

Transmission of COVID-19 in dental settings – a rapid review. March 2022

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Key points:

- 31 studies were identified, only 12 of which provided information about transmission of COVID-19 in dental settings.
- Most infections of dental staff were not linked to dental settings.
- Only a small number of cases of COVID-19 have been attributed to transmission between dental patients and dental professionals.
- In most studies that reported prevalence of COVID-19 infection in different groups, infections in dental professionals were no greater than the general population.
- In the international research literature, the absence of a significant body of evidence of transmissions associated with dental healthcare might indicate that dental healthcare should not be considered to be high risk.

Introduction

The emergence of the novel coronavirus disease 2019 (COVID-19) caused by the highly infectious SARS-CoV-2 virus at the end of 2019 led the World Health Organisation to declare a global pandemic on 11 March 2020.[1] The introduction of public health control measures by many governments severely curtailed the delivery of dental health services. In many countries control measures have remained in place to varying extents. In the UK, the requirement to apply enhanced public health control measures, including infection prevention and control protocols, has resulted in a major reduction in the number of patients attending for dental care compared with rates prior to the pandemic.[2, 3] In addition to the impact on population oral health, the longer-term effects on the profession are also of concern.[4, 5]

The introduction of enhanced infection prevention and control protocols was a precaution necessitated by the emergence of a novel virus, SARS-CoV-2, and a lack of understanding about its transmission. There was concern that the close contact between patients and members of the dental team when providing oral health care places dental professionals at high risk of infection and patients may become infected if the dental professional is infected. In addition, many dental treatments involve procedures that generate aerosols, which might provide a route for transmission.[6]

To help inform decisions about future infection prevention and control measures, we conducted a rapid review of the international research literature to identify any reports of transmission of SARS-CoV-2 associated with provision of dental healthcare.

Materials and Methods

The research question for this review was: *What evidence is there of SARS-CoV-2/COVID-19 transmission in dental settings?* A broad literature search of Medline, Embase, medRxiv and WHO COVID Global literature database was carried out on 27 January 2022 that combined diverse search terms for SARS-CoV-2/COVID-19, dentistry, incidence/prevalence/epidemiology, and transmission (see Appendix 1 for

details). This approach was supplemented with several papers that had been identified prior to the search. Titles and abstracts were screened in duplicate against inclusion criteria (any study type except editorials, letters, opinion pieces, modelling, narrative reviews; provides a measure of SARS-CoV-2/COVID-19 infections associated with dental settings) for relevance to the review question. Disputes were resolved through discussion with a third researcher. Full text articles were checked for relevance to the review question, data were extracted from included articles using a standard form and then collated to identify which articles addressed the review question and how to synthesise the evidence. A formal risk of bias assessment was not carried out due to the rapid nature of the review process and the heterogeneity of the study designs to be included.

Results

As presented in Figure 1, 1912 articles were identified which, after removing duplicates, reduced to 1397 articles. After screening of titles and abstracts, 1356 articles were excluded, and 41 articles remained. 10 articles were excluded when full text articles were examined - four non-dental; four provided no data (i.e. only protocols or conference abstracts); one study in which reporting was inadequate; one small descriptive case study. As it was recognised that transmission of SARS-CoV-2 might not be the primary focus of the included studies and therefore not clearly reported in the abstract, screening to this point was inclusive.

Thirty-one articles were included that represented studies of a variety of designs from 16 countries. Twelve studies provided transmission information. Details of these 12 studies are presented in Table 1 Part A, with the other included studies in Part B.

Transmission studies

In four of the studies that addressed transmission of SARS-CoV-2/COVID-19, the reported transmission was based on participants' perceptions about the source of their infection[7-10]. In these studies, between 8.8% and 45.9% of participants suspected that their infection was related to their dental workplace but there was no follow up to substantiate this.

In seven studies, epidemiological investigation (contact tracing) was used to establish the likely source of transmission.[11-17] In two of these, none of the six positive cases of infection investigated was associated with the dental setting.[11, 13] In one study, 23 of the 57 positive cases were investigated.[12] Of these, two were likely to be associated with the dental practice, but whether this was patient to staff transmission is not stated. In the report of a COVID-19 outbreak in a US prison, the most likely source was an infected dentist, but this was not certain.[14] Approximately 30% of COVID-19 positive dental health workers identified in one year in Germany were considered to be occupational diseases, meaning there was a reasonable suspicion of occupational infection when the worker performed an exposure-prone procedure and infection occurred. However, as proven contact with an infectious patient is not reported, the routes of transmission are not known.[15] A report of COVID-19 infections in oral health care workers in Wuhan, China very early in the pandemic found five cases of transmission likely to be associated with dental settings.[16] A study in Israel comprising thorough epidemiological investigations of nearly 1500 interactions involving patients or dental staff known to be COVID-19 positive found the transmission rate to be very low (cumulative prevalence for exposure to infected patients and dental professionals were 0.6% and 0.7% respectively).[17]

We included one systematic review,[18] which itself included just one report about transmission. This was an overview of COVID-19 based on early pandemic experience in Wuhan, China, which we excluded

during our title and abstract screening of search results.[19] It provided anecdotal information that two of nine reported cases of infection of dental staff (who were using standard precautions before quarantine was imposed) were likely to be transmissions in dental facilities.

To summarise, there are few studies that have used epidemiological investigations of COVID-19 infections in dental settings. While the majority of infections were not linked to dental healthcare, in a small number of cases, COVID-19 infections were likely to be linked to dental settings. No studies used genome sequencing to confirm routes of transmission. Consequently, the conclusions of these studies are not definitive, and we assess the certainty of this body of evidence as very low.

Prevalence studies

Twenty-eight studies presented a measure of infections within dental staff[7-13, 15-17, 20-37], and three in patients.[11, 17, 38]

Fourteen of the included studies attempted to compare COVID-19 prevalence or case numbers in dental staff with the general population. Of these, ten reported that prevalence or case numbers of infections in dental staff are lower or similar to the general population.[8-10, 13, 17, 24, 28, 30, 32, 33] In four studies the proportion of dental staff infected was found to be higher than the general population. In one of these studies it was suggested that this could be due to regional differences[35] and in two studies it might reflect the limited use of enhanced PPE early in the pandemic.[20, 36] In the fourth study, incidence proportions were higher in dentists than the national working age population during the first COVID-19 wave, but similar to the general population in the second wave.[31] In addition, a survey of dentists in 36 countries concluded that dentists tended to have lower levels of positivity than the general population.[23]

Seven studies that commented on the rates of COVID-19 infections in various healthcare professions. One found that dental staff were more likely to test positive than other healthcare workers.[20] In the others, infection rates in dentistry were found to be lower[21, 26, 33] or likely to be similar[29] or lower[12, 15] than other healthcare professions.

Given the inherent bias within these studies, including a dependence on convenience sampling, the reliance in many on self-reporting and the diverse methods used to count a positive case, we assess the certainty of this body of evidence as very low.

Discussion

We have conducted a rapid review of the global research literature to identify evidence of SARS-CoV-2/COVID-19 transmission in dental settings. We identified 31 reports of studies of a variety of designs that appeared to provide information about transmission. Most provided some measure of infections within dental staff and/or patients, but only 12 included any information about transmission. Some cases were likely to constitute transmission in the dental setting, but in the majority of cases the source of infection was likely to be elsewhere. While we have assessed the evidence reported in this review to be of very low certainty, we do acknowledge that in this area of research conducting high quality studies may not be feasible in practice.

A review of guidance worldwide in July 2020 found 63 documents, 12 of which recommended the use of FFP3 masks. The majority (44) recommended FFP2/N95 and 21 recommended only surgical masks. [39] Consistent with this, in our review most of the studies that provided details of infection prevention and control measