ORIGINAL RESEARCH PAPER

Volume-7 | Issue-6 | June-2018 | PRINT ISSN No 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

ESTIMATION OF THYROID PROFILE & ITS CORRELATION TO PERIODONTAL STATUS

Periodontology

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ABSTRACT

Aim: The aim of the present study was to correlate and compare the periodontal status and thyroid hormone levels in systemically healthy, hyperthyroid and hypothyroid subjects. The present study also aims to correlate the duration of thyroid disease to periodontal health.

Methods: Periodontal status and thyroid profile were estimated for 60 patients aged 25-50yrs who were divided into three groups of systemically healthy, hyperthyroid and hypothyroid. Duration of thyroid disease to periodontal health was also correlated.

Results: Almost similar oral hygiene conditions and gingival status were observed in all the three groups.Even though hypothyroid group showed more periodontal destruction compared to other groups the difference was not statistically significant.Pearson's correlation showed positive association between probing depths and duration only in hyperthyroid group.

Conclusion: This study concludes that thyroid hormone disorders didn't affect the periodontal health thereby suggesting a casual relationship.

KEYWORDS

Thyroid Disease, Periodontitis, Hypothyroid, Hyperthyroid,

Introduction

Periodontal disease is an inflammatory disease affecting the periodontium and is characterised by the destruction of connective tissue and alveolar bone. Although dental plaque is the primary etiological factor causing periodontal disease, studies have shown that systemic factors also play an important role in the initiation and progression of the disease.[1] Periodontitis and systemic disease interrelationship constitutes an important part of clinical periodontal research.[2]

One of the systemic disease affecting todays population are thyroid diseases which are on high prevalence especially in India.According to a projection from various studies on thyroid disease, it has been estimated that about 42 million people in India suffer from thyroid diseases . The prevalence of hypothyroidism in India is 11% compared to only 2% in UK & 4-6% in USA.[3]

Thyroid hormones play an important role in maintaining homeostasis of the body by regulating normal physiologic growth and development, skeletal maturation and bone turnover.Thyroid hormones are essential for maintenance of systemic health, importantly in the regulation of physiologic processes. Triiodothyronine (T_3) and thyroxine (T_4) are produced by the thyroid gland and may affect metabolic processes throughout the body. [4] T_3 and T_4 are fundamental for normal bone turnover. [5] It has been proposed that thyroid hormones have an important role in controlling bone resorption through their action on the osteoprotegerin & RANKL [6] & on bone regulating factors such as IL-6 & IL-8.[7] TSH (Thyroid Stimulating Hormone) has direct effect on cells of immune system.[8] The role of cells of immune system in the production of TSH has been demonstrated since long time. The production of TSH by leukocytes gives a reasonable assumption that it may act like a cytokine-like regulatory molecule within the immune system. Since these hormones have an impact on host response and bone ,the hormonal imbalance may show its effect on periodontal disease which is a host immunomodulatory disease and alveolar bone loss being a prominent features of this disease,Periodontitis and thyroid diseases both being most prevalent diseases, limited data available regarding the effect of thyroid hormone imbalance and its treatment on periodontal health. Hence this study was designed to estimate and compare the serum levels of T_3, T_4, thyroid stimulating hormone (TSH), Free Triiodothyronine (FT_3) and Free thyroxine (FT_4) and correlate these levels with periodontal status in systemically healthy, hyperthyroid and hypothyroid subjects. The present study also aims to correlate the duration of thyroid disease to periodontal health which was never considered in previous studies.

Materials and methods

Study population

This was a cross-sectional study comprising of 60 subjects with 20 subjects in systemically healthy control group and 20 subjects in hypothyroid and 20 subjects in hyperthyroid study groups.The study sample population was selected from the Department of periodontics ,The Oxford dental college, Bangalore, India between April 2016 to September 2017. Ethical clearance was obtained from the Institutional Review Board . The study was approved and registered at Central Trial Registry India (CTRI) with CTRI number : CTRI/2016/06/007027.

