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CASE STUDY

HISTOLOGICAL CHANGES IN DENTAL PULP OF DIABETES MELLITUS (TYPE II)

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ABSTRACT

Purpose: Type 2 diabetes mellitus is the commonest form of diabetes. The common complications associated with DM are retinopathy, nephropathy, neuropathy, microvascular disease, infection and impaired wound healing. The relationship between oral health and diabetes has been extensively studied, particularly with respect to periodontal disease, but effect of diabetes mellitus on dental pulp is less documented in the literature. This study aims to explore the relationship between the dental pulp and diabetes mellitus by histological analysis, which in turn will widen the horizon of diagnosis and treatment planning of such conditions.

Materials and Methods: A pilot study was conducted on 20 patients. 10 teeth were extracted from study group and the control group, employing intra-alveolar technique. Teeth were sectioned at apical third and subjected for histological procedure. The teeth were decalcified, processed and sections were stained.

Results: Study group showed thickened basement membrane blood vessels (60%) and pulp stones (40%).

Conclusion: Human dental pulp of type 2 diabetic patient revealed impairment of vasculature, which in turn interferes with tissue nutrition, pulpal repair, and creates a microaerophilic state for anaerobic development.

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INTRODUCTION

Diabetes mellitus (DM) is a group of complex multisystem metabolic disorders due to a deficiency in insulin secretion caused by pancreatic β-cell dysfunction and/or insulin resistance in liver and muscle (Segura-Egea *et al*, 2012). The prevalence of diabetes is rapidly rising all over the globe at an alarming rate. Type 2 diabetes mellitus is the commonest form of diabetes & its prevalence is 2.4% in rural population & 11.6% in urban population (Mohan *et al.,* 2007). The primary driver of the epidemic of diabetes is the rapid epidemiological transition associated with changes in dietary patterns & decreased physical activity as evident from the higher prevalence of diabetes in the urban populations. The most disturbing trend is the shift in age of onset of diabetes to a younger age in recent years. Type 1 diabetes results from cellular-mediated autoimmune destruction of pancreatic â cells, which usually leads to total loss of insulin secretion; in contrast, type 2 diabetes is caused by resistance to insulin combined with a failure to produce enough additional insulin to compensate for the resistance (Segura-Egea *et al.,* 2012). Diabetes mellitus is particularly important for patients who develop infections. The diabetic is not only more vulnerable to bacterial infections, and once invaded, there is a greater probability of developing more serious infections with a disturbance in insulin uptake. This vulnerability is caused by a generalized circulatory disorder, attributed to a lack of insulin, which controls glucose metabolism, with a resultant inadequate blood supply to regions of injury. Moreover, the increased blood glucose at the injury site may enhance bacterial multiplication with ultimate cell death and apoptosis and

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clearance of leukocytes with arrest of polymorphonuclear leucocyte recruitment. Type 2 diabetes is commonly linked to obesity, which contributes to insulin resistance through elevation of circulating levels of free fatty acids derived from the adipocytes; these free fatty acids inhibit glucose uptake, glycogen synthesis and glycolysis (Tunes *et al.,* 2010). The common complications associated with DM are retinopathy, nephropathy, neuropathy, microvascular disease, infection and impaired wound healing. The relationship between oral health and diabetes has been extensively studied, particularly with respect to periodontal disease, but effect of diabetes mellitus on dental pulp is less documented in the literature. Only two human histologic pulp studies have been reported according to computer analysis. Russel reported that the changes observed in the periodontal tissue were the same as in the pulps, angiopathies, and a thickened basement membrane. These changes were located in both large and small pulp vessels (Russel, 1967). Contrary to this, Bissada and Sharawy found no vascular changes in the dental pulps of diabetics (Bissada, 1970). Endodontists and even general practitioners come across various diabetic patients with pulp and periapical problems and also this systemic disease has the direct influence on the healing of the same. This study aims to explore the relationship between the dental pulp and diabetes mellitus by histological analysis, which in turn will widen the horizon of diagnosis and treatment planning of such conditions.

MATERIALS AND METHODS

A pilot study was conducted on the patients attending the Out Patient Department of Dr. D. Y. Patil Dental College and Hospital, Pimpri, Pune with a complaint of tooth mobility and partially edentulous mouth. Patients between 45-65 years with a history of controlled diabetes mellitus, whose teeth were indicated for extraction due to periodontal reasons, were included in the study. While, patients with h/o Type 1 diabetes and teeth indicated for root canal treatment were excluded. For control group, patients between similar age group with no h/o diabetes mellitus were selected. A sample size of 20 was considered using convenient sampling technique. Ethical clearance was taken from the institutional review board. Patients meeting following inclusion and exclusion criteria were considered. Informed consent was obtained from all the subjects willing to participate in the study. All these patients participating in the study underwent recent random serum glucose estimation by the same pathologist. 10 teeth were extracted from study group and the control group. All the teeth were extracted under local anesthesia using 2% lignocaine hydrochloride with 1:200,000 adrenaline, employing intra-alveolar technique. Standard postoperative instructions were given. Teeth were sectioned at apical third and subjected for histological procedure (Fig 1). The teeth were decalcified, processed and sections were stained with hematoxylin and eosin.

