Periodontal Health Status and Assessment of Osteocalcin levels in Saliva of Diabetic Patients and Systemically Healthy Persons (Comparative study)

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ABSTRACT

Background: Diabetes and periodontitis are complicated prolonged disorders through a recognized two-way association. There is elongated-conventional mark that hyperglycaemia in diabetes is affected on immune-inflammatory response and disturb the action of osteoclast and in balance bone turnover, which might rise the person vulnerability to the progress of prolonged periodontitis. Osteocalcin is one of the greatest plentiful matrix proteins originate in bones and produced absolutely there. Small osteocalcin crumbles are noticed in regions of bone remodeling and are in fact degradation products of the bone matrix, that is released outside cells into the Gingival Crevicular Fluid (GCF) and saliva after destruction of periodontal tissue during periodontitis

Materials and Methods: Eighty patients with Type2Diabetes Maleates (T2DM), males and females, were recruited for the study, with an age range of (30-50) years were divided into four groups, (20 subjects each): poorly controlled Type 2Diabetes Mellitus with chronic periodontitis group (CP+pT2DM) and well controlled Type 2Diabetes Mellitus with chronic periodontitis group(CP+wT2M) , group of patients with only chronic periodontitis (CP)and control group with healthy periodontium and systemically healthy. From all subjects five ml of unstimulated whole salivary samples were collected, then, the samples were centrifuged and the supernatants were collected and kept frozen until the biochemical analysis to measure OC concentrations then clinical periodontal parameters (plaque index, gingival index, bleeding on probing, probing pocket depth and clinical attachment loss) were recorded for all subjects at four sites per tooth except for the third molars.

Results: The results of this study revealed highly significant differences among all study and control groups for all the clinical periodontal parameters (plaque index, probing pocket depth, clinical attachment loss) ,and OC concentrations. Additionally patients had chronic periodontitis with poorly controlled Type 2Diabetes Mellitus(CP+pT2DM)demonstrated the highest median values of all clinical periodontal parameters and highest increase in levels of salivary OC followed by CP+wT2M group then CP and Control groups. The current study demonstrates the correlation between OC concentrations with each one of the clinical parameters.It revealed highly significant strong positive correlations with PLI, GI and BOP score 1, while highly significant strong negative correlations with PPD. Also, non-significant weak positive correlation existed with CAL in CP+pT2DM group. Also, high significant strong positive correlation with PLI, GI, BOP and CAL; while, non-significant weak positive correlation with PPD in CP+wT2M group . High-significant strong positive correlation with BOP and CAL, as well as, high significant moderate positive correlation with PPD and significant weak positive correlation with PLI, while non-significant weak positive correlation with GI existed in CP group .Finally, high significant moderate positive correlation with PLI and GI existed in the Control group.

Conclusion: Patients with poor glycemic control had more severe periodontal tissue break down with increase in levels of OC than well controlled type 2 diabetic patients and non-diabetic patients all of them with chronic periodontitis. So, this biochemical marker may be useful of periodontal tissue destruction and allowed practitioners for early diagnosis, prognosis and efficient management of periodontal diseases and type 2 diabetes mellitus

Keywords: Periodontitis, Type 2Diabetes Mellitus, salivary Osteocalcin..**(J Bagh Coll Dentistry 2017; 29(1):89-95).**

INTRODUCTION

2Diabetes Mellitus (DM) is a multisystem disorder considered as a relatively or absolutely inadequacy of insulin secretion and/or associated resistance to the metabolic action of insulin on target tissues[1, 2].The DM is regarded as a hyperglycemia and T2DM is susceptible to oral complications such as periodontal disease (PD), dry mouth and abscesses [3, 4].

Periodontitis is an inflammatory lesion that is attended by soft tissue impairment and bone resorption in the tooth supportive structures. It has a multifactorial etiology and the distinguishing tissue destruction is mediated essentially by the aberrant immune response of different inflammatory periodontal diseases [5].

The greatest communal form of periodontitis is the chronic periodontitis (CP) that characteristically disturbs adults between 40 to 50 years old and is branded by its slowly progressing nature, but at particular point suffers exacerbation[6].