Inclusion criteria

Patient selection: 60 patients aged 25-50yrs were divided into 3 groups:

Group A: systemically healthy subjects

Group B: subjects diagnosed with hypothyroidism for past 1yr or above and are on treatment for the same

Group C: subjects diagnosed with hyperthyroidism for past 1yr or above and are on treatment for the same

Exclusion criteria

- Patients with any other systemic disease or Medically compromised patients (except for thyroid disorders in group B and C).
- Patients on any medications (except for group B and group C subjects undergoing treatment)
- Smokers and alcoholics
- Pregnant and lactating women
- History of periodontal treatment in last 6 months

Periodontal parameters

Prior to clinical examination, blood samples were collected for thyroid profile (T3, T4 ,TSH, FT3 & FT4) estimation.

- Following which clinical parameters were recorded.

1. Plaque index (PI)
2. Gingival index (GI)
3. Probing pocket depth in mm (PD)
4. Clinical attachment loss in mm (CAL)

During the oral clinical examination, the following parameters on all erupted teeth in each subject were recorded. Oral hygiene status was assessed using the Plaque index (Silness and Loe).[9] Gingival status was assessed by gingival index (Loe and Silness).[10] Pocket depth was measured from the base of the sulcus, or pocket, to the free gingival

margin at six sites per tooth (mesiobuccal, midbuccal, distobuccal, mesiolingual, midlingual and distolingual) using an UNC-15 probe. Clinical attachment loss (CAL) was measured from the cementoenamel junction to the base of the pocket at six sites per tooth (mesiobuccal, midbuccal, distobuccal, mesiolingual, midlingual and distolingual) using an UNC-15 probe.

Mean PD and mean CAL were calculated per patient. All the parameters were recorded by one experienced periodontist and the examiner was blinded about the groups to prevent examination bias. Required radiographs were taken to confirm the presence of alveolar bone loss.

Statistical methods

Descriptive statistical analysis was carried out in the present study. Results on continuous measurements are presented as mean ± SD and results on categorical measurements are presented in number (%). ANOVA test was conducted to find out for any statistically significant difference between periodontal variable, thyroid status and different groups .Post hoc test using Dunnet test was carried out to find out the group which made statistically significant difference. Pearson's correlation was used to find the relationship between duration of thyroid diseases and study parameters. The statistical significance was considered at $p < 0.05$.

Results

A total of 60 patients participated in this cross-sectional study.

Table(1) shows the mean age and gender distribution. Mean age in the control, hypothyroid and hyperthyroid group was 37±6 years, 41±8 and 35±5 years respectively. There was no significant difference in the mean age between the study and control group. The study population constituted 15 males (25%) and 45 females (75%). All the subjects in hypothyroid group were only females.

Table 1:Mean age and gender distribution in the control and study groups

	Control group	Hypothyroid group	Hyperthyroid group
Age (years) (Mean ± SD)	37±6	41±8	35±5
Gender	No (%)	No(%)	No(%)
Male	9(45%)	0(0%)	6(30%)
Female	11(55%)	20(100%)	14(70%)
Total	20	20	20

Periodontal parameters that were compared between the three groups were PI,GI,PD and CAL. Table (2),Fig 1 & Fig 2 shows a comparison of the periodontal parameters between the control and study groups. Mean PI was 0.91 ± 0.55 in the control group, 1.15 ± 0.51 in the hypothyroid group and 0.92 ± 0.33 in hyperthyroid group showing almost similar oral hygiene conditions between the three groups. Mean GI was 0.97±0.33 in the control group and 1.18±0.47 in the hypothyroid group and 0.83±0.41 in the hyperthyroid group. Mean GI was slightly higher in the hypothyroid group but was not significant. Mean PD was 1.77±2.4 in the control and 1.20±1.5 in hypothyroid and in hyperthyroid group it was 0.72±0.76. Although PD was more in control group compared to other two groups, the difference was not significant. Mean CAL was 1.55± 2.4 in the control group, 0.87 ± 0.88 in the hypothyroid group and 1.10 ± 1.98 in hyperthyroid group. Mean CAL was not significantly different between the three groups.

Table 2:Comparison of PI , GI, PD & CAL in the control & study groups

	Control group	Hypothyroid group	Hyperthyroid group	
PI	0.91±0.55	1.15±0.51	0.92±0.33	p=0.222 ANOVA
GI	0.97±0.33	1.18±0.47	0.83±0.41	p=0.091 ANOVA
PD	1.77±2.4	1.20±1.5	0.72±0.76	p=0.59 ANOVA
CAL	1.55±2.4	0.87±0.88	1.10±1.98	p=0.64 ANOVA

Fig 1:Comparison of PI , GI, in the control & study groups

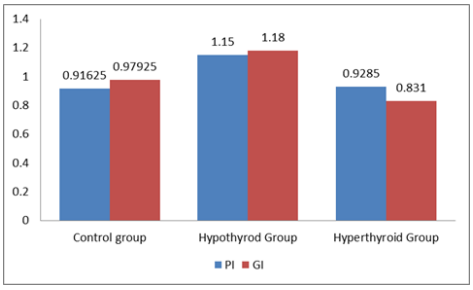
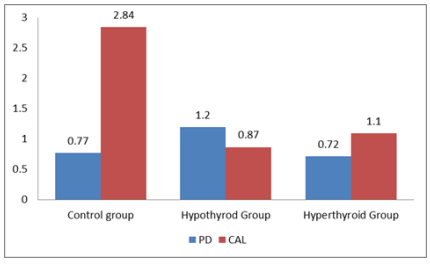


Fig 2:Comparison of PD & CAL in the control & study groups



Post hoc test using Dunnet test was carried out to find out the group which made statistically significant difference. Table (3) shows the comparisons. It was found out that there was no statistically significant difference in either groups.

Table 3: Post hoc Dunnet test - To know group which made statistically significant difference

Dependent Variable	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.
PI	Hypothyrod	Control	.2367500	.1517432	.214
	Hyperthyroid	Control	.0122500	.1517432	.995
GI	Hypothyrod	Control	.2027500	.1574713	.337
	Hyperthyroid	Control	-.1482500	.1574713	.545
PD	Hypothyrod	Control	.436	.601	.688
	Hyperthyroid	Control	-.051	.717	.996
CAL	Hypothyrod	Control	-1.967	1.153	.168
	Hyperthyroid	Control	-1.743	1.175	.248

Thyroid profile parameters that were compared between the groups were T3,T4.TSH,FT3 and FT4. Table (4) shows comparison of the thyroid profile parameters between the control and study groups. Mean T3 was 1.07 ± 0.17, 1.02 ± 0.17 and 1.32 ±1.07 in the control, hypothyroid and hyperthyroid group respectively with no significant difference. Mean T4 was 6.77 ± 1.47 in control group; it was 7.00 ± 1.17 in hypothyroid group and 8.76 ± 3.73 in the hyperthyroid group. There was a significant difference between the groups with $p < 0.05$. Mean TSH was 2.73 ± 3.18 in control and 5.34 ± 4.54 in hypothyroid and in hyperthyroid it was 0.96 ± 0.8. TSH shows statistically significant difference with $p < 0.05$. Mean FT3 values showed no siginificant difference with values 2.84 ± 0.32 in controls , 2.65 ± 0.31 in hypothyroid and 4.00 ± 4.04 in hyperthyroid patients. Mean FT4 was 1.08 ± 0.18 in the control group , 1.23 ± 0.30 in hypothyroid group and 1.59 ± 1.08 in hyperthyroid group.

Table 4: Comparison of thyroid profie in the control & study groups

	Control	Hypothyroid	Hyperthyroid	Significance
T3	1.07±0.17	1.02±0.17	1.32±1,07	0.273
T4	6.77±1.47	7.00±1.17	8.76±3.73	0.02*
TSH	2.73±3.18	5.34±4.54	0.96±0.8	0.00 *
FT3	2.84±0.32	2.65±0.31	4.00±4.04	0.158
FT4	1.08±0.18	1.23±0.30	1.59±1.08	0.049*

Dunnet post hoc test was conducted to find out the statistically significant difference in between groups when compared with thyroid status(Table 5).Hypo thyroid and control among TSH showed significant difference P<0.02. For FT4 control and hyperthyroid group showed statistically significant difference P<0.032

