NUJHS Vol. 3, No.3, September 2013, ISSN 2249-7110
Nitte University Journal of Health Science

Original Article

IN VIVO ANALYSIS OF LIPID PEROXIDATION AND TOTAL ANTIOXIDANT STATUS IN SUBJECTS TREATED WITH STAINLESS STEEL ORTHODONTIC APPLIANCES

Dilip Daniel Quadras[1], U.S. Krishna Nayak[2], Suchetha Kumari N.[3], Prashant Pujari[4], Vijay R.[5] & Ajay Dethose[6]

[1]Reader, Department of Orthodontics & Dentofacial Orthopedics, K.V.G Dental College, Sullia 574 327, D.K District, Karnataka, [2]Professor & Head of Department, Dean, Department of Orthodontics and Dentofacial Orthopedics, [3]Professor, Department of Biochemistry, K.S.Hegde Medical Academy, Deralakatte, [4] Reader, Department of Orthodontics and Dentofacial Orthopedics Pacific Dental college, Udaipur, [5,6]Central Research Laboratory, [5,6,2]A.B. Shetty Memorial Institute of Dental Sciences, Nitte University, Mangalore 575018

Correspondence :
Dilip Daniel Quadras,
Reader, Department of Orthodontics & Dentofacial Orthopedics, K.V.G Dental College, Sullia -574 327. Karnataka, India.
Mobile : +91 98457 14190 E-mail : dilipdq@gmail.com

Abstract :

Introduction: Nickel is a strong immunologic sensitizer, although nickel sensitivity has been reported to be lower in subjects who have received orthodontic treatment; perhaps they develop immunological tolerance over the long period of treatment. Hence the present aim of the work was to determine the levels of lipid peroxidation and total antioxidant status in Serum and Saliva in subjects treated with stainless steel Orthodontic appliances.

Methods and Materials: The study group included 25 participants and Samples were taken in different time intervals: Time interval 1- Collection of samples before the appliances fixed, Time interval 2- Collection of sample after one week of fixed appliances, Time interval 3- Collection of sample after three months of fixed appliances each from the Orthodontic Department of A.B Shetty Memorial institute of dental science.

Lipid peroxidation (Malondialdehyde) level is estimated using Thiobarbituric acid (TBA) method. Total antioxidant level was estimated using Phosphomolybdenum method.

Conclusion: Total antioxidant and Malondialdehyde levels are increased in case of Females compared to Males in serum whereas in case of Saliva Total antioxidant level is increased in Time interval 2 and 3 in Males compared to Females.

Keywords: stainless steel Orthodontic appliances, Lipid peroxidation, Total antioxidant.

Introduction :

Nickel is a strong immunologic sensitizer, although nickel sensitivity has been reported to be lower in subjects who have received orthodontic treatment; perhaps they develop immunological tolerance over the long period of treatment.[1,2] On the other hand, chromium and cobalt ions can also cause hypersensivity, dermatitis, and asthma.[3-5] These metals can induce other adverse biologic effects, such as cytotoxicity, and they are suspected genotoxic agents.[6] Many metal compounds are carcinogenic to animals or humans; their mechanisms are not overall known, but 1 pathway might be the involvement of the metals with DNA interaction, either directly or indirectly.[7]

Access this article online
Quick Response Code

Living organisms have evolved different molecules that speed up termination by catching free radicals and therefore protect the cell membrane. One important such antioxidant is vitamin E. Other anti-oxidants made within the body include the enzymes superoxide dismutase, catalase, and peroxidase. In addition, end products of lipid peroxidation may be mutagenic and carcinogenic. [8]

Free radicals are electrically charged molecules, i.e., they have an unpaired electron, which causes them to seek out

and capture electrons from other substances in order to neutralize themselves. Antioxidants are capable of stabilizing, or deactivating, free radicals before they attack cells.[9] Antioxidants are absolutely critical for maintaining optimal cellular and systemic health and well-being. Hence body maintains complex system of enzymatic antioxidants such as catalase, SOD, peroxidases etc. and non enzymatic antioxidants such as Vit C, E & glutathione etc. Oxidative stress occurs as a result of increased oxidative metabolism. An inadequate intake of antioxidant nutrients may compromise antioxidant potential, thus compounding overall oxidative stress .Conditions associated with oxidative damage include heart disease, cancer, pulmonary disorders, ageing etc. [10] On these backgrounds, the present work was designed to determine the levels of lipid peroxidation and total antioxidant status in subjects treated with metal stainless steel Orthodontic appliances.

Methods and Materials :

The present study was conducted after getting the clearance from the institutional ethical committee. The study group included 25 participants and Samples were taken in different time intervals: Time interval 1- Collection of samples before the appliances fixed, Time interval 2- Collection of sample after one week of fixed appliances, Time interval 3- Collection of sample after three months of fixed appliances each from the Orthodontic Department of A.B Shetty Memorial institute of dental sciences.