Osteocalcin is a calcium-connecting protein of bone and is the greatest plentiful non collagenous protein in mineralized tissues. Osteocalcin is synthetic mostly by osteoblasts, odontoblasts and hypertrophic chondrocytes and it has an imperative role in bone formation and turnover. It has also been exposed to promote bone

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resorption, and stimulate differentiation of osteoclast progenitor cells, that may be involved in employing osteoclasts to positions of recently formed bone and as a result may role as a negative regulator. Osteocalcin is currently an effective marker of bone turnover when resorption and formation are coupled and is a particular marker of bone formation when formation and resorption are uncoupled [7, 8]. osteocalcin is the hormonally active isoform and stimulates insulin discharge and increases insulin sensitivity in adipose tissue and muscle. The places of the skeleton act as a true endocrine organ in a traditional feedback mechanism [9].

There has been association between T2DM, PD and numerous indicators in saliva [10]. These have interested us to make the present study, so as to assess the salivary OC levels in T2 diabetic patients with CP to establish the result of the glycemic regulator on their stages and the extent of the periodontal damage.

MATERIALS AND METHODS

The human sample consists of 80 patients with T2DM, males and females, with age range of (30-50) years. The collection of The subjects recruited for the study were patients attending the diabetic department of Imam AL- Hussein Medical City, as well as, patients from Specialized Dental Center in Karbala city.

The subjects were divided into four groups:

A. CP with poorly controlled T2DM (CP+pT2DM): consisted of 20 males and femaies with CP and HbA1c > 9%.

B. CP with well controlled T2DM (CP+wT2DM): consisted of 20 males and femals with CP and HbA1c < 7%.

C. Systemically healthy with chronic periodontitis (CP): consisted of 20 males and females with CP. Chronic periodontitis in patients was defined as the presence of minimally four sites with PPD ≥ 4 mm and clinical attachment loss of (1-2) mm or greater[11].

D. Systemically healthy with healthy periodontium (Control): consisted of 20 males and females apparently systemically healthy and with clinically healthy periodontium, this was defined by gingival index (GI) scores <0.5 [12] and without periodontal pockets or clinical attachment loss. This group represents a base line data for the levels of salivary OC. Inclusion criteria: males and females with T2DM (diabetic for 5 years) on oral hypoglycemic therapy only, at least 20 teeth present [13]. While, the exclusion criteria included:, T1DM and T2DM administering insulin, smoking and alcohol consumption, presence of systemic diseases other than T2DM, presence of nephropathy, retinopathy and diabetic foot, patients who've undergone periodontal treatment or administrated medications (anti-inflammatory, anti-microbial and anti-depressants) in the three months prior to the study and Pregnant, lactating and menstruation cycle . From all subjects five ml of unstimulated whole salivary samples were collected from all of the groups at 9-12 a.m. [14]. Then the samples were centrifuged at 4000 rpm for 15 min. and frozen at - 20°C.

Clinical periodontal parameters examination was performed after collecting the salivary samples by using the Michigan O periodontal probe on four surfaces (mesial, buccal/ labial, distal and lingual/palatal) of all teeth except the third molar. These included:

1. Assessment of Soft Deposits by the PlaqueIndex System (PLI) [15].
2. Assessment of Gingival Inflammation by theGingival Index System (GI) [12].
3. Assessment of Gingival Bleeding on Probing (BOP) [16].
4. Assessment of Probing Pocket Depth (PPD).
5. Assessment of clinical attachment level (CAL).

For the purpose of biochemical analysis of salivary OC, this was done by Enzyme Linked ImmunoSorbent Assay (ELISA) technique by using kit manufactured by (Shanghai yehua, China). The study variables were statistically analyzed using Statistical Process for Social Science (SPSS version 19) by using Median, Minimum, Maximam, Percentage and inferential statistics in the form of Kruskal-Wallis H test, Mann-Whitney U test and Pearson Correlation were used in this study. The levels of significant (S) was accepted at P-value < 0.05, highly significant (HS) at P value < 0.01 and non-significant (NS) at P-value > 0.05.

