

EFFECT OF ZINC SUPPLEMENTATION ON PERIODONTAL STATUS

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**ABSTRACT**

**Background and objectives** A link between the occurrence of periodontitis and zinc deficiency has been suggested. The aim of this study was to evaluate the effect of zinc supplementation on periodontal status in patients with type 2 diabetes mellitus.

**Methods** Three hundred diabetic patients with chronic periodontitis (age range 45-65 years old) were selected. The patients divided into three groups as I :zinc supplement; II: scaling and polishing; III: zinc plus scaling and polishing. At initial visit, the blood samples of all patients collected and analyzed for serum zinc and glucose. Periodontal status of the patients based on clinical attachment loss and probing pocket depth score was determined. The patients in group I and group III were assigned to receive 50 mg elemental zinc three times a day for six months period. Periodontal status reassessed after intervention following the same procedure.

**Results** At initial, there were no significant differences in any parameter between the three groups. At the end of the 6 months period, the mean values of clinical attachment loss and probing pocket depth scores were significantly lower among group III as compared to group II (P<0.01). The percentage of change in clinical attachment loss and probing pocket depth were significantly higher in the group III as compared to group II ( p<0.05).

**Conclusion** Zinc supplement for vulnerable population to low zinc status such as type 2 diabetes mellitus patients decreases the chance of the occurrence of severe periodontitis.

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**Keywords:** Zinc, Periodontitis, Diabetes mellitus

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**P**eriodontitis is a multifactorial disease caused by gram-negative anaerobic bacteria, with systemic and environmental factors. Periodontitis, if untreated, leads to loss of alveolar bone and supporting tissues of the teeth, so a proper intervention is required from stage to stage in order to retain the teeth in the oral cavity in functional state for long period<sup>1</sup>. Patients with type 2 diabetes mellitus (T2DM) are at a higher risk for periodontitis<sup>2,3,4</sup>, and screening of patients

with diabetes and periodontitis that may threaten longevity and the quality of life is necessary<sup>5</sup>.

Zinc(Zn) is an essential trace element to all forms of life because of its fundamental role in gene expression, cell development of cell<sup>6</sup>. It has been reported that the altered metabolism of zinc would lead to some diabetic complications such as periodontitis<sup>7,8</sup>. In rate, the improve effect of oral supplementation of zinc has been determined in rat; oral and periodontal

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health in rat was better in oral zinc supplementation than in zinc deficiency<sup>9</sup>. In the light of these findings; considering that link between zinc and periodontitis may have a role in the improvement of periodontal tissues in T 2 DM; we aimed to evaluate the effect of zinc supplementation on periodontal status in patients with T2 DM.

## **METHODS**

### **Study population**

A total of 300 T2 DM patients with periodontal disease were included in the study.

The patients were divided into three groups consisting of 100 participants in each group as follows: Zinc supplement (group I); scaling and polishing (group II); and zinc plus scaling and polishing (group III). Their age ranged from 45-65 years. All patients were selected from the outpatients attending Diabetes Health Center, Duhok, Kurdistan Region, Iraq. Patients interviewed and informed about the nature of the study and then verbal consent was obtained from each subject. The study protocol was approved by the ethical Committee of the General Directorate of Health in Duhok.

### **Study protocol**

The participants underwent two visits, at base line and after 6 months of taking oral zinc supplementation and periodontal treatment. A protocol for zinc supplementation involved zinc sulphate cap 220 mg three time daily which is equivalent to 50mg elemental zinc (150mg /day) for six months period. The first group were given zinc only, the second group involved periodontal treatment

(scaling and polishing) without zinc therapy, and the third group were given zinc as a complementary to their conventional treatment, scaling and polishing. After 6 months, blood samples were collected from 199 patients only. Of these, 51 in (group I), 83 in (group II) and 65 in (group III). The remainder, 101 did not complete the study because some of them not taken zinc supplement regularly, while others were missed for follow up.

### **CLINICAL EXAMINATION**

The oral examination was done by calibrated periodontal probe (Williams probe) at 4 sites mesiobuccal, distobuccal, midbuccal and midlingual. This included clinical attachment loss(CAL) and probing pocket depth (PPD). The CAL was assessed by measuring the distance from cement-enamel junction (CEJ) to base of the probing pocket depth in millimeters. The PPD was assessed from gingival margin to base of the pocket<sup>10</sup>.

### **DATA COLLECTION**

A pre-tested questionnaire was done to obtain information, on age, gender, and duration of the disease. The participants were asked to fast overnight for at least 12 hours. At the morning venous blood samples were collected for serum glucose and zinc measurements. Serum glucose and Zinc levels were determined by using (Giese Diagnostica-Italy) kits in clinical chemistry analyzer Kinza 240.

### **STATISTICAL ANALYSIS**

Data were collected and analyzed using SPSS version 19.0 for windows (SPSS, Chicago; Illinois, USA). Quantitative data were analyzed by using independent sample t- test.

**RESULTS**

The base line characteristics of the patients have been described in Table 1. The mean of age, serum glucose and serum zinc concentrations were not significantly different between the three groups. The clinical attachment loss and probing pocket depth was also not significantly differing.

At the end of the 6 months period, the mean values of clinical attachment loss and probing pocket depth were significantly lower among group III as compared to group II (P<0.05, P<0.01 respectively). Patients in Group III had

also lower mean values of clinical attachment loss and probing pocket depth as compared to group I (p<0.01), as shown in Table 2.

On using percentage of change, the result showed significant higher values in group III with respect to clinical attachment loss and probing pocket depth as compared to Group II (p<0.05). Similarly, group I had a high percentage of changes as compared to group II (Table 3).

**Table 1 . Clinical and anthropometric characteristics of the subjects studied**

Parameter	Group I n=100	Group II n=100	Group III n=100	P* value
Age(years)	51.0 ± 6.0	52 ± 6.0	51.0 ± 7.0	0.927
Male sex [ ( n % ) ]	26 ( 51)	43( 51.8)	36 ( 55.4)	0.71
Fasting blood glucose (mg /dl)	221.7 ± 59.9	221.9 ± 67.1	222.4 ± 49.1	0.999
Serum zinc(mg /dl)	61.2 ± 4.5	62.3 ± 5.4	60.4 ± 4.7	0.540
Probing Pocket Depth (mm)	5.9 ± 0.9	5.4 ± 1.0	5.7 ± 1.2	0.145
Clinical Attachment Loss (mm)	4.0 ± 1.0	3.4 ± 1.1	3.6 ± 1.2	0.158

\* One way ANOVA

**Table 2. Comparison of Blood glucose, Serum zinc level, clinical attachment loss, probing pocket depth in( Zinc, Scaling and Polishing), (Zinc), (Scaling and Polishing) groups at the end of the study**

group	n	Fasting blood glucose	Serum zinc	Clinical attachment loss **	Probing pocket depth *
Group I	51	181.5 ± 53	85.6 ± 8.3	3.6 ± 1.0	5.3 ± 1.1
Group II	83	210.3± 68.7	61.8 ± 4.4	3.2 ± 1.1	5.1 ± 1.1
Group III	65	180.7± 36.2	82.3± 7.3	3.0 ± 1.1	4.8 ± 1.1

Group III Vs group II , Clinical attachment loss p < 0.05, Probing pocket depth p <0.01  
 Group III Vs group I, Clinical attachment loss <0.01 , Probing pocket depth p < 0.01

**Table 3. Baseline and 6 months comparison of fasting blood glucose, serum zinc level, clinical attachment loss and probing pocket depth in groups**

Groups	Fasting blood glucose		Serum zinc level		Probing pocket depth		Clinical attachment loss	
	Change of mean	% of change	Change of mean	% of change	Change of mean	% of change	Change of mean	% of change
Group I	40.1	18.2*	-24.5	28.6*	0.54	10.1*	0.38	9.6*
Group II	11.5	5	-0.5	0.8	0.18	3.5	0.20	5.8
Group III	41.7	18.7**	-21.9	26.6**	0.80	14.2**	0.58	15.9**

\* Group I Vs. group II, P < 0.05 for all parameters

\*\* Group I Vs. group III, P < 0.05 for all parameters

## DISCUSSION

Accumulating evidence suggests that zinc may be associated with increase chance of decreasing severity of periodontitis and improvement of glycemic status in type 2 diabetes patients. Although there have been several studies investigating the role of zinc in DM patients with periodontitis, there are few published data on zinc supplementation in our population<sup>11</sup>. Thus, a large group of diabetes mellitus patient may be at increased risk for developing zinc deficiency, which in turn, may lead to periodontitis, a finding previously reported by (Biju *et al.*)<sup>12</sup>. It is noteworthy that 100% appears at risk for mild-moderate zinc deficiency, serum zinc level < 70 ug/dl; a cutoff value stated by others (Al-Timimi *et al.*)<sup>13</sup> and an improvement in biochemical zinc status during supplementation support the existence of low zinc status in those patients. Because zinc may play a role in the pathophysiology of this condition, our finding that T2 DM patients with periodontitis have lower concentrations of serum zinc of potential concern. It has been shown that serum zinc level were lower in diabetic patients with periodontitis when compared to healthy individuals with periodontitis<sup>12</sup>.

The lower concentrations of serum zinc among those with diabetes may have resulted from lower intake, excessive loss or inherited disturbances in its metabolism. In our study, the patients with non-surgical periodontal therapy plus oral zinc supplementation had a higher percentage of change of clinical attachment loss and probing pocket depth as compared to the other therapy groups. Several potential mechanisms has been suggested, zinc might protect cells against oxidative damage by inhibition the production of reactive oxygen species (ROS). Zinc may also play different role in mitochondria, because it prevent H<sub>2</sub>O<sub>2</sub>-induce apoptosis of cells through regulation of B-cell lymphoma -2/ Bax protein ratio<sup>14</sup>.

There is clear evidence that diabetes have increased prevalence and severity of periodontitis and that individual with periodontitis have an increased prevalence of diabetes<sup>11</sup>. Indeed, unstable periodontitis may have the potential to worsen glycemic control in diabetes. Taylor *et al* showed that in the pima Indian population of Arizona individuals with severe periodontitis had up to 13 times greater risk of worsening glycemic control after 2 years, depending on age<sup>15</sup>.

Interventional studies, in which glycemic control was assessed in participant with preexisting periodontitis and diabetes before and after a course of periodontal therapy, provide insight into this relationship. Randomized controlled trials have demonstrated significant improvement to glycemic control in type 1<sup>16</sup> and type two diabetes<sup>17,18</sup> following non-surgical periodontal therapy. Several other studies failed to support this including randomized controlled trials investigation type 1<sup>19,20</sup> and type 2 diabetes<sup>21</sup>. However, our data show that individuals on zinc supplementation had higher percentages of change in fasting blood glucose than those without supplementation. Moreover, our data show that individual's periodontal health and glycemic control was better in group III than in group I and II, so a combination of zinc supplementation with non-surgical periodontal therapy appears to have a significant effect.

Zinc supplement for vulnerable population to low zinc status such as patients with T 2 DM decreases the chance of the occurrence of severe periodontitis. Therefore we recommended the routine screening of zinc status in patients with T2DM. Zinc supplementation may be an effective dental health intervention means, to improve the periodontal status of the population.

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#### **REFERENCES**

1. Morimoto-Yamashita Y, Ito T, Kawahara K, Kikuchi K, Tatsuyama-Nagayama S, Kawakami-Morizono Y, et al.. Periodontal disease and type 2 diabetes mellitus: Is the HMGB1-RAGE axis the missing link?. *Med Hypotheses* . 2012;79:452-5.
2. Anjani Kumar P, Vijaykumar S, Chandra A, Kopal G Association between diabetes mellitus and periodontal status in north Indian adults. *Eur J Gen Dent* . 2013;2:58-1.
3. Rajhans NS, Kohad RM, Chaudhari VG, Mhaske NHA clinical study of the relationship between diabetes mellitus and periodontal disease. *J Indian Soc Periodontol*. 2011;15:388-92.
4. Tomat AL, Costa MA, Girgulsky LC, Veiras L, Weisstaub A R, Inserra F, et al.. Zinc deficiency during growth: Influence on renal function and morphology. *Life Sciences*. 2007; 80: 1292–1302.
5. Judith J, Wolfram K, Lothar R, .Zinc and diabetes – clinical links and molecular mechanisms. *J. Nutr Biochem*. 2009; 20:399-417
6. Uckardes Y, Tekcicek M, Ozmert EN, et al. The effect of systemic zinc supplementation on oral health in low socioeconomic level children .*Turk J Pediatr*. 2009;51:424-8.
7. Seyed Ali, Maryam Seyedmajidi, Aliakbar et al.. Effect of zinc-deficient diet on oral tissues and periodontal indices in Rats. *IntJ Mol Cell Med*. 2014.Vol 3, No2

8. Neema S, Rajesh S, Lalit K, Balaji M, Aditi M, Meetu J. Gingival crevicular blood.: As a non-invasive screening tool for diabetes mellitus in dental clinics. *J Indian Soc Periodontol.* 2013 Jul-Aug; 17(4): 472–477.
9. Orbak R, Kara C, Ozbek E, Tezel A, Demir T..Effect of zinc deficiency on oral and periodontal diseases in rats. *J Periodont Res.* 2007; 138-143.
10. Loe, H, Brown LJ. Early-onset periodontitis in the United States of America. *J Periodontol.* 1991;62:608-616.
11. Al-Timimi DJ, Salih SM .Periodontal status in patients with metabolic syndrome. *Duhok Med J.* 2012; 6(3): 117-127.
12. Thomas B, Ramitha SK, Kumari MBA. Comparative evaluation of micronutrient status in the serum of diabetes mellitus patients and healthy individuals with periodontitis. *Indian Society Periodontology.* 2010; vol. 14 (1): 46-49.
13. Al-Timimi DJ, Al-Sharbatti SS, Al-Najjar F .Zinc deficiency among a healthy population in Baghdad, Iraq .*Saudi Med J.*2005 ;Vol.26(11): 1777-1781.
14. Viktorinova A, Toserova E, Krizko M, Durackova Z. Altered metabolism of copper, zinc and magnesium is associated with increased levels of glycated hemoglobin in patients with diabetes mellitus. *Metabolism.* 2009; 58: 1477-1482.
15. Taylor GW, Burt BA, Becker MP, Genco RJ, Shlossman M, Knowler WC, et al. Severe periodontitis and risk for poor glycemic control in patients with non-insulin-dependent diabetes mellitus .*J Periodontol.* 1996 ; 67: 1085-93.
16. Skleric U, Schara R, Medvesscek M, Hanlon A, Doherty F, Lessem J. Periodontal treatment by Arestin and its effects on glycemic control in type diabetes patients. *J Acad Periodontol.* 2004; 6:160-5
17. Kiran M, Arpak N, Unsal E, Erdogan MF. The effect of improvement of periodontal health on metabolic control in type two diabetes mellitus .*J Clin Periodontol.* 2005; 32: 266-72.
18. Rodrigues DC, Taba MJ, Noves AB, Souza SL, Grisi. Effect of non-surgical periodontal therapy on glycemic control in patients with type 2 Diabetes mellitus. *J Periodontol.* 2003; 74:1361-7
19. Aldridge JP, Lester V, Watts TL, Collins A, Viberti G, Wilson RF. Single-blind studies of the effect of improvement periodontal health on metabolic control in type 1 diabetes mellitus. *J Clin Periodontol.* 1995; 22: 271-5.
20. Tervonen T, Lamminsalo S, Hiltunen L, Raunio T, Knuutila M. Resolution of periodontal inflammation does not guarantee improved glycemic control in type 1 diabetic subjects. *J Clin Periodontol.* 2009; 36: 51-7.
21. Jones JA, Miller DR, Wehler CJ, Rich SE, Krall-Kaye EA, McCoy LC et al. Does periodontal care improve glycemic control? The Department of Veterans Affairs Dental Diabetes Study. *J Clin Periodontol.* 2007; 34: 46-52.

## پوختہ

## کارتیکرنا دانا زنگی ل سہرہوشا پدی

**پیشہ کی و نارمانج:** فاکتہ ری رییس و گروپین خوینی ہاتہ خواندن پشیوہ کی بہ رفرہ ہ دناف خہ لکی دا ، بہ لی سہ بارہ ت کوردین ٹانکجییت پاریزگہ ہا دھوکی لکوردستانا عراقی ہیچ دانہ یہ ک لبہ رده ست نینہ . ز بہ رفی چہ ندی ئہ فہ کولینہ ہاتہ ئہ نجامدان بو دیارکرنا گریڈانا پہ یدابونا ئیشیت پدی و کیم بوونا زنگی . نارمانج ز فی فہ کولیندی دیارکرنا کارتیکرنا دانامادی زنگی لسہ ر پدی دناف نہ خوشین شہ کری ز جوری ۰۲ .

**ریکین فہ کولینی:** ۳۰۰ نہ خوشین شہ کری ئہ وین ئیشین پدی ہہ ین ہاتنہ زیگرتن . نہ خوش ہاتنہ دابہ ش کرن ہوسی گروپا . گروپی ئیکی : ئہ وین مادی زنگی وہ ردگرن . گروپی دووی: ئہ وین جارہ سہ ریا پدی وہ ردگرن . گروپی سی: ئہ وین مادی زنگی و جارہ سہ ریا پدی وہ ردگرن . د سہ رہ دانا ئیکی دا یا نہ خوشا خوین دی ز ہہ میا ہیئہ وہ رگرتن . نہ خوش د گروپی ئیکی و دووی دا دی ۵۰ ملغم زنگی روزی سی جارہ وہ رگرت ہو موی شہ ش ہہ یفا .

**ئہ نجام:** ل دہ ستیکی . چ جباوازیین دیار دناف بہ را ہہ رسی گروپان دا نہ بو . پشتی بورینا شہ ش ہہ یفا . تیکرای ہہ زمارا یا گریڈانا ریشالی و کووراتیا فالہ ہیین پدی ب شیوہ کی بہ رجاڈ کیمتر ہو د گروپی سی دا بہ راورد دگہ ل گروپی دوو . ریژا گھورینی دناف بہ را گریڈانا ریشالی و کووراتیا فالہ ہیین پدی ب شیوہ کی بہ رجاڈ بلند تر ہو د گروپی سی دا بہ راورد دگہ ل گروپی دوو .

**دہ رتہ نجام:** دانا مادی زنگی بو ہاولاتیین خو بہ خش ئہ وین ریژا زنگی کیم د لہ شی وان دا وہ کی نہ خوشین جوری دوو ئیشین شہ کری دہ لیفا پہ یدابونا ئیشین پدی دی کیمتریبت .

## الخلاصة

### تأثير اعطاء الزنك على حالة اللثة

**خلفية واهداف البحث:** عامل الريس وفصائل الدم المنتشرة تم دراستها بين الشعوب المختلفة ومع ذلك لا توجد معلومات متوفرة للناس الكورد الدين يعيشون في دهوك؛ العراق. ولهذا السبب تمت الدراسة لتحديد العلاقة بين حدوث التهاب اللثة ونقصان الزنك. وكان الهدف من البحث لتحديد تأثير اعطاء الزنك على حالة اللثة في المرضى السكري النوع الثاني.

**طرق البحث:** ٣٠٠ مريض سكري مصابين التهاب اللثة المزمن معدل اعمارهم ٤٥-٦٥ سنة تم اختيارهم. المرضى تم تقسيمهم الى ثلاث مجموعات: المجموعة الاولى تم اعطائهم الزنك والمجموعة الثانية تم لهم تنظيف اللثة والمجموعة الثالثة تم اعطائهم الزنك مع تنظيف اللثة ومن الزيارة الاولى تم سحب عينات الدم لجميع المرضى ليتم فحص الزنك والكلوز في المصل. حالة اللثة للمرضى تم قياسها بمقياس المجموعة الاولى والثانية للمرضى وافقوا لتناول ٥٠ مليغرام زنك ثلاث مرات في اليوم لمدة ستة اشهر. حالة اللثة تم قياسها مرة ثانية بعد المقابلة وبنفس الطريقة.

**النتائج:** في البداية لا يوجد فروقات معنوية في اي مقياس بين المجاميع الثلاثة. في نهاية فترة الستة اشهر، معدل قيم فقدان الترابط النسيجي السريري وعمق الجيوب اللثوية كان قليل معنويا في المجموعة الثالثة عندما تم مقارنتها بالمجموعة الثانية. النسبة المئوية للتغيير في فقدان الترابط النسيجي السريري وعمق الجيوب اللثوية كان كثير معنويا في المجموعة الثالثة عندما تم مقارنتها بالمجموعة الثانية.

**الاستنتاج:** اعطاء الزنك للناس المتطوعين وعندهم نقص بالزنك مثل مرضى السكري النوع الثاني يقلل فرصة حدوث التهاب اللثة الحاد.