Saliva samples were collected in the morning before breakfast. The patients rinse their mouth thoroughly with deionised and distilled water before the collection. Saliva was sampled for 5 minutes with the mouth closed without stimulation and transferred to plastic test tubes.

1 ml of blood sample was collected in fluoride bottle to separate plasma. 2ml of blood collected in a plain bottle, centrifuged to separate serum.

Lipid peroxidation (Malondialdehyde) level is estimated using Thiobarbituric acid (TBA) method. Total antioxidant level was estimated using Phosphomolybdenum method.

Statistical Analysis: The obtained data was statistically analyzed for its significance by student t-test.

Results :

In our present study we analyzed the level of total antioxidant and lipid peroxidation in subjects treated with metal stainless steel Orthodontic appliances. The general characteristic of subjects is given in Table 1.

Total antioxidant status in serum was increased in case of Females compared to males. There was slight increase in 3 month subjects (68.32±16.34 µg/ml) compared to 1 week (59.30±10.82 µg/ml) and before appliance subjects (48.06±11.32 µg/ml) in Males whereas Total antioxidant level was gradually increased in 3 month (106.87± 23.82 µg/ml) and 1 week (91.19±22.63 µg/ml) subjects compare

Fig 1: Shows the Total antioxidant levels in serum of patients with stainless steel brackets.

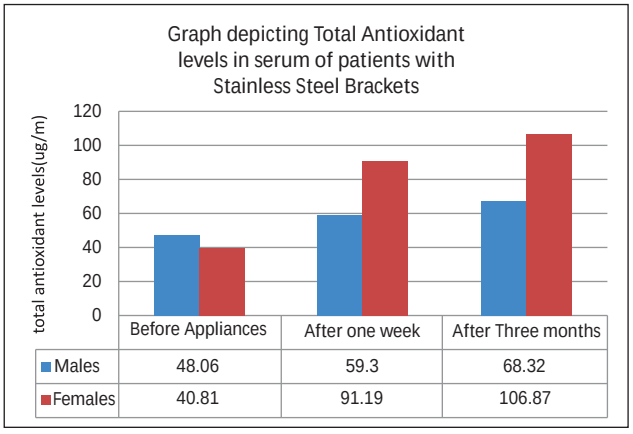
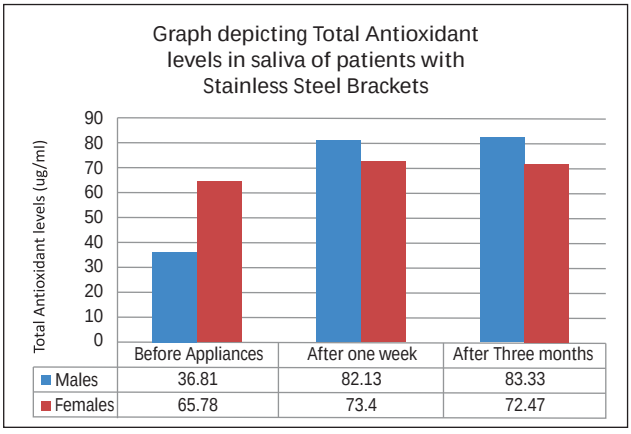


Fig 2: Shows the Total antioxidants levels in saliva of patients with stainless steel brackets.



Keywords : stainless steel Orthodontic appliances, Lipid peroxidation, Total antioxidant - Dilip Daniel Quadras

to before appliance subjects (40.81±20.5 µg/ml) in females is shown in Fig 1.

Total antioxidant status in saliva was increased in case of males compared to females. There was sudden increase in 1 week (82.13±22.8 µg/ml) and 3 mouth (83.33±18.62 µg/ml) subjects compared to before appliances subjects (36.81± 8.62 µg/ml) in males whereas Total antioxidant level was gradually increased in 1 week (73.40±16.5 µg/ml) subjects compared to before appliances (65.78±15.34) but there was fall in 3 month Subject (72.47±20.34 µg/ml) in females is shown in Fig 2.

Lipid peroxidation status in serum was observed to be increased in females compared to males. 3 month (1.230±0.23 µm/l) and 1 week (0.8173±0.40 µm/l) subjects were increased compared to before appliance subjects (0.096715±0.13 µm/l) in males whereas the lipid peroxidation status was gradually increased in females.3 month (1.56±0.38 µm/l) and 1 week (1.053±0.32 µm/l) subjects increased compared to before appliances (0.317764±0.24 µm/l) subjects is shown in Table 2.