RESULTS

The results of this study revealed highly significant differences among all study and control groups for all the clinical periodontal parameters (plaque index, probing pocket depth, clinical attachment loss) that demonstrated in the results of Kruskal-Wallis H test (X^2), as shown in (Table -1). The highest median value of PLI (2.76) was in the CP+pT2DM, followed by CP+wT2DM was (2.27) then CP was (1.15) and finally the Control group demonstrated the lowest median value was (0.42).While the highest median value of GI (2.27) was in the CP+pT2DM, followed by CP+wT2DM was (1.99) then CP was (1.08) and the Control group demonstrated the lowest median value was (0.55). Likewise, the highest median percentage value of

BOP sites found in CP+pT2DM was (37.7), followed median percentage was found in CP+wT2DM (28.7), while lowest median percentage of BOP for CP (27.3).Additionally, CP+pT2DM showed the highest median value of "PPD" was (6.35) among the study groups followed by CP+wT2DM which was (5.31) and CP group was (4.43). Regarding CP+pT2DM showed the highest median value of "CAL" was (4.66) among the study groups followed by CP+wT2DM was (3.73) and CP group was (2.6). Inter study groups comparisons regarding all clinical periodontal parameters revealed, HS differences between CP + pT2DM with both CP + wT2DM, CP groups and control groups (Table - 2).

The biochemical analysis (table-3) In the levels of salivary OC of the study group CP+pT2DM showed the highest median value of OC among the four groups, the median value was (55.60), followed by CP+wT2DM with median value of (38.90) then CP group with median value of (25.99), finally the lowest median value was (8.46) which demonstrated by Control group, that showed in figure(1) for median values of Osteocalcin concentrations (ng/ml) for the study and control groups.

The results of the comparisons for all pairs of the study and control groups in (table-4) about biochemical parameters levels revealed: highly significant differences between Control group and all of the study groups.

The current study demonstrates the correlation between OC concentrations with each one of the clinical parameters.It revealed highly significant strong positive correlations with PLI, GI and BOP score 1, while highly significant strong negative correlations with PPD Also, non-significant weak positive correlation existed with CAL in CP+pT2DM group.Also, high significant strong positive correlation with PLI, GI, BOP and CAL, while non-significant weak positive correlation with PPD in CP+wT2M group.High-significant strong positive correlation with BOP and CAL, as well as, high significant moderate positive correlation with PPD and significant weak positive correlation with PLI, while non-significant weak positive correlation with GI existed in CP group.Finally, high significant moderate positive correlation with PLI and GI existed in the Control group.

Table 1: Analytic statistics in clinical parameters for the study and control groups

Variables	Groups	N	Median	X^2	p-value
PI	Control	20	0.42	72.216	0.000
	Chronic Periodontitis	20	1.15		
	Well control D.M.+CP	20	2.27		
	Poor control D.M.+CP	20	2.76		
GI	Control	20	0.55	67.757	0.000
	Chronic Periodontitis	20	1.08		
	Well control D.M.+CP	20	1.99		
	Poor control D.M.+CP	20	2.27		
BOP	Chronic Periodontitis	20	27.3	21.731	0.000
	Well control D.M.+CP	20	28.7		
	Poor control D.M.+CP	20	37.7		
PPD	Chronic Periodontitis	20	4.43	43.095	0.000
	Well control D.M. +CP	20	5.31		
	Poor control D.M. +CP	20	6.35		
CAL	Chronic Periodontitis	20	2.6	50.060	0.000
	Well control D.M. +CP	20	3.73		
	Poor control D.M. +CP	20	4.66		

Table 2: Comparison between each two groups in clinical parameters

Groups	Test	PI	GI	BOP	PPD	CAL
Control vs. Periodontitis	Mann-Whitney U	0	14.5	-	-	-
	p-value	0.000	0.000			
Control vs. well control D.M.	Mann-Whitney U	0	0	-	-	-
	p-value	0.000	0.000			
Control vs. poor control D.M.	Mann-Whitney U	0	0	-	-	-
	p-value	0.000	0.000			
Periodontitis vs. well control D.M.	Mann-Whitney U	0	5	109.5	41	17
	p-value	0.000	0.000	0.014	0.000	0.000
Periodontitis vs. poor control D.M.	Mann-Whitney U	0	0	53	4	0
	p-value	0.000	0.000	0.000	0.000	0.000
Well control D.M. vs. poor control D.M.	Mann-Whitney U	27	82	73.5	26.5	2
	p-value	0.000	0.001	0.001	0.000	0.000

Table 3: Analytic statistics of Osteocalcin concentrations (ng/ml) for the study and control groups