Table 5: Post hoc Dunnet test - To know group which made statistically significant difference in between groups when compared with thyroid status

Dependent Variable	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.
T3	Hypothyrod	Control	-.0472500	.2006121	.960
	Hyperthyroid	Control	.2567000	.2006121	.341
T4	Hypothyrod	Control	-2.3220000	2.1784440E0	.464
	Hyperthyroid	Control	-.5565000	2.1784440E0	.953
TSH	Hypothyrod	Control	2.6034000*	1.0326751E0	.027*
	Hyperthyroid	Control	-1.7686000	1.0326751E0	.162
FT3	Hypothyrod	Control	-.2065000	.7435761	.945
	Hyperthyroid	Control	1.1420000	.7435761	.224
FT4	Hypothyrod	Control	.1499500	.2094818	.697
	Hyperthyroid	Control	.5146000*	.2094818	.032*
*The mean difference is significant at the 0.05 level.					

Pearson's correlation coefficient was used to find the relationship between duration of thyroid diseases and PD & CAL . Table (6) shows the Pearson's coefficient for the correlation between the duration of thyroid diseases and the periodontal parameters. There was a positive correlation(0.669) between duration and PD in hyperthyroidism. This means that greater values of duration are associated with greater values of PD

Table 6: Correlation of duration of thyroid disease with periodontal parameters in the study groups

*Correlation coefficient lies around ± 1, then it is said to be a perfect degree of association between the two variables

Pair	p value
HYPOTHYROID	
Duration vs. PD	0.329
Duration vs. CAL	0.118
HYPERTHYROID	
Duration vs. PD	0.669 *
Duration vs. CAL	- 0.137

Discussion

Periodontal diseases are host-immunomodulatory infections characterised by an imbalance between the bacterial challenge and host response. Even the influence of the systemic factors on the host may play an important role in the initiation and progression of periodontal diseases.

Thyroid disorders are the most common endocrine disorders worldwide. India too is no exception.[3]

Thyroid dysfunction may rear its head in any system in the body including the mouth.[11] The oral cavity is adversely affected by either an excess or deficiency of these hormones. As these hormones are very important in regulation of physiologic processes, their imbalance can affect the host response and the systemic health and may in turn affect the periodontal health. So alterations of thyroid hormone levels may act as a modulating factor in periodontal disease.

Limited data is available regarding the relationship between thyroid hormone imbalance & periodontal health. Most of the available data are animal studies . In animal studies thyroid disease may be induced by medication and are uncontrolled, therefore the observed results from these studies cannot be applied to human population.

There are several clinical conditions in which the use of TSH as a screening test may be misleading, particularly without simultaneous unbound or free T4 determination. Any severe non thyroid illness can cause abnormal TSH levels. Although hypothyroidism is the most common cause of increased TSH levels, rare causes include a TSH-secreting pituitary tutor, thyroid hormone resistance and assay artifact. Because unbound thyroid hormone levels are normal and the patient is euthyroid in all these circumstances , assays that measure unbound hormone are preferable to those for total thyroid hormones.T4 and T3 are highly protein-bound and numerous factors like illness, medications and genetic factors can influence protein binding. It is useful therefore, to measure the free or unbound hormone levels which correspond to the biologically available hormone pool.[12] So in this study we considered FT3 and FT4 also to get more accurate thyroid condition of the patient. None of the studies till date considered these levels which can have a huge impact on the results obtained .Because of these assays we are sure that patients are having abnormal hormone levels due to thyroid dysfunction and not because of associated diseases.In the present study we evaluated patients who were already diagnosed with thyroid dysfunction and on treatment for the same.Patients with any other systemic conditions were strictly excluded .

