascular system. *N Engl J Med* 344: 501-509.
24. Dillmann WH (2002) Cellular action of thyroid hormone on the heart. *Thyroid* 12: 447-452.
25. Danzi S, Klein I (2004) Thyroid hormone and the cardiovascular system. *Minerva Endocrinol* 29: 139-150.