

# Assessment of Dental Calculus, Plaque and Gingival Inflammation in Patients with Urinary Stone

Maher Balash Mohammed, B.D.S., H.D.D<sup>(1)</sup>

Maha Sh. Mahmood, B.D.S., M.Sc.<sup>(2)</sup>

## ABSTRACT

**Background:** Dental calculus is mineralized dental plaque formed on teeth and dental prosthesis surfaces in the oral cavity. Urinary stone is a crystal aggregation formed in urinary system due to minerals saturation present in urine. The structure of dental calculus is similar to that of urinary stone.

**Objective:** To assess oral hygiene and gingival status in patients with urinary stone. And compared with healthy subjects.

**Patients and Methods:** Sixty participants, 25-40 years, were involved in this study who were divided into study and control group. The study group involved patients with urinary stone while the control group involved healthy subjects. Clinical parameters including plaque, calculus and gingival indices were recorded for all participants. The correlation between the recorded clinical parameters was estimated.

**Results:** The study group mean ( $\pm$ SD) plaque (1.435 $\pm$ 0.499), gingival (0.995 $\pm$ 0.288) and calculus (1.28  $\pm$ 0.66) indices were found to be significantly high compared with control group (0.868 $\pm$ 0.265), (0.602 $\pm$ 0.265) (0.501 $\pm$ 0.457 ) respectively. The formed calculus was positively associated with accumulated plaque (r: 0.608, p < 0.05) and gingival inflammation (r: 0.612, p < 0.05).

**Conclusion:** Urinary stone patients were associated with more plaque and calculus accumulation, and had worse gingival inflammation compared to healthy participants. Thus, they need to be more aware of their gingival health status and improved preventive care of oral health.

**Keywords:** dental calculus, plaque, gingival inflammation, urinary stone. (Received: 2/1/2018, Accepted: 11/2/2018)

## INTRODUCTION

Dental calculus denotes a mineralized dental plaque that forms on the surfaces of normal teeth and dental prosthesis in the oral cavity<sup>(1)</sup>. It is classified into supra and subgingival calculus, and always covered its surface with an unmineralized film of viable bacterial plaque that complicates its role in periodontal destruction<sup>(2, 3)</sup>. Dental plaque remains the main etiology of periodontal diseases<sup>(4)</sup>. The most common pathologies found in the oral cavity are the chronic inflammatory periodontal diseases<sup>(5, 6)</sup>.

The dental plaque absorbed calcium and phosphate from saliva for development of supragingival calculus, while from crevicular fluid for the formation of subgingival calculus. There is a very near relationship between the matrix of the calculus and the matrix of the tooth surface; and also very similar in the crystalline structures of both<sup>(7)</sup>. The percentage of inorganic constituents in calculus is same to that in other calcified tissues of the body, and it has the same structural composition and mineralization process that occurs in all biological system including renal stone<sup>(8, 9)</sup>. There is an association between the severity of chronic kidney disease in young patients and dental calculus formation as a manifestation of disturbed calcium and phosphate homeostasis<sup>(10)</sup>.

Urinary stone which is a multifactorial disease, and it is regarded as one of the most common diseases in modern society<sup>(11)</sup> and may affect 12-15 % of the population<sup>(12, 13)</sup> with the observation of an increase in its prevalence<sup>(14)</sup>.

It is more public in males than females and categorized into calcareous (calcium-containing) stones which form about 90% of all stones and non-calcareous stones<sup>(11)</sup>. Moreover, the probability of its recurrence among calcium renal stone formers is approximately 50 % occurs within (1-5) years from the first stone formed<sup>(15)</sup>. Although many inherited and systemic diseases are associated with renal stones, most of such stones are idiopathic<sup>(16)</sup>.

Urinary stone remains the primary source of morbidity in human<sup>(17)</sup> since its formation may contribute to the progress of chronic kidney disease<sup>(18)</sup> and increase the risk of hypertension in addition to bone disease<sup>(19)</sup>. It has been estimated that up to 90% of renal patients will show oral symptoms<sup>(20)</sup>.

Since the factors of formation and the process of calcification of dental calculus and renal calculi share multiple features<sup>(8, 21)</sup> furthermore few studies that investigated the correlation of dental calculus and plaque accumulation with urinary stone formations<sup>(8, 22, 23)</sup>, Therefore this study was decided to be conducted.

## PATIENTS AND METHODS

The study was started from the end of November 2016 until the last week of April 2017. Samples

(1) Ministry of health, Najaf, Iraq

(2) Professor, Department of Periodontics, College of Dentistry, University of Baghdad.

collected from the clinic of urology department in the Al- Sader city Hospital in AL- Najaf city.

This study included thirty patients with renal stones with an average age (25- 40) years. They were diagnosed as having a renal stone (in the renal pelvis, the ureter, or the bladder) based on new X-ray and general urine examinations and ultrasonography (US). The control group also composed of thirty persons and they were healthy (no history of any medical problem) and didn't have urinary stone according to new ultrasonography and their medical history. The participants were matching with age and gender to that of the study group,

The general criteria for all participants in this study excluded those wearing any removable or fixed dental prosthesis or orthodontic appliance, the patient attending the dentist for calculus removal (scaling process) at least three months before, those suffering from serious medical problem or having systemic disease (e.g., chronic kidney disease, diabetes mellitus, asthma ) and not pregnant women.

#### Oral Hygiene indices

Plaque Index of Silness and Loe(1964) and Calculus Index of Green and Vermillion(1960), recorded as oral hygiene index while Gingival

Index of Loe(1967) recorded for gingival health status.

The data processing and analysis were carried out using SPSS program version 22 which provided the statistical parameters, means, standard deviation, The statistical t-tests( student t-test.), Person's correlation coefficient test. P-value represented the level of significance was accepted at  $P \leq 0.05$ .

## RESULTS

Clinical periodontal parameters revealed higher mean values of plaque, gingival and calculus indices of the study group compared to those of control group, and with highly significant difference at  $P < 0.01$ (table 1).

Regarding gender differences, the males within control and study groups showed higher mean values of plaque, gingival and calculus indices than females for each group, with statistically highly significant difference in the study group (Table 2).

There was positive highly significant correlation coefficient recorded between dental calculus accumulation with plaque accumulations and gingival inflammation in the study group(Table 3).

**Table 1: mean values and standard deviations of PLI, GI, and CI for study and control groups**

Index	Groups		Statistic	
	Control Mean $\pm$ SD	Study Mean $\pm$ SD	Calculated t	P value
PLI	0.868 $\pm$ 0.265	1.435 $\pm$ 0.499	5.493	<0.05 *
GI	0.602 $\pm$ 0.265	0.995 $\pm$ 0.288	5.500	<0.05 *
CI	0.501 $\pm$ 0.457	1.28 $\pm$ 0.66	5.31	<0.05 *

\* significant at  $P < 0.05$

**Table 2: mean values and standard deviations of PLI, GI, and CI for males and females for each group.**

Variables	Group	Gender		Statistic	
		Male Mean $\pm$ SD	Female Mean $\pm$ SD	Calculated t	P value
PII	Control	0.951 $\pm$ 0.205	0.785 $\pm$ 0.299	2.088	0.046 *
	Study	1.678 $\pm$ 0.491	1.125 $\pm$ 0.282	3.016	0.005 *
GI	Control	0.673 $\pm$ 0.275	0.531 $\pm$ 0.244	1.494	0.146
	Study	1.134 $\pm$ 0.273	0.856 $\pm$ 0.237	2.981	0.006 *
CI	Control	0.514 $\pm$ 0.429	0.489 $\pm$ 0.498	1.43	0.887
	Study	1.512 $\pm$ 0.67	1.055 $\pm$ 0.592	1.99*	0.052

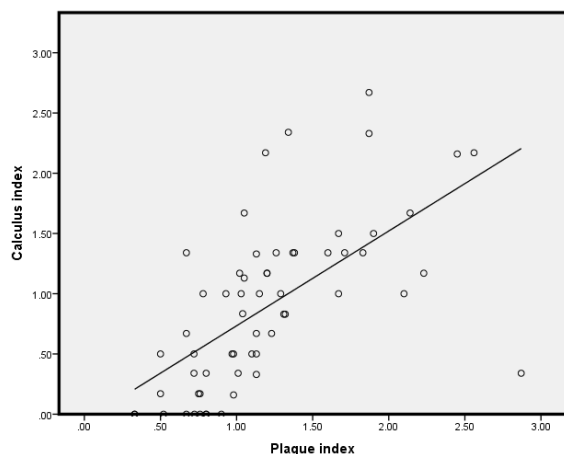
\* Significant at  $P < 0.05$

**Table 3: the correlation coefficient (r) between CI with GI and PLI.**

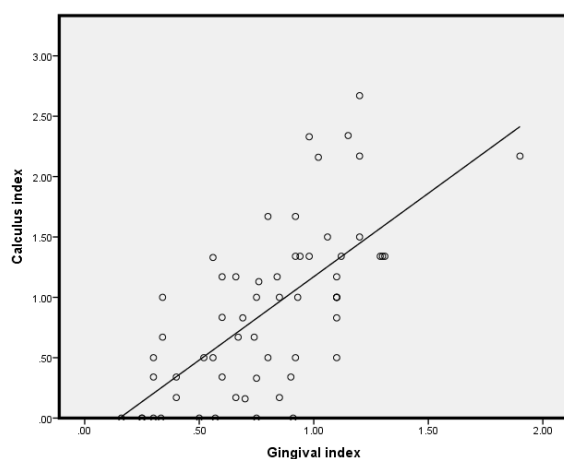
Parameter	Group	PLI		GI	
		R	P value	R	P value
Calculus index	Control	0.417	0.022*	0.38	0.039*
	Study	0.608	<0.05*	0.612	<0.05*

\* Significant at  $P < 0.05$

Scatter plots (1) and (2) showed the positive correlation between CI and ( PLI, GI) represented by linear regression. Both variables move in the same direction. This means as one variable (CI) increases, the other variable also increases. Figures (1), (2).



**Figure 1: Scatter plot of the correlation between CI and PLI.**



**Figure 2: Scatter plot of the correlation between CI and GI.**

## DISCUSSION

The mean value of plaque index that recorded in current study for control group found to be similar to previous studies (24-26). And for the urinary stone group was higher than control group with a statistically highly significant difference. These results agree with previous studies (22, 23). Explanation of the increase of plaque index in the urinary stone group may be because of the increase in the calculus index, where the dental calculus represents the retentive factor for plaque accumulation.(27, 28). Other reason for the increase plaque index, maybe the psychological behavior of patients with kidney disease result in negligence of preventive health measures and poor oral hygiene conditions (29, 30)

Males had higher mean values of plaque index with highly significant difference than females, and this may be attributed to that women practice better oral hygiene skills such as brushing and flossing than males (31, 32).

Regarding gingival index, the mean value of stone group was (0.995±0.288) with a significant difference compared to the control group. This could be attributed to the higher mean values of plaque index that recorded in the study group, where the plaque is considered the main factor of gingival inflammation (33, 34).

Male had higher mean value gingival index in a study group with highly significant difference than females. This result could be related to the difference of societal gender and most probably is a consequence of lifestyle where the males have more periodontal disease than females in all race or ethnic group, ages, and geographic area (35, 36), moreover the high mean value of plaque index in a study group for males compared to females.

The current study was recorded higher dental calculus mean values of the urinary stone group with highly significant difference than the non-stone group. This result agrees with a previous study (22, 23) but disagrees with Sargolzaee et al. in 2007. The variation in the results may be due to variations in age, geographical area, the type of food and water intake. The explanations of increase dental calculus in stone group could be the following:

- 1) A mineralized dental plaque had strong positive correlation with plaque accumulation.
- 2) The gingival inflammation had higher mean value in stone group, and positive correlation with calculus accumulation, Where inflammatory and proinflammatory cytokines can affect the deposition of calcium crystals in different organs, this gives rise to calcifying disorders (37).
- 3) may be related to alteration in the salivary electrolytes and PH in patients with urinary stone(22-23)

## REFERENCES

1. Hinrichs J. The role of dental calculus and other predisposing factors. Carranza's Clinical Periodontology 10th Ed Saunders. 2006.
2. Lang N, Mombelli A, Attström R. Oral biofilms and calculus. Lindhe J, Lang NP, Karring T Clinical Periodontology and Implant Dentistry 5th ed Oxford: Blackwell Munksgaard. 2008:183-203.
3. Keyes PH, Rams TE. Dental Calculus Arrest of Dental Caries. Journal of oral biology (Northborough, Mass). 2016;3(1).
4. Slots J. Periodontology: past, present, perspectives. Periodontology 2000. 2013;62(1):7-19.

5. Laudenbach JM, Simon Z. Common dental and periodontal diseases. *Medical Clinics*. 2014;98(6):1239-60.
6. Marcenés W, Kassebaum NJ, Bernabé E, Flaxman A, Naghavi M, Lopez A, et al. Global burden of oral conditions in 1990-2010: a systematic analysis. *Journal of dental research*. 2013;92(7):592-7.
7. Newman M, Takei H, Klokkevold P, Carranza F, Odont D. The role of dental calculus and other predisposing factors. *Carranza's clinical periodontology*. 2007.
8. Sargolzaee N, Najafi M, Mohammadzadeh M, Taheri M, Okati B. The evaluation of calculus rate in patients with nephrolithiasis. *J Mashhad Dent Sch*. 2007;31(3):195-200.
9. Smith DR, Tanagho EA, McAninch JW. *Smith's general urology*: Lange Medical Books/McGraw-Hill; 2008.
10. Davidovich E, Davidovits M, Peretz B, Shapira J, Aframian DJ. The correlation between dental calculus and disturbed mineral metabolism in pediatric patients with chronic kidney disease. *Nephrology Dialysis Transplantation*. 2009;24(8):2439-45.
11. Reed BY, Gitomer WL. The genetics of stone disease. *Urinary Stone Disease*: Springer; 2007. p. 35-54.
12. Fervenza FC. *A Color Handbook of Renal Medicine*: Thieme Medical Pub; 2004.
13. Pearle MS, Lotan Y. Urinary lithiasis: etiology, epidemiology, and pathogenesis. *Campbell-walsh urology*. 2007;2:1363-92.
14. Dallera JE, Chandhoke PS. Epidemiology and incidence of stone disease. *Urinary stone disease*. 2007:27-34.
15. Reynard J, Brewster S, Biers S. *Oxford handbook of urology*: OUP Oxford; 2013.
16. Worcester EM, Coe FL. Nephrolithiasis. *Primary Care: Clinics in Office Practice*. 2008;35(2):369-91.
17. Schrier RW. *Manual of nephrology*: Lippincott Williams & Wilkins; 2008.
18. Burtis CA, Ashwood ER, Bruns DE. *Tietz textbook of clinical chemistry and molecular diagnostics-e-book*: Elsevier Health Sciences; 2012.
19. Worcester EM, Coe FL. Calcium kidney stones. *New England Journal of Medicine*. 2010;363(10):954-63.
20. Tadakamadla J, Kumar S, Mamatha G. Comparative evaluation of oral health status of chronic kidney disease (CKD) patients in various stages and healthy controls. *Special Care in Dentistry*. 2014;34(3):122-6.
21. Stoller M. Chapter 16. *Urinary Stone Disease*. *Smith's General Urology 17th ed* New York: McGraw-Hill. 2008.
22. Tawfig A. Dental Calculus Formation among Recurrent Renal Calculi Formers. *Int J Dent & Oral Heal*. 2017;3:1-7.
23. Yaser SK, Al-Casey MS. Dental calculus in relation to idiopathic calcium renal stone. *Scientific Journal Published by the College of Dentistry–University of Baghdad*. 2012:140.
24. Mahmood AA. Comparison Of Oral Health Status And Behavior between First And Fifth Years Of Al-Mustansiriyah Dental Students. *Journal of Baghdad College of Dentistry*. 2017;29(2):71-7.
25. Radhi NJM. Oral health status in relation to nutritional status among institutionalized autistic children and adolescents in Baghdad city, Iraq. *Journal of Baghdad College of Dentistry*. 2017;29(1):117-24.
26. Al Huwaizi R. Oral health status in Najaf City. *Journal of Baghdad College of Dentistry*. 2017;23(1):162-6.
27. Jepsen S, Deschner J, Braun A, Schwarz F, Eberhard J. Calculus removal and the prevention of its formation. *Periodontology 2000*. 2011;55(1):167-88.
28. Lindhe J. *Textbook of clinical periodontology*: WB Saunders Company; 1983.
29. Gürkan A, Köse T, Atilla G. Oral health status and oral hygiene habits of an adult Turkish population on dialysis. *Oral health & preventive dentistry*. 2008;6(1).
30. Souza CRDd, Libério SA, Guerra RNM, Monteiro S, Silveira ÉJd, Pereira ALA. Assessment of periodontal condition of kidney patients in hemodialysis. *Revista Da Associacao Medica Brasileira*. 2005;51(5):285-9.
31. Newman H. The development of dental plaque. *Harris, NO & Christen, AG*. 1994:19-58.
32. Al-Shammari KF, Al-Ansari JM, Al-Khabbaz AK, Dashti A, Honkala EJ. Self-reported oral hygiene habits and oral health problems of Kuwaiti adults. *Medical Principles and Practice*. 2007;16(1):15-21.
33. Falco M. The lifetime impact of sugar excess and nutrient depletion on oral health. *General dentistry*. 2001;49(6):591-5.
34. Syrjälä AMH, Ylöstalo P, Niskanen MC, Knuuttila ML. Relation of different measures of psychological characteristics to oral health habits, diabetes adherence and related clinical variables among diabetic patients. *European journal of oral sciences*. 2004;112(2):109-14.
35. Eke PI, Dye B, Wei L, Thornton-Evans G, Genco R. Prevalence of periodontitis in adults in the United States: 2009 and 2010. *Journal of dental research*. 2012;91(10):914-20.
36. Grossi SG, Zambon JJ, Ho AW, Koch G, Dunford RG, Machtei EE, et al. Assessment of risk for periodontal disease. I. Risk indicators for attachment loss. *Journal of periodontology*. 1994;65(3):260-7.
37. Franklin BS, Mangan MS, Latz E. Crystal formation in inflammation. *Annual review of immunology*. 2016;34:173-202.

## الخلاصة

الخلفية: التكتلات هي ترسب او تصلب الصفيحات الجرثومية الموجودة على سطوح الاسنان في الفم, وهي تشبه تركيبية الحصى البولية. الحصى البولية هي ترسب المعادن اوالموادغير العضوية الموجودة في البول في الكلية او المجاري البولية.

اهداف الدراسة: لمعرفة فيما اذا كان هناك اختلاف بين مؤشرات نظافة الفم ومؤشر صحة اللثة بين مجموعة الحصى البولية والأشخاص الاصحاء, وأيضا معرفة فيما اذا كان هناك فرق بين الذكور والاناث بالنسبةلهذه المؤشرات.

المواد وطرق العمل: أجرينا الدراسة في مدينة الصدر الطبية استشارية الجراحة البولية في مدينة النجف الاشرف في العراق على ثلاثين مرضى بحصى الكلى والمجاري البولية(مجموعة الدراسة ) وثلاثين من الاصحاء (مجموعة المقارنة) , وكانت أعمارهم بين (25-40) وعملنا على تقييم مؤشر نظافة الفم بقياس نسبة تجمع التكتلات والصفيحات الجرثومية وتقييم صحة اللثة من خلال قياس مؤشر التهاب اللثة عند المجموعتين.

النتائج: بينت الدراسة زيادة ملحوظة في معدل تجمع التكتلات والصفيحات الجرثومية ومؤشر التهاب اللثة عند مجموعة الدراسة نسبة الى مجموعة المقارنة. وأيضا زيادة ملحوظة في هذه المؤشرات عند الذكور مقارنة عند الاناث. ووجود علاقة إيجابية قوية بين تجمع الترسبات والصفيحات الجرثومية وكذا بين الترسبات ومؤشر التهاب اللثة.

الاستنتاج: ان مرضى الحصى البولية اكثر تجمع للتكتلات والصفيحات الجرثومية على اسنانهم, واكثر مستوى التهاب اللثة من الناس الاصحاء لذا يجب مراعاة هذه النتيجة عند معالجة مرضى الحصى البولية.