Lipid peroxidation status in saliva was observed to be increased in females compared to males. There was slight increase in 3 month (0.678±0.21) and 1 week (0.5442±0.15) subjects compare to before appliances (0.290277±0.34) subjects in males whereas the lipid peroxidation level was gradually increased in 3 month (1.762±0.56) and 1 week (0.8789±0.10) subjects compared to before appliances (0.623916±0.79 µm/l) subjects in females is shown in Table 3.

Discussion :

In this study we observed that Total antioxidant and Malondialdehyde levels is increased in case of Females compared to Males in serum whereas in case of Saliva Total antioxidant level is increased in Time interval 2 and 3 in Males compared to Females.

An antioxidant is a molecule capable of inhibiting the oxidation of other molecules. Oxidation is a chemical reaction that transfers electrons from a substance to an oxidizing agent. Oxidation reactions can produce free radicals. In turn, these radicals can start chain reactions that damage cells. Antioxidants terminate these chain reactions by removing free radical intermediates, and inhibit other oxidation reactions. They do this by being oxidized themselves, so antioxidants are often reducing agents such as thiols, ascorbic acid or polyphenols. Although oxidation reactions are crucial for life, they can also be damaging; hence, plants and animals maintain complex systems of multiple types of antioxidants, such as glutathione, vitamin C, and vitamin E as well as enzymes such as catalase, superoxide dismutase and various peroxidase. Low levels of antioxidants, or inhibition of the antioxidant enzymes, cause oxidative stress and may damage or kill cells.

Lipid peroxidation refers to the oxidative degradation of lipids. It is the process whereby free radicals "steal" electrons from the lipids in cell membranes, resulting in cell damage. This process proceeds by a free radical chain reaction mechanism. It most often affects polyunsaturated fatty acids, because they contain multiple double bonds in between which lie methylene -CH2- groups that possess especially reactive hydrogens. As with any radical reaction the reaction consists of three major steps: initiation, propagation and termination. Thus from the study we conclude that Total antioxidant and malondialdehyde levels are increased in case of Females compared to Males.

Conclusion :

Total antioxidant and Malondialdehyde levels are increased in case of Females compared to Males in serum whereas in case of Saliva Total antioxidant level is increased in Time interval 2 and 3 in Males compared to Females.

Table 1. General characteristics of subjects

Parameters	Controls	Patients
Number of subjects	25	25
Male	12	12
Female	13	13
Age (y)	16-40	16-40
Fixed appliances (m)	0-3	0-3

Table 2: Lipid peroxidation level in Serum of patients with stainless steel brackets.

Sl. No	Before Appliances µm/l	After one week µm/l	After Three months µm/l
Males	0.096715±0.13	0.8173±0.40	1.230±0.23
Females	0.317764±0.24	1.053±0.32	1.56±0.38

Table 3: Lipid peroxidation level in Saliva of patients with stainless steel brackets.

Sl. No	Before Appliances µm/l	After one week µm/l	After Three months µm/l
Males	0.290277±0.34	0.5442±0.15	0.678±0.21
Females	0.623916±0.79	0.8789±0.10	1.762±0.56

References :

1. Vreeburg KJJ, von Blomberg M, Scheper RJ. Induction of immunological tolerance by oral administration of nickel and chromium. J Dent Res 1984; 63:124-8.
2. Van Hoogstraten IMW, Andersen KE, von Blomberg BME, Boden D, Bruynzeel DP, Burrows D. Reduced frequency of nickel allergy upon oral nickel contact at an early age. Clin Exp Immunol 1991; 85:441-5.
3. Bencko V. Nickel: a review of its occupational and environmental toxicology. J Hyg Epidemiol Microbiol Immunol 1983; 27:237-17.
4. Burrows D. Hypersensivity to mercury, nickel and chromium in relation to dental materials. Int Dent J 1986; 36:30-4.
5. Fisher JR, Rosenblum GA, Thomson BD. Asthma induced by nickel. J Am Med Assoc 1982; 248:1065-6.
6. Hartwing A. Current aspects in metal genotoxicity. Biometals 1995; 8:3-11.
7. Fracasso ME, Perbellini L, Solda S, Talamini G, Franceschetti P. Lead induced DNA strand breaks in lymphocytes of exposed workers: role of reactive oxygen species and protein kinase C. Mutat Res 2002;515:159-69.
8. Mataix J, Quiles JL, Heurtas JR, Battino M , Manas M. Free Radical Biol Med 1998; 24: 511-521.
9. Srikrishna R, Suresh DR. Variation of Total antioxidant Status after Ischemic stroke, British J Med Practision 2009; 2(1): 35-37.
10. Bast, Haenen CD. Reactive oxygen species and airway inflammation. Free Radio Bio Med 2003; 91(3):2-13.

Keywords : stainless steel Orthodontic appliances, Lipid peroxidation, Total antioxidant - Dilip Daniel Quadras