RESULTS

Angiopathic changes like thickened basement membrane were evident in both large and small blood vessels of six teeth in study group along with pulp fibrosis (Fig 2 and 3), while control group showed no thickened basement membrane in blood vessels. Pulp stones were evident in four teeth of study group (Fig. 4 and 5).

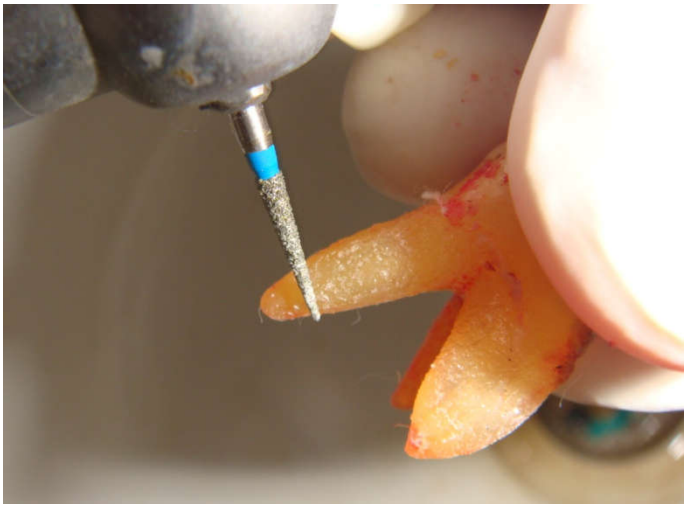

Fig.1. Photograph showing apical sectioning of the extracted tooth

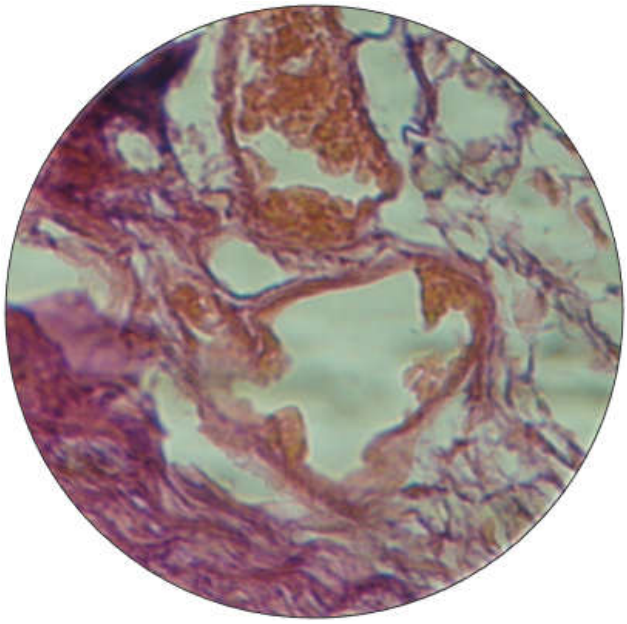

Fig.2. Microphotograph (40x) showing thickened basement membrane of blood vessel

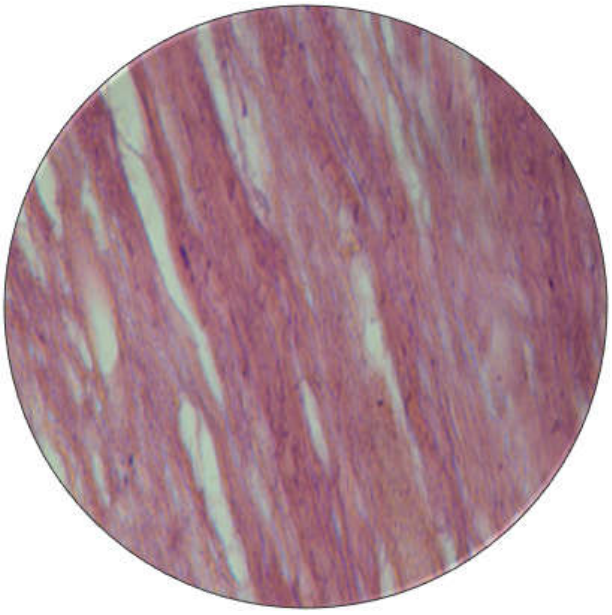

Fig.3. Microphotograph (40x) showing pulp fibrosis

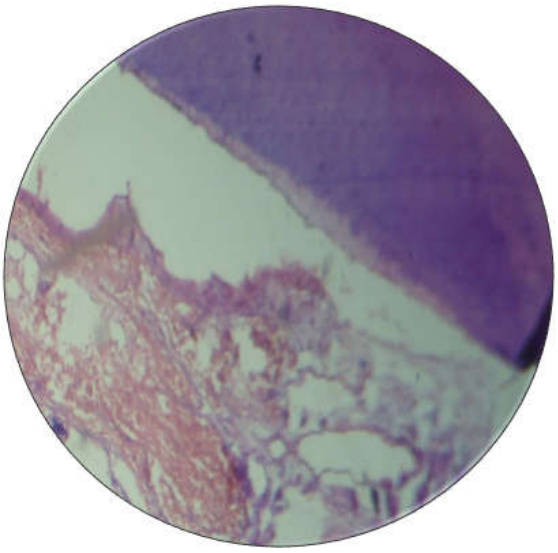

Fig.4. Microphotograph (10x) showing no thickened basement membrane

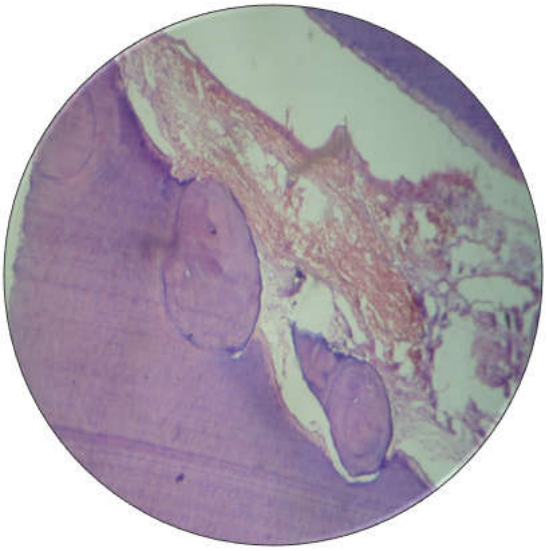

Fig.5. Microphotograph (10x) showing pulp stones

DISCUSSION

It is very well proved that diabetes mellitus (Type 1and 2) is associated with systemic complications and with depression of natural defenses against infection. Usually Systemic changes are seen on oral tissues also. Patients with poorly controlled diabetes have a chronic metabolism disorder of carbohydrate and lipid metabolism, and are prone to gingival and dental injuries (Listgarten *et al.,* 1974). Since dental pulp has limited or no collateral circulation if diabetes causes vascular changes in periapical tissues it should results in vascular changes in pulp as well. In this study though sample size is very limited, still we are able to notice the vascular and cellular changes in the pulp with diabetic mellitus. Angiopathies were noticed in both the small and large blood vessels. This is commonly seen in glomerulus, retina, skin and muscle. But gingival microvasculature also showed same changes in normal and inflamed gingiva (Fouad, 2003). Both generalized accumulation of atheromatous deposit in the vessels lumen and increased endothelial cell permeability occur. These changes impair the leukotactic response and decrease the leucocyte microbicidal activity. Vascular changes with thickened basement membrane may lead to increased inflammatory reaction and in uncontrolled or poorly controlled diabetic the inflammatory reaction is more acute because of vascular leakage and cell dehiscence.