This was a cross-sectional study conducted on patients suffering from thyroid diseases. Subjects in the range if 25-50 years of age were recruited for the study.Hence, the aim of this study was to evaluate the effect of Our study has shown almost similar oral hygiene in all the three groups. Plaque index was slightly higher in hypothyroid group but the difference was not statistically significant when compared with other groups. Bhankar et al. noticed higher amount of local factors in hypothyroid compared to control group, but results cannot be compared as this study didn't include hyperthyroid group.[13] Study by Andriana et al. included both hypo and hyperthyroid groups and found more plaque levels in hyperthyroid . But this study evaluated newly diagnosed patients with thyroid dysfunction and who were not on any treatment contrasting our study where we included patients who were on treatment for thyroid dysfunction.[14]

Gingival status didn't show much significant difference between the groups, even though inflammation was more in the hypothyroid group. Increased gingival inflammation may be because of increased cytokines in thyroid dysfunction as reported by Adriana.[15]

Considering periodontal parameters, 6 (30%) of subjects in control group had periodontal pockets and only 5 (25%) in hyperthyroid but to a greater extent that is 11 (55%) had pockets in hypothyroid group.The difference was not significant staitistically. Clinical attachment loss was similar in all the three groups.

Even though hypothyroid patients showed a slightly more destruction compared to other two groups, the difference was not statistically significant. Our results are in accordance with Feitosa et al.[16] who studied the impact of thyroid hormone imbalance on alveolar bone loss using a rat model of ligature-induced periodontitis. They demonstrated a statistically significant increase in alveolar bone loss in the hypothyroid rats relative to the controls. They finally concluded that alveolar bone seems to be less sensitive to alterations in hormone levels .Contrasting results were observed by Andriana et al.[14] concluded that hyperthyroidism can induce more periodontal destruction than hypothyroidism. Hyperthyroid subjects had significantly higher prevalence of pockets compared to hypothyroid subjects .It can be concluded from our study that thyroid dysfunction if treated properly may not show any influences on periodontium , agreeing to Feitosa et al.[16] who concluded that alveolar bone seems to be less sensitive to alterations in thyroid hormone levels. At physiologic concentrations no direct effects of T4 & T3 on bone resorption as concluded by Mundy GR et al.[17]

Even though patients were on treatment, seven patients in hypothyroid group showed increased TSH levels and out of these 4 patients showed periodontal destruction.Seven patients in hyperthyroid still had very low TSH levels and out of these only one patient showed periodontal destruction. In these patients T4, FT3 and FT4 were also not in physiologic range. We noted that most of these patients who showed periodontal destruction were using the same dosage of medication since long and didn't follow up with their doctor to increase or decrease their medication dosage.So frequent visit and compliance to adjust the medication much be emphasised to patients to maintain their overall health and in turn their periodontal health. So proper treatment to maintain physiologic range of these hormone levels is important to even maintain periodontal health.

Pearson's correlation coefficient was used to find the relationship between duration of thyroid diseases and PD & CAL . Table (6) shows the Pearson's coefficient for the correlation between the duration of thyroid diseases and the periodontal parameters. It was found that as the number of years of thyroid disease increases there is an increase in number of pocket depths. So the longevity of disease also plays an important role in manifesting its effect on the periodontium. To the best of our knowledge, there are no published reports in the literature

evaluating the relationship between duration of thyroid diseases and PD & CAL for us to compare our results. Our findings suggest that duration of thyroid dysfunction may be an important parameter to consider to know more in depth about the association between these two diseases. The study by Hadidy et al.[18] also found that people suffering from hyperthyroidism had significant bone loss and it was related with the severity and duration of thyrotoxic state but this study was done to measure the bone mineral density and periodontal status was not considered.

Conclusion

Within the limitations of cross-sectional design with parameters recorded at one point of time and a relatively small sample size ,this study concludes that thyroid hormone disorders didn't affect the periodontal health thereby suggesting a casual relationship.Based on this study we conclude that thyroid hormone dysfunction if properly treated may not have major influence on periodontium . Duration of disease process seems to be important to show its effect in hyperthyroidism and this has to be emphasised in future studies.Duration from disease onset to treatment might also be critical factor .Further longitudinal large sampled prospective cohort studies must be carried out to know more about the causal relationship between these two diseases.

Source of funding: This research work was funded by university grants received from RGUHS (Rajiv Gandhi university of health sciences,Bangalore)

Acknowledgment

Sincere gratitude to Dr.Anantharaman , Endocrinologist .

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