

هل من الممكن أن تتلوث فرشاة أسناننا بزمر الإشريكية القولونية؟

مهند كاظم*

الملخص

خلفية البحث وهدفه: لتقييم إمكانية تلوث فرشاة الأسنان بزمر الإشريكية القولونية، وارتباطه بعادات نظافة الفم والظروف البيئية.

مواد البحث وطرائقه: تألفت العينة من 60 مريضاً راجعوا عيادات الجامعة الدولية للعلوم والتكنولوجيا (IUST) وزودوا بفرشاة ومعجون أسنان جديدة من النوع نفسه. جُمعت فراشي الأسنان بعد أسبوعين من الاستخدام، وجرى تقصي التلوث بزمرة القولونية (E.Coli) باستخدام وسط الزرع ماكونكي (MacConkey). طلب إلى المشاركين جميعهم الإجابة إلى مجموعة من الأسئلة لتقييم وضع حالة الممارسة الصحية الفموية لديهم. النتائج: بينت الدراسة أن معظم المشاركين يحتفظون بفرشاة الأسنان في مكان مفتوح داخل الحمام؛ الذي عرض العديد من فراشي الأسنان للتلوث بالمستعمرات القولونية. الاستنتاج: ينبغي استبدال فرشاة الأسنان وتطهيرها بانتظام للحد من تلوثها، الذي يعدُّ مهماً في السيطرة على عدة أمراض فموية.

الكلمات المفتاحية: زمرا الإشريكية القولونية، الصحة الفموية، فرشاة الأسنان.

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Could our Toothbrushes be Contaminated by *Escherichia Coli* Colonies?

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Abstract

Aims: To assess the possibility of toothbrushes contamination by *E. Coli* and its association with oral hygiene habits and environmental conditions.

Materials and methods: Sixty patients, who attended at the International University for Science and Technology (IUST) clinics, were supplied with new toothbrushes and the same toothpaste. After two weeks of using them, the toothbrushes were collected and examined for *E.Coli* contamination using MacConkey agar media. All participants were asked to answer a group of questions to their oral hygiene practices status.

Results: This study shows that most participants kept their toothbrush in bathroom and in an open area; also, most of these toothbrushes were contaminated by *E.Coli* colonies.

Conclusion: Toothbrushes should be replaced and disinfected regularly to reduce toothbrush contamination which may be important in the control of several oral diseases.

Key words: *E. Coli*, oral hygiene, toothbrush.

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Introduction:

Toothbrushes considered as the most important oral hygiene aids, used by millions of people every day through plaque control procedures. Depending on its function in removing plaque and preventing its accumulation, toothbrushes become contaminated with bacteria, blood, saliva, oral debris and toothpaste after each use. Even after being rinsed with tap water, visibly clean toothbrushes can remain contaminated with potentially harmful microorganisms.

Also toothbrush contamination is highly possible depending upon storage conditions, unfortunately regarding to the lack of awareness among the public of toothbrush maintenance, toothbrush is often kept in bathrooms which are a good place to harbor millions of microorganisms. Survival microorganisms on toothbrush after brushing are considered as a possible cause of re-contamination of the mouth⁽¹⁾. Prolonged use of the toothbrush facilitates contamination by various micro-organisms such as Streptococcus, Staphylococcus⁽²⁾, and lactobacilli⁽³⁾. These micro-organisms are implicated to cause dental caries, gingivitis⁽⁴⁾, stomatitis, infective endocarditis in an individual, affecting both oral and general health⁽¹⁾.

Escherichia coli typically colonizes the gastrointestinal tract of human infants within a few hours after birth. Usually, *E. coli* and its human host coexist in good health and with mutual benefit for decades⁽⁵⁾.

The objective of this study was to investigate the daily tooth brushing behaviour, toothbrush maintenance and contamination by *E. Coli*.

Materials and methods:

Sixty healthy adults from the IUST Dental Faculty patient clinic, aged between (18- 35) years old were given a new toothbrush of the same brand and type, together with identical tubes of fluoridated toothpaste. After participants agreement to involve in the study, they signed the appropriate Consent forms. The participants in the study were chosen equally depending on gender and according to the following criteria:

- Should be free of systemic disease
- Should not be under dental treatment.
- Females should not be pregnant.
- Full permanent dentition.

They were requested to follow their normal oral hygiene practices for two-week period, at the end of which each toothbrush was collected in a sterile bag and processed within 18 hours of its last use.

All participants were asked to answer the following questions:

1. How many times do you use toothbrush a day (once a day, twice a day, more)
2. Where do you keep your toothbrush (kitchen, bathroom, others...).
3. If you keep it in bathroom where did you keep it (open place, close place).
4. Do you clean your toothbrush? (yes, no)
5. If yes, describe your way
6. Do you have a gingival bleeding ? (yes, no)

Escherichia Coli colonies detecting process.

The bristles of toothbrush were cut off by scissors and inoculated into the glucose broth, which supports the growth of micro-organisms and was incubated for 24 hours.

Sterilized agar plates were selected; agar media to allow growth of micro-organisms were prepared by weighing correct proportion of water and agar powder according to manufacturer's instructions and following aseptic protocol. The prepared agar media were poured into the agar plates and kept in the refrigerator to allow cooling of the agar media and to prevent contamination. To isolate *E Coli* micro-organisms, Mac-Conkey agar media were used. After inoculation, agar plates were kept in an incubator to allow for the growth of the micro-organisms. After 24 hours, agar plates were observed and examined.

Statistical analysis.

Contamination differences in prevalence rates between toothbrushes were tested for significance using chi-squared tests and results discussed. A linear mixed model was fitted for which the correlation between several measurements in time was taken into account. Correlations between contamination and environmental /storage variables were analysed by Spearman's correlation coefficients. We fixed the levels of significance at $P \leq 0.05$ using the statistical software package SPSS for Windows Version 15.0 (SPSS, Chicago).

Result:

42 toothbrushes were stored in bathrooms, 30 of which were combined toilet/ bathroom facilities, and were stored in open to the environment while only 12 of them were protected in closed area, figure(1). 12 toothbrushes were stored in kitchen, 3 did not name the place were they keep their toothbrush and 3 of the sample canceled, figure (2).

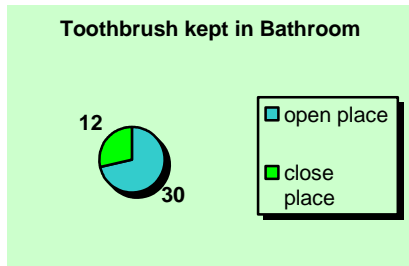


Figure1. Distribution of toothbrush according

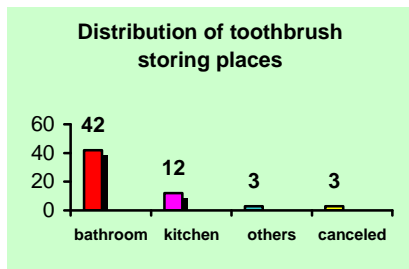


Figure 2. Frequencies of toothbrushes according to place of storage at bathroom to storage places

39 of the toothbrushes were rinsed using a finger to manipulate the bristles, 14 of the users did not clean there tooth brush and only 4 of them used mouth rinse solutions to clean their toothbrush, figure (3).

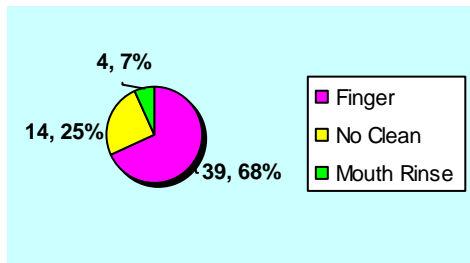


Figure 3. Prevalence and frequency of toothbrush rinsing technique.

No correlation founded between toothbrush rinsing techniques and storage methods/environments, table (1).

Table1: distribution of rinsing techniques according to place of storage.

Toothbrush rinsing techniques	Place of storage place		
	Bathroom	Kitchen	Other
Finger	28	10	1
No Clean	10	2	2
Mouth rinse	4	0	0

The answers of our questions showed that 54.4% of the participants brushed once, 42.1% twice, and 3.6 more than twice daily. Although the percentage of gingival bleeding is 78% of the sample, the result

showed female group brushing frequency was significant comparing to male group.

Percentage of *E. Coli* Presence in the sample were only 30%, 42.8 % of brushes that were kept in bathroom contaminated by *E. Coli*, all contaminated toothbrushes were kept in open area and their percentage was 60% of toothbrushes that kept in bathroom and in open area, figure (4).

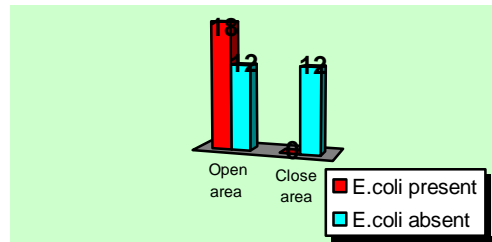


Figure4. Number of contaminated toothbrushes depending on area in bathroom

Clear correlation were found between storage methods/ environments and contamination of toothbrush in bathroom group. But no significant relation was found between frequency of toothbrush use and its contamination.

Discussion:

Most authors approved that there are relations between oral hygiene behaviours and socio-demographic factors such as age, sex, race/ethnicity and socio-economic status (6,7,8,9,10,11,12,13), and it become an universal finding that girls have better oral hygiene than boys (7,8,13). Dorri M et al study (14) showed that Iranian girls were significantly more likely to brush their teeth more often than boys. This is in line with the universal finding that girls have cleaner bodies and mouths than boys (15,8,16).

In our study, sample size was equal in both male and female group and regarding to significance of frequency use of toothbrush in female group compared to male one, our result come with most other researches in this field (7,8,13,14), and we think this result is reflect the needed of providing a good appearance thing which play a role in concerning and rising brushing frequency in female group. Although frequency of toothbrush was significant in female group comparing to male, but we should remember that Most of our participant are used tooth brush once a day 54.4% then those who used it twice and more (42.1%, 3.6%) respectively, this finding is similar to Dorri M et al study(16), 56% of his sample used toothbrush once a day comparing to those who used it twice or more 44%, but Ganss C et al 2009 (17) shows the opposite to our result. The higher percentage of gingival bleeding illustrate that the techniques that

used by participants were incorrect and improving or changing of techniques are needed.

Toothbrushes can harbor pathogenic microorganisms, and acting as a source of microbial transmission and dissemination. According to Glass and Lare⁽¹⁸⁾ contaminated toothbrushes may play a role in systemic or localized disease. Tooth brush will be contaminated after single use⁽¹⁹⁾, but some kinds of microorganisms are not routinely usually colonized in toothbrush one of them is *E Coli* which is found in our sample. The Significant association between toothbrush storage way and contamination by *E Coli* in our sample explained the presence of this colon in toothbrush storage sample. 42.8 % of toothbrushes that kept in bathroom and 60% of group that storage their toothbrush in bathroom and in open area, were contaminated by *E Coli* after two week of use, will the brushes that kept in closed area in bathroom or in other places of storage did contaminate by the *E Coli*. Although we leave the toothbrush only for two weeks in use, most brushes that kept in bathroom open area were contaminated by *E Coli* this result is confirmed by the S. Taji⁽²⁰⁾ study that showed the concentration of microorganism is elevated by time, depending on

this result we can say that the presence of microorganism is depend on time and frequency of use, in other words according to the time of availability in contact with infected environment, and maybe if we leave the toothbrush for a long time the presence of *E Coli* will be much more in our sample.