Variables	Groups	N	Median	X2	p-value
Osteocalcin	Control	20	8.46	74.074	0.000
	ChronicPeriodontitis	20	25.99		
	Well control D.M. +CP	20	38.90		
	Poor control D.M. +CP	20	55.60		

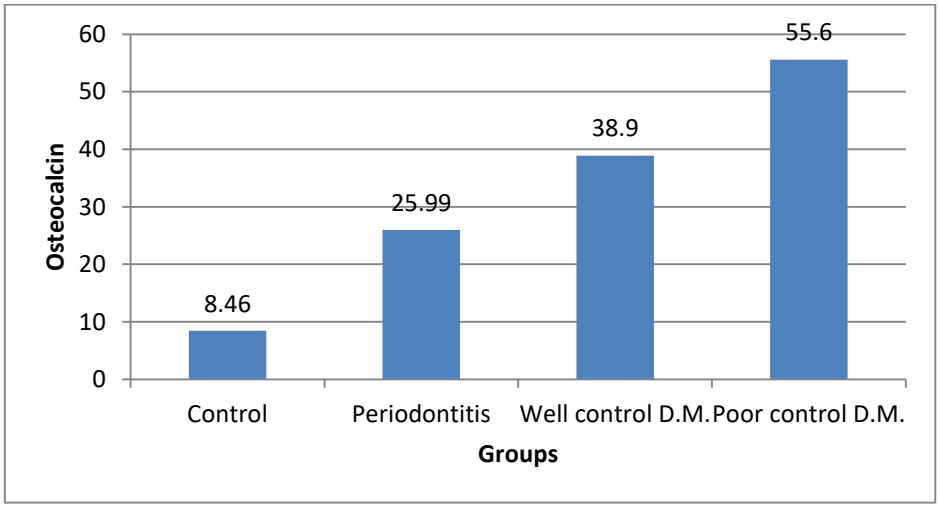

Figure 1: Bar chart for median values of Osteocalcin concentrations (ng/ml) for the study and control groups

Table 4: Comparison between each two groups of Osteocalcin concentrations (ng/ml) for the study and control groups

Groups		Mann-Whitney U test	P-value	Sig
CP+pT2DM	CP+wT2DM	0	0.000	(HS)
	CP	0	0.000	(HS)
	Control	0	0.000	(HS)
CP+wT2DM	CP	0	0.000	(HS)
	Control	0	0.000	(HS)
CP	Control	0	0.000	(HS)

Table 5: Correlations between the levels of osteocalcin with the clinical parameters of each study and control groups

Parameters	Statistical analysis	CP+pT2DM	CP+wT2DM	CP	Control
PLI	r	0.900	0.911	0.430	0.663
	p-value	0.000	0.000	0.058	0.001
	Sig	HS	HS	S	HS
GI	r	0.901	0.999	0.317	0.687
	p-value	0.000	0.000	0.174	0.001
	Sig	HS	HS	NS	HS
BOP	r	0.919	0.998	0.636	-
	p-value	0.000	0.000	0.003	-
	Sig	HS	HS	HS	-
PPD	r	-0.761	0.299	0.539	-
	p-value	0.000	0.201	0.014	-
	Sig	HS	NS	HS	-
CAL	r	0.032	0.645	0.754	-
	p-value	0.895	0.002	0.000	-
	Sig	NS	HS	HS	-