According to the histological investigation conducted by Russel on the human pulp of non-carious extracted teeth of seven patients suffering from diabetes for a long term duration and control group of 13 non-diabetics which concluded that calcification in angiopathies and thickened basement membrane were noted in both large and small blood vessels, and vascular changes seemed more pronounced in the central area of the pulp (Russel, 1967). Calcifications in diabetics were frequent and often sickle-shaped. In another histopathological study, conducted by Bissada and Sharawy on 21 human dental pulps of diabetics and 20 matched controls, no vascular changes groups were found in the dental pulp of both (Bissada, 1970). However, amorphous calcified bodies in the pulp of diabetics were found. Dental pulp of patients who suffer from diabetes mellitus tend to age more readily because it of obliterate endarteritis and because it has limited or no collateral blood circulation in fully developed teeth. The clinical significance of pulpal calcification is not completely understood. It has been reported upon numerous occasions that pulp stones are a cause of pain, varying from mild to severe excruciating pain. Given the association between pulp stones and nerve tissue, both in terms of pulp stone formation and nerve fibre entrapment, it has been suggested that some pain of an idiopathic nature may be caused by pulp stones This may be one of the predisposing factor unknown pain in diabetic patients. Another observation on these dental pulps revealed significant increase in volumetric density of collagen fibers and fibroblasts when compared to control group. This may because of age changes in pulp. Histological Analysis of periapical area in animal studies showed huge periapical lesions & severe alveolar bone loss when compare to control group suggesting that the metabolic conditions produced by the diabetes may increase the development of periradicular lesions (Nayak *et al.,* 2013). Vascular Changes in the pulp of DM patients may also induce changes in immune cell function produce an inflammatory response his predisposes to chronic inflammation, progressive tissue breakdown, and diminished tissue repair capacity (Delamaire *et al.,* 1997). Detailed human pulp studies, at present, do not exist in diabetes mellitus, but still we can understand from these observations that the impaired vasculature also interferes with tissue nutrition, pulpal repair, and creates a microaerophilic state for anaerobic development.

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