Conclusion:

These contaminated brushes may play a role in systemic or localized disease. We recommend that patients about to undergo major surgery procedures and debilitated or immunosuppressed patients be considered candidates for disposable brushes. We recommend that for the general population, toothbrushes be changed at least once a month and after any illness. Further, the dentists should inform their patient about the risks of contamination of toothbrush after single use and the effect of surrounding environment in toothbrush contamination. Toothbrush should be kept in closed clean area and dentists responsible to advise patients to clean their toothbrush by mouth wash solutions to protect it from microorganisms attack.

References

1. Wetzel WE, Schaumburg C, Ansari F, Kroeger T, Sziegoleit A. Microbial contamination of toothbrushes with different principles of filament anchoring J Am Dent Assoc 2005;136:758-64.
2. Taji SS, Rogers AH. The microbial contamination of toothbrush: A pilot study. Aust Dent J 1998;43:128-30.
3. Fernandez V, Cesar D. Microbiology evaluation of toothbrushes. In Vitro Cell Dev Biol Anim 2006;42:31A.
4. Boylan R, Li Y, Simeonova L, Sherwin G, Kreismann J, Craig RG, et al. Reduction in bacterial contamination of toothbrushes using violet light, ultraviolet light activated toothbrush sanitizer. Am J Dent 2008;21:313-7.
5. James B. Kaper, James P. Nataro and Harry L. T. Mobley. Pathogenic Escherichia Coli. Nature Reviews Microbiology 2004; vol2:123-140.
6. Jenkins, W. M & Papananou, P. N. Epidemiology of periodontal disease in children and adolescents. Periodontology 2000 2001;26, 16–32.
7. Albandar, J. M. Periodontal diseases in North America. Periodontology 2000 (a) 2002;29, 31–69.
8. Albandar, J. M. Global risk factors and risk indicators for periodontal diseases. Periodontology 2000 (b) 2002; 29, 177–206.
9. Baelum, V & Scheutz, F. Periodontal diseases in Africa. Periodontology 2000 2002;29, 79–103.
10. Corbet, E. F, Zee, K. Y. & Lo, E. C. M. Periodontal diseases in Asia and Oceania. Periodontology 2000 2002;29, 122–152.
11. Gjermo, P, Rosing, C. K., Susin, C. & Oppermann, R. (2002) Periodontal diseases in Central and South America. Periodontology 2000 29, 70–78.
12. Sheiham, A & Netuveli, G. S. Periodontal diseases in Europe. Periodontology 2000 2002;29, 104–121.
13. Maes, L, Vereecken, C, Vanobbergen, J & Honkala, S. Tooth brushing and social characteristics of families in 32 countries. International Dental Journal 2006;56, 159–167.
14. Dorri M, Sheiham A, Hardy R, Watt R. The relationship between Sense of Coherence and toothbrushing behaviours in Iranian adolescents in Mashhad. J Clin Periodontol 2010; 37: 46–52.
15. Kuusela, S, Honkala, E, Kannas, L, Tynjala, J & Wold, B. Oral hygiene habits of 11 year-old schoolchildren in 22 European countries and Canada in 1993/1994. Journal of Dental Research 1997;76, 1602–1609.
16. Taani, D. S, al-Wahadni, A. M & al-Omari, M. The effect of frequency of toothbrushing on oral health of 14–16 year olds. Journal of the Irish Dental Association 2003;49, 15–20.
17. C. Ganss, N. Schlueter, S. Preiss, J. Klimek. Tooth brushing habits in uninstructed adults—frequency, technique, duration and force. Clin Oral Invest 2009;13:203–208
18. Glass RT, Lare MM. Toothbrush contamination: a potential health risk? Quintessence Int 1986; 17:39-42.
19. Paulo Nelson-Filho, Gisele Faria, Raquel Assed Bezerra da Silva, Marcos Antonio Rossi, Izabel Yoko Ito. Evaluation of the Contamination and Disinfection Methods of Toothbrushes Used by 24- to 48-month-old Children. J Dent Child 2006;73:152-158.
20. S. S. Taji, A. H. Rogers. The microbial contamination of toothbrushes. A pilot study. Australian Dental Journal. 1998;43:(2):128-30