DISCUSSION

In diabetic patients, the decrease in the volume of saliva and buffering capacity in addition to the variation in bacterial flora. Altogether, these factors produce greater accumulation of plaque [17]. Furthermore, the harmful effects of advanced glycation end products and receptor for advanced glycation end products (AGEs-RAGEs) interactions in the periodontium of diabetic patients that comprise: increase vascular permeability, impaired wound healing and vascular variations contribute to further periodontal destruction [18].Diabetic is related with complications, such as inflammation, (AGEs) [19], microangiopathy [20], macroangiopathy [21]. The combination of these abnormalities makes diabetic patients vulnerable to bacterial infection in the periodontal tissue [22].The DM alters periodontitis by deregulating the immune and inflammatory responses in the periodontium, further cytokines are accumulated in the gingival tissues which will give rise to further periodontal destruction [23, 24]. Also, DM effects diminished function of the neutrophils and hyperactivity of macrophages and monocytes which will result in further devastation of the periodontium, thus diabetic patients have greater prevalence and extent of periodontal pockets [25, 26]. Poor glycemic control, with the associated rising in AGEs [27], these certainly play a significant role in the susceptibility of diabetic patients to infections and damaging PD. There were augmented BOP, augmented tooth mobility and more loss of attachment as the individuals with diabetes are twice as possible to exhibit attachment loss as nondiabetic individuals [28]. In the present study, the salivary OC concentrations were higher in the chronic Periodontitis with pT2DM group than the chronic Periodontitis with wT2DM group, chronic Periodontitis group and control groups. This increase may designate an increase in the cellular actions of osteoblasts to reparation the broken alveolar bone [29].In addition, unusual blood glucose control was a risk factor for bone loss. Reduced bone mass and augmented fracture rate were communal in diabetes, that attributable to reduce late-stage differentiation of osteoblasts and a decrease in osteoblast function. Also, advanced glycated end products (AGEs) had been associated to abnormal development of osteoblasts, that believed to enhance bone resorption and induce apoptosis .As well as, enzymatic cross-linkage of collagen fibers provided strength to bone, nevertheless AGE-induced non-enzymatic collagen cross-linkage caused increasing fracture risk[30]. Moreover, osteocalcine was a potential marker of abnormal bone turnover in periodontal disease progression. The connotation between diabetes and periodontal diseases was demonstrated. Diabetes was a risk factor for periodontal disease, so as the diabetic patients showing an augmented prevalence, extent and severity of gingivitis and periodontitis compared to healthy adults [31].The OC is produced by osteoblasts and is widely accepted as a marker of bone osteoblastic activity. OC, incorporated into the bone matrix, is released into the circulation from the matrix during bone resorption and, hence, is considered a marker of bone turnover, rather than a specific

marker of bone formation [32].when the values of clinical periodontal parameters increase, this mean increase in the severity of PD, more destruction of alveolar bone, more activity of osteoblast and increase in the OC concentration to repair the damaged alveolar bone[29].As well as, The results gained from this study identified positive significant correlation with the BOP, PPD and CAL parameters, which may be attributable to presence of further periodontal tissue destruction in diabetic groups that resultant in augmented enzymatic activity with increasing severity of periodontitis. These outcomes can be explained by the rise in severity of inflammation that caused by rise of plaque bacteria which demonstrated by increasing in mean values of BOP, PPD and clinical attachment loss [28].

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الخلاصة:

الخلفية: داء السكري والتهابات اللثة امراض مزمنة وذات مضاعفات ومثبتة بعلاقة ذات اتجاهين في العديد من الدراسات .ارتفاع نسبة الكلوكوز لدى المرضى المصابين بداء السكري هو العامل المحفز للأمراض المناعية الالتهابية والمؤثر في فعالية الاوستيوكلاست و عدم الموازنة في اعادة تنظيم العظم ، التي تزيد قابلية التقدم لالتهاب اللثة المزمن .الاوستيوكالسين هو واحد من بروتينات المصفوفة العظمية الاكثر وفرة في العظام والمصنوعة حصرا هناك .تم العثور على قطع صغيرة من تكسر الاوستيوكالسين في مناطق اعادة تشكيل العظام وهي في الواقع نواتج التحلل من مصفوفة العظام، الذي يتحرر خارج الخلايا في السائل اللثوي واللعاب بعد تحطيم الانسجة اللثوية خلال الالتهاب اللثوي.
الموادوالطرق: تم اختيار ثمانين شخصا لغرض الدراسة من الذكور والاناث من اصحاب الفئة العمرية (35-50) تم تقسيم الاشخاص الى اربعة مجاميع (20شخص لكل مجموعة) المجموعة الاولى :تتكون من 20 مريضا بالسكري من النوع الثاني الغير مسيطر, المجموعة الثانية:تتكون من20مريضا بالسكري من النوع الثاني المسيطر علية, المجموعة الثالثة:تتكون من 20 مريضا غير المصاب بالسكري, كل منهم لدية مرض ألتهاب اللثة المزمن, المجموعة الرابعة:تتكون من20 شخصا اصحاءواللثة لديهم صحية كمجموعة ضابطة.تم جمع 5مل من عينات اللعاب غير المحفزمن جميع المشاركين في الدراسة ومن ثم وضع العينات في جهاز الطرد المركزي حيث تم بعدها جمع الخلاصة الصافية للعينة وتجميدها الى وقت التحليل الكيميائي الحيوي للاوستيوكالسين ،ألفا أميليس وتوتل بروتين اللعابية ثم قياس مؤشرات ماحول الاسنان السريرية بما في ذلك مؤشر الصفيحة الجرثومية, مؤشر التهاب اللثة, مؤشر النزف عند التسبير, عمق جيوب اللثة ومستوى الانسجة الرابطة سريريا سجلت لكل شخص في الدراسة ولاربعة اسطح في كل سن بأستثناء الرحى الثالثة.
النتائج: وجدت فروقات معنوية عالية بين المجاميع الدراسية والمجموعة الضابطة في المؤشرات السريرية للثة والتحليلات الكيميائية الحيوية.بالإضافة لتسجل اعلى قيم للمتوسط الحسابي لمؤشرات حول الاسنان السريرية في مجموعة التهاب اللثة المزمن لدى المصابين بمرض السكري النوع الثاني الغير مسيطر علية.التحليل الكيميائي الحيوي للاوستيوكالسين اللعابي اظهر بان اعلى تركيز وجد في مجموعة التهاب اللثة المزمن لدى المصابين بمرض السكري النوع الثاني الغير مسيطر علية يليها مجموعة التهاب اللثة المزمن لدى المصابين بمرض السكري النوع الثاني المسيطر علية ثم مجموعة التهاب اللثة المزمن والمجموعة الضابطة. الربط بين مستويات الاوستيوكالسين اللعابي مع المؤشرات السريرية للثة اظهر علاقة معنوية عالية وموجبة عند الربط بين مستويات الاوستيوكالسين اللعابي مع قياس مؤشر الصفيحة الجرثومية وقياس مؤشر التهاب اللثة وقياس مؤشر النزف عند التسبير, بينما وجدت علاقة معنوية سالبة مع قياس عمق جيوب اللثة ،كذلك لا توجد علاقة معنوية ضعيفة وموجبة مع قياس مستوى الانسجة الرابطة سريريا في مجموعة التهاب اللثة المزمن لدى المصابين بمرض السكري النوع الثاني الغير مسيطر علية. ايضا اظهر علاقة معنوية عالية وموجبة عند الربط بين مستويات الاوستيوكالسين اللعابي مع قياس مؤشر الصفيحة الجرثومية وقياس مؤشر التهاب اللثة وقياس مؤشر النزف عند التسيير و قياس مستوى الانسجة الرابطة سريريا، بينما لا توجد علاقة معنوية عند الربط مع قياس عمق جيوب اللثة في مجموعة التهاب اللثة المزمن لدى المصابين بمرض السكري النوع الثاني المسيطر علية ، وجدت علاقة معنوية عالية وموجبة عند الربط مع قياس مؤشر النزف عند التسيير و قياس مستوى الانسجة الرابطة سريريا ،بالإضافة الى وجود علاقة معنوية متوسطة موجبة عند الربط مع قياس عمق جيوب اللثة و اظهر علاقة معنوية ضعيفة مع قياس مؤشر الصفيحة الجرثومية ,بينما لا توجد علاقة معنوية عند الربط مع قياس مؤشر التهاب اللثة في مجموعة التهاب اللثة المزمن لغير المصابين بداء السكري .واخيرا, وجدت علاقة معنوية متوسطة موجبة عند الربط مع قياس مؤشر الصفيحة الجرثومية وقياس مؤشر التهاب اللثة في المجموعة الضابطة .
الاستنتاج: من الممكن استنتاج ان المصابين بالسكري من النوع الثاني والغير مسيطر علية يعانون من تدمير اكثر لانسجة اللثة مع ازدياد مستويات الاوستيوكالسين اللعابي من المصابين بالسكري من النوع الثاني والمسيطر علية و الغير مصابين بالسكري كل منهم لدية مرض ألتهاب اللثة المزمن و هذا المؤشر الكيميائي الحياتي يستخدم لقياس درجة تدمير اللثة, توفر فرصا للتشخيص المبكر ومراقبة افضل ومعالجة فعالة لامراض اللثة وكذلك معالجة مرض السكري من النوع الثاني.