Contaminated Toothbrushes and Potential COVID-19 Transmission: Concerns and Recommendations

Andrea Vergara-Buenaventura[1] Carmen Castro-Ruiz[1]

[1]Department of Periodontology, School of Dentistry, Universidad Cientifica del Sur, Lima, Peru

Address for correspondence Andrea Vergara-Buenaventura, DDS, MSc, PhD(s), Department of Periodontology, School of Dentistry, Universidad Cientifica del Sur, Calle Cantuarias 398, 15048, Miraflores, Lima, Perú (e-mail: avergarab@cientifica.edu.pe).

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Abstract

Substantial past evidence has demonstrated microbial contamination of oral devices and possible transmission of viral diseases, drawing attention to habits related to using and storing toothbrushes. Since toothbrushes are in intimate contact with the oral cavity, the question arises as to whether they can transmit COVID-19.

An electronic search was performed in four databases to identify relevant literature about the possible contamination or transmission of SARS-CoV-2 through toothbrushes until May 2021. Forty-five records were retrieved, and after a thorough search, we found no articles reporting significant evidence. However, studies with other viral diseases have indicated that improper use and storage of toothbrushes could contribute to indirect disease transmission.

Therefore, this narrative review supports the implementation of toothbrush disinfection and storage measures to minimize the risk of SARS-CoV-2 infection among cohabitants and community settings. Finally, recommendations and a suggested protocol to reduce the potential risk of transmission between cohabitants are provided.

Keywords
- COVID-19
- contamination
- oral health
- SARS-CoV-2
- toothbrushes
- transmission

Introduction

The severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) has caused the coronavirus disease 2019 (COVID-19) outbreak and a global concern.[1-3] Most governments implemented strict measures to limit viral transmission such as isolation, personal protective equipment, and handwashing.[1]

Evidence has suggested that inadequate measures could indirectly contribute to COVID-19 infection between people living together,[4] drawing attention to habits related to using and storing oral appliances.[5-7] In the past, considerable evidence has demonstrated microbial contamination of toothbrushes and possible transmission of viral diseases to users.[8-11] Like other microorganisms, SARS-CoV-2 has been detected in the oral mucosa,[12,13] and saliva samples turn the oral cavity into an important route of transmission and potential reservoir of the virus.[13-16] Since toothbrushes are in intimate contact with the oral cavity, the question arises as to whether they can transmit COVID-19. Not to mention that experts have suggested that a fecal-oral route of SARS-CoV-2 transmission is possible, with the potential to contaminate toothbrushes stored near the toilet.[17,18]

Therefore, the purpose of this review was to answer the following questions:

- Has SARS-CoV-2 been found on toothbrushes?
- Is there evidence of the transmission of the SARS-CoV-2 through toothbrushes?

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Simultaneously, recommendations on toothbrush disinfection and storage based on other viral infections are given to reduce the potential risk of transmission between cohabitants.

Material and Methods

An electronic search was performed in Medline via PubMed, Embase, Scopus, and Scielo databases to identify relevant literature about the possible contamination or transmission of SARS-CoV-2 through toothbrushes until May 2021. The search strategy included the following terms: toothbrush, SARS-COV-2, and COVID-19. The complete search strategy, by database, is shown in ►**Table 1**.

The search was not limited to language restrictions or time and included all levels of evidence that reported the results of a study. Also, the references of selected articles were planned to be hand searched. Reviews, editorial, editor letters, personal opinions, congress abstracts, and animal studies were excluded.

Two review authors (A.V. and C.C.) were involved in title and abstract screening and article selection after full-text screening following the inclusion criteria. Articles that do not contain information regarding toothbrushes and SARS-CoV-2 were excluded. Full-text articles were evaluated to identify studies that met the inclusion criteria. The same authors performed the synthesis of the data extracted.

Results

A total of 45 records were retrieved from four databases. After the removal of duplicated articles, 29 articles remained for a title and abstract screening. After a thorough search, we found no articles reporting substantial evidence about contamination or transmission of SARS-CoV-through toothbrushes. ►**Fig. 1** shows the flowchart diagram for the search strategy used.

Discussion

The theory of a potential risk of SARS-CoV-2 infection by toothbrushes is based on aerosol and surface contamination studies. Van Doremalen et al[19] detected that SARS-CoV-2 was viable for up to 3 hours in drops, 24 hours in cardboard, 48 hours in stainless steel, and 72 hours in plastics. Meanwhile, Santarpia et al[20] reported that 70.6% of all personal items in quarantine rooms were positive for SARS-CoV-2.

Although the presence of SARS-CoV-2 in toothbrushes has not yet been reported, considerable past evidence has indicated that toothbrushes can be easily contaminated

Table 1 Search strategy

MEDLINE (via Pubmed)	(“toothbrush”[All Fields] OR “toothbrushes”[All Fields] OR “toothbrushing”[MeSH Terms] OR “toothbrushing”[All Fields] OR “toothbrushings”[All Fields] OR “Toothbrush contamination”[All Fields]) AND (“covid 19”[All Fields] OR “covid 19”[MeSH Terms] OR “sars cov 2”[All Fields] OR “sars cov 2”[MeSH Terms] OR “severe acute respiratory syndrome coronavirus 2”[All Fields])
SCOPUS	(TITLE-ABS-KEY (toothbrush OR toothbrushes OR toothbrushing OR toothbrushing) AND TITLE-ABS-KEY ((covid 19) OR (sars AND cov 2) OR (severe AND acute AND respiratory AND syndrome AND coronavirus 2)))
EMBASE	(“coronavirus disease 2019”/mj OR “2019 novel coronavirus disease” OR “2019 novel coronavirus epidemic” OR “2019 novel coronavirus infection” OR “2019-ncov disease” OR “2019-ncov infection” OR “covid” OR “covid 19” OR “covid 19 induced pneumonia” OR “covid 2019” OR “covid-10” OR “covid-19” OR “covid-19 induced pneumonia” OR “covid-19 pneumonia” OR “covid19” OR “sars coronavirus 2 infection” OR “sars coronavirus 2 pneumonia” OR “sars-cov-2 disease” OR “sars-cov-2 infection” OR “sars-cov-2 pneumonia” OR “sars-cov2 disease” OR “sars-cov2 infection” OR “sarscov2 disease” OR “sarscov2 infection” OR “wuhan coronavirus disease” OR “wuhan coronavirus infection” OR “coronavirus disease 2” OR “coronavirus disease 2010” OR “coronavirus disease 2019” OR “coronavirus disease 2019 pneumonia” OR “coronavirus disease-19” OR “coronavirus infection 2019” OR “ncov 2019 disease” OR “ncov 2019 infection” OR “new coronavirus pneumonia” OR “novel coronavirus 2019 disease” OR “novel coronavirus 2019 infection” OR “novel coronavirus disease 2019” OR “novel coronavirus infected pneumonia” OR “novel coronavirus infection 2019” OR “novel coronavirus pneumonia” OR “paucisymptomatic coronavirus disease 2019” OR “severe acute respiratory syndrome 2” OR “severe acute respiratory syndrome 2 pneumonia” OR “severe acute respiratory syndrome cov-2 infection” OR “severe acute respiratory syndrome coronavirus 2 infection” OR “severe acute respiratory syndrome coronavirus 2019 infection” OR “severe acute respiratory syndrome coronavirus 2”/mj OR “2019 ncov” OR “2019 new coronavirus” OR “2019 novel coronavirus” OR “2019 severe acute respiratory syndrome coronavirus 2” OR “2019-ncov” OR “covid 19 virus” OR “hcov-19” OR “human coronavirus 2019” OR “sars coronavirus 2” OR “sars-cov-2” OR “sars-related coronavirus 2” OR “sars2 (virus)” OR “sever acute respiratory syndrome coronavirus 2” OR “severe acute respiratory coronavirus 2” OR “severe acute respiratory syndorme coronavirus 2” OR “severe acute respiratory syndrome coronavirus 2” OR “severe acute respiratory syndrome coronoavirus 2” OR “severe acute respiratory syndrome coronvirus 2” OR “severe acute respiratory syndrome related coronavirus 2” OR “severe acute respiratory syndrome virus 2” OR “severe acute respiratory syndrome coronavirus 2” OR “wuhan coronavirus” OR “wuhan seafood market pneumonia virus” OR “ncov-2019” OR “novel 2019 coronavirus” OR “novel coronavirus 2019” OR “novel coronavirus-19” OR “severe acute respiratory syndrome 2 virus” OR “severe acute respiratory syndrome cov-2 virus” OR “severe acute respiratory syndrome corona virus 2” OR “severe acute respiratory syndrome coronavirus 2019”) AND (“tooth brushing”/mj OR “brushing, dental” OR “brushing, tooth” OR “dental brushing” OR “tooth brushing” OR “toothbrushing” OR “toothbrush”/mj OR “brush, dental” OR “brush, tooth” OR “dental brush” OR “tooth brush” OR “toothbrush” OR “toothbrushes”)
SCIELO	(toothbrush OR toothbrushes OR toothbrushing OR toothbrushing) AND (sars cov 2) OR (severe acute respiratory syndrome coronavirus 2)

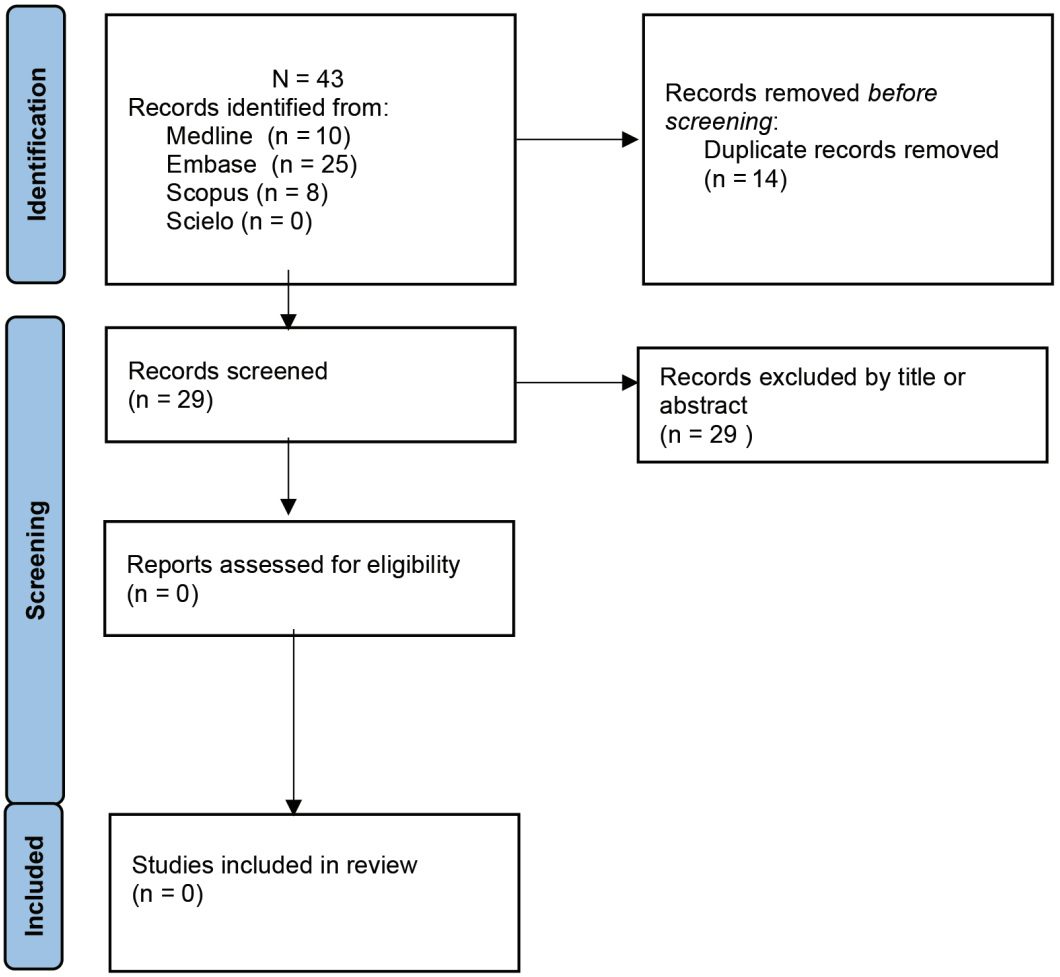

Fig. 1 Prisma flowchart.

with different microorganisms.[6,7] Previous studies have found proviral DNA on the toothbrush of an HIV-positive patient.[21] In the same way, HCV-RNA was found in toothbrushes of patients with hepatitis C.[22]

Authors have suggested a possible oral-fecal route of SARS-CoV-2 transmission,[17,18] indicating that toothbrushes placed near toilet seats could be contaminated.[17] Moreover, it has been reported the presence of Herpes simplex virus type 1 from 48 hours to 7 days on stored toothbrushes, especially in moist environments such as bathrooms.[23] Similarly, rhinovirus contamination was found in toothbrushes and other home surfaces of people with a common cold.[24]

Earlier studies have demonstrated that toothbrushes could behave as vectors for the transmission and reinfection of viral diseases.[8,9] It has been reported that cross-contamination of toothbrushes used by human papilloma virus (HPV) patients,[10] hepatitis B,[11] and hepatitis C patients[25] may occur between family members and inmates who often share the device.[26] It is essential to emphasize that in the context of COVID-19, some patients did not show any symptoms during the early stage of infection,[27,28] and infected subjects can spread the disease even before developing symptoms[29-31] through infected saliva.[32-34]

Recently, González-Olmo et al[4] have found that 3% of cohabitants share toothbrushes, 64.2% used the same toothbrush container, and 50.3% the same toothpaste, suggesting that inadequate measures and habits could indirectly contribute to COVID-19 infection between people living together.[4]

Regarding the disinfection and storage of toothbrushes, no experimental studies were found related to SARS-CoV-2 infection. However, concerning other viruses, Devine et al[35] demonstrated that tetrasodium EDTA reduces Herpes simplex virus and poliovirus infectivity, suggesting its use to neutralize enveloped and nonenveloped viruses on dental appliances. Other studies have indicated that microwave and ultraviolet (UV) irradiation can effectively disinfect virus-infected toothbrushes.[36,37] Moreover, ozone, a powerful cellular oxidant, has been considered a promising bactericidal, virucide, and antifungal agent for toothbrushes after 30 minutes of exposure.[38]

Although the real impact of decontaminants on SARS-CoV-2 is still uncertain, it has been suggested that the use of some mouthwashes may reduce the oral viral load, decreasing the risk of transmission and the severity of COVID-19.[39,40] Different antiseptics, including cetylpyridinium chloride, delmopinol hydrochloride, povidone-iodine,

and chlorhexidine digluconate, have demonstrated in vitro SARS-CoV-2 inactivation.[41-44] Lamarca et al[32] have emphasized toothbrush disinfection in family and community settings (schools and hospitals) and suggested a hygiene protocol for disinfecting toothbrushes against SARS-CoV-2.

Depending on their storage, toothbrushes can become a source of cross-infection.[6,45] Studies comparing microbial contamination of toothbrushes used between 1 and 3 months suggested that toothbrushes should be replaced after 3 to 4 weeks.[46-48] Concerning viral contamination, Glass and Jensen recommended replacing toothbrushes every 2 weeks.[49] Besides, the storage of toothbrushes in closed containers and close contact with other devices may increase the number of microorganisms.[46,50-52] In addition, some authors recommended not sharing toothbrushes or toothpaste tubes.[4,17]

Suggested Protocol for Storage and Disinfecting Toothbrushes

Although evidence has not yet been established, the following recommendations are made as a precautionary measure in the COVID-19 preventive approach:

- Do not share toothbrushes.
- Do not store them in closed containers.
- Disinfection of the toothbrush handle with a proven disinfectant tested against SARS-CoV-2 (in community settings).
- Disinfection of the toothbrush bristles with a proven in vitro oral rinse tested against SARS-CoV 2 for 1 minute.
- Replace toothbrushes every month in uninfected persons living with a polymerase chain reaction (PCR)-positive patient.
- If sharing the restroom with many people, prefer to store toothbrushes in another clean place.
- If a COVID-19 infection is confirmed, replace the toothbrush after 2 weeks, keep it separate, and use a personal toothpaste tube.

Conclusions

No studies on the possible transmission of SARS-CoV-2 via toothbrushes were identified for inclusion in this review. Although there is no substantial published evidence, studies with other viral diseases have indicated that improper use and storage of toothbrushes could contribute to indirect disease transmission. Therefore, this narrative review supports the implementation of toothbrush disinfection and storage measures to minimize the risk of SARS-CoV-2 infection among cohabitants and community settings. Dentists should educate their patients about this. However, these recommendations urgently need to be validated with studies related to COVID-19.

Conflict of Interest

The authors do not have any financial interest in the companies whose materials are included in this article.

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