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

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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 (±SD) plaque (1.435±0.499), gingival (0.995±0.288) and calculus (1.28 ±0.66) indices were found to be significantly high compared with control group (0.868±0.265), (0.602±0.265) (0.501±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 (1). 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 (2, 3). Dental plaque remains the main etiology of periodontal diseases (4). The most common pathologies found in the oral cavity are the chronic inflammatory periodontal diseases (5, 6).

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 (7). 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 (8, 9). 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 (10).

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

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 (11). Moreover, the probability of its recurrence among calcium renal stone formers is approximately 50 % occurs within (1-5) years from the first stone formed (15).

Although many inherited and systemic diseases are associated with renal stones, most of such stones are idiopathic (16).

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

Since the factors of formation and the process of calcification of dental calculus and renal calculi share multiple features (8, 21) furthermore few studies that investigated the correlation of dental calculus and plaque accumulation with urinary stone formations (8, 22, 23). 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
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≤ 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**

<table>
<thead>
<tr>
<th>Index</th>
<th>Groups</th>
<th>Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control Mean ± SD</td>
<td>Study Mean ± SD</td>
</tr>
<tr>
<td>PLI</td>
<td>0.868±0.265</td>
<td>1.435±0.499</td>
</tr>
<tr>
<td>GI</td>
<td>0.60±0.265</td>
<td>0.995±0.288</td>
</tr>
<tr>
<td>CI</td>
<td>0.501±0.457</td>
<td>1.28±0.66</td>
</tr>
</tbody>
</table>

* Significant at P<0.05

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

<table>
<thead>
<tr>
<th>Variables</th>
<th>Group</th>
<th>Gender</th>
<th>Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Male Mean ± SD</td>
<td>Female Mean ± SD</td>
</tr>
<tr>
<td>PII</td>
<td>Control</td>
<td>0.95±0.205</td>
<td>0.785±0.299</td>
</tr>
<tr>
<td></td>
<td>Study</td>
<td>1.678±0.491</td>
<td>1.125±0.282</td>
</tr>
<tr>
<td>GI</td>
<td>Control</td>
<td>0.673±0.275</td>
<td>0.531±0.244</td>
</tr>
<tr>
<td></td>
<td>Study</td>
<td>1.13±0.273</td>
<td>0.85±0.237</td>
</tr>
<tr>
<td>CI</td>
<td>Control</td>
<td>0.51±0.429</td>
<td>0.489±0.498</td>
</tr>
<tr>
<td></td>
<td>Study</td>
<td>1.512±0.67</td>
<td>1.05±0.592</td>
</tr>
</tbody>
</table>

* Significant at P<0.05

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Group</th>
<th>PLI</th>
<th>GI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>R</td>
<td>P value</td>
</tr>
<tr>
<td>Calculus index</td>
<td>Control</td>
<td>0.417</td>
<td>0.022*</td>
</tr>
<tr>
<td></td>
<td>Study</td>
<td>0.608</td>
<td>&lt;0.05*</td>
</tr>
</tbody>
</table>

* 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).

**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, 29). 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**


الخلاصة
الخلاصة: التكلسات هي ترسب أو تصلب الصفائح الجرثومية الموجودة على سطوح الأسنان في الفم، وهي تشبه تركيبة الحصى البولية. الحصى البولية هي ترسب المعادن أو المواد غير العضوية الموجودة في البول في الكلية أو المجاري البولية، وتشبه تركيبة الحصى البولية. التكلسات هي ترسب أو تصلب الصفائح الجرثومية الموجودة على سطوح الأسنان في الفم، وهي تشبه تركيبة الحصى البولية. الحصى البولية هي ترسب المعادن أو المواد غير العضوية الموجودة في البول في الكلية أو المجاري البولية.

أهداف الدراسة: لمعرفة فيما إذا كان هناك اختلاف بين مؤشرات نظافة الفم ومؤشر صحة اللثة بين مجموعة الحصى البولية والأشخاص الصحاء، وكذلك معرفة فيما إذا كان هناك فرق بين الذكور والإناث بالنسبة لهذه المؤشرات.

مواد وطرق العمل: أجرينا الدراسة في مدينة الصدر الطبية استشارية الجراحة البولية في مدينة النجف الإشرف في العراق على ثلاثين مرضى بحصى الكلى والمجاري البولية (مجموعة الدراسة) وثلاثين من الأصحاء (مجموعة المقارنة). وكانت أعمارهم بين (25-40) وعملنا على تقييم مؤشر نظافة الفم (مقياس نظافة الفم يقياس نسبة تجمع التكلسات والصفائح الجرثومية) ون_physiological_score (مقياس صحة اللثة من خلال قياس مؤشر التهاب اللثة عند المجموعتين.

النتائج: بينت الدراسة زيادة ملحوظة في معدل تجمع التكلسات والصفائح الجرثومية ومؤشر التهاب اللثة عند مجموعة الدراسة نسبة إلى مجموعة المقارنة. وزيادة ملحوظة في هذه المؤشرات عند الذكور مقارنة بالإناث، ووجود علاقة إيجابية قوية بين تجميل الترباس والصفائح الجرثومية وكذا بين الترباس ومؤشر التهاب اللثة.

الاستنتاج: أن مرضى الحصى البولية أكثر تجمع للتكلسات والصفائح الجرثومية على أسنانهم، وأكثر مستوى التهاب اللثة من الناس الأصحاء إذا جرب مراعاة هذه النتيجة عند معالجة مرضى الحصى البولية.