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Research Article

Serum Copper Levels in Periapical Inflammation Patients Compare with Healthy Individuals

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Abstract: Copper is an essential trace mineral. All the tissues of the body need it for normal metabolic function. There is a continuous synergy between nutrition and the integrity of the oral cavity in health and disease. The study was designed as a case-control study comprising 50 patients with periapical inflammation and 50 healthy subjects as controls. Serum copper estimation was performed by atomic absorption spectrometry. There was a decrease in serum copper level in periapical inflammation patients when compared to healthy individuals ($p<0.001$, highly significant). The multi-faceted role of copper in biological systems is demonstrated by several studies. The study suggests the need of a balanced copper containing diet is for normal health and well being of individuals.
Keywords: Copper, Periapical inflammation, Micronutrients, Diet, Periapical granuloma, Abcess

INTRODUCTION

Sound nutritional status and sufficient supply of essential vitamins and minerals play a considerable importance in maintenance of oral health as well as essential for immune response. The importance of a balanced diet consisting of micronutrient and antioxidants in the prevention of oral diseases is well established [1-3].

Bacterial inflammation of the pulp is the result of untreated dental caries which may lead to periapical lesions, most of the periapical lesions are periapical granulomas, radicular cyst or abscess. Periapical inflammation is frequently interchangeably used as apical periodontitis and periapical granuloma. Most common pathologic condition seen at the periapical area are Periapical granuloma, periapical abscess [4, 5].

Literature survey done by Fernandez M and Ataide ID [6] showed the Occurrence of periapical granulomas ranges from 9.3% and 87.1% and of periapical abcesses between 28.7 and 70.7%. Periapical abscess, periapical granuloma and radicular cyst are the common sequalae of dental caries [7]. There is also the possibility of subtle transformation of one type of disease into another type of lesion and also certain type of reversibility may be possible in some cases. The exact pathobiology for the diversity in the periapical pathology is not clearly understood. Multiple factors are playing synergistically and in a combative way. Some of the known key factors include the nature and quality of irritation, duration of the exposure, systemic factors, chemical mediators etc.

The role of the diet and nutritional factors deserves special consideration because of the often observed differences in caries incidence of various populations who subsist on dissimilar diets. Zinc (Zn), copper (Cu) and iron (Fe) are essential minerals that are required for a variety of biomolecules to maintain the normal structure, function, and proliferation of cells [8] and immune functions [9].

METHODOLOGY

The study was designed as a case-control study comprising 50 patients (36 male & 14 female) with periapical lesions and 50 healthy subjects as controls (32 male & 18 female). The scope, nature, aims and objectives of our study were thoroughly explained to the participants for their consent. All subjects underwent an initial screening that included a detailed history (medication, smoking, diet, and alcohol and supplemental vitamin intakes etc.). A detailed oral examination was performed and clinical details were recorded. Clinically suspected cases with histologically and radiologically confirmed cases of periapical abcess and granulomas were considered as periapical inflammation and were included in the study.

Serum copper estimation was performed by atomic absorption spectrometry. The data was entered in Microsoft excel for Windows. Unpaired t-test was used to describe any significant differences between the 2 groups. Statistical analysis was carried out using SPSS version 16.0 (Chicago, Inc).

RESULTS AND DISCUSSION

The mean serum copper level was 54.64± 38.6 µg/dl for patients having periapical inflammation and 93.84 ± 5.46 µg/dl for healthy individuals. There was a decrease in serum copper level in periapical inflammation patients when compared to healthy individuals ($p<0.001$, highly significant) (Fig. 1).

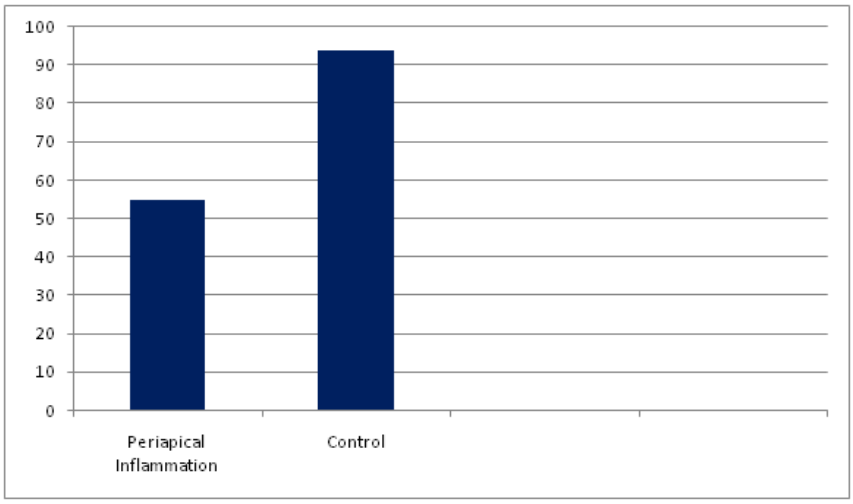

Fig. 1: Comparison of serum copper level between periapical inflammation patient and healthy individuals

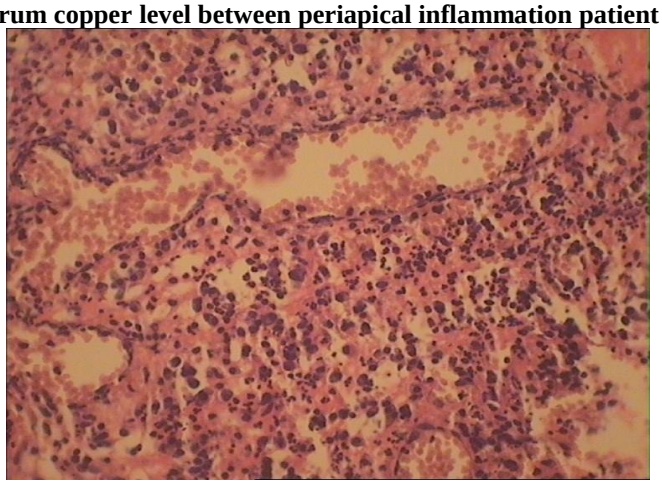

Fig. 2: Photomicrograph showing Histopathologically confirmed of periapical inflammation

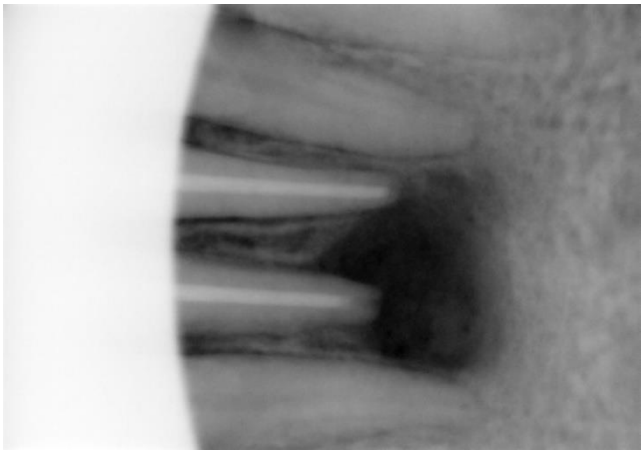

Fig. 3: Photograph showing radiographic features of periapical inflammation

Copper is an essential trace mineral. All the tissues of the body need it for normal metabolic function. Copper is a part of many proteins of the human body including copper containing enzymes (eg: aminooxidase, ferroxidase, cytochrome, superoxide dismutase) copper binding proteins and low molecular weight ligands. Its general main physiological functions relate to connective tissue formation, iron metabolism, nervous system, cholesterol metabolism and immune function. Copper has been shown to inhibit S-H containing enzymes and may inhibit acid production in dental plaque and carries on rodents[10]. Copper is also considered as toxic to streptococcus mutans acidogenic bacteria [11]. As the body cannot synthesize copper, the human diet must supply the regular amount of copper for metabolism.

Copper and Magnesium also have an important role to play in bone health since they are known to be an essential metabolic cofactor for enzymes involved in the synthesis of various bone matrix constituents [12] .

Serum copper level is influenced by age, acute phase reaction, pregnancy, anemia and medications [13]. Many minerals like zinc, manganese and sulphur singularly or in combinations can produce copper deficiency, especially if the nutrition or tissue copper status is marginal. In Wilson's disease, serum copper is paradoxically low [14]. Low copper level is most often due to excess iron or zinc ingestion and infrequently due to dietary copper deficit. Other diseases associated with decreased copper concentration include malnutrition, hypoproteinemia, malabsorption etc.

The present study showed a significant decrease in the serum copper level in periapical inflammation subjects compared to normal healthy controls.

Copper is known for its role in reducing inflammation. Excess copper is normally excreted with the bile. Prolonged cortisone treatment has been shown to increase the body excretion of copper and may lead to copper deficiency. Copper deficiency has been associated with anaemia, arthritis, free radicals damage, immune dysfunction and inflammatory disease. Copper – Zinc enzyme superoxide dismutase is one of the most important antioxidant [15]. Bo Sinaro *et al*. [16] stated that more than half of our population consumed less than the recommended daily copper intake based on their study and review. Inflammation / infection known to affect mineral metabolism and alter its requirements. Altered iron/ copper level in the tissue is a strong indicator of chronic inflammation,leads to a alteration in serum copper in various inflammatory condition in humans and lab animals.

CONCLUSION

Micronutrients are said to be playing a central part in metabolism and in the maintenance of tissue function. Multiple factors influence the status of micronutrients. It is also known fact that subclinical deficiency often of multiple micronutrients is more difficult to recognize and assess in the laboratory and is often complicated by the acute phase response [17, 18]. Eating well balanced diet is imperative to maintain a good oral health. Nutritional evaluation of caries prone subjects and nutritional supplement therapy may help in preventing dental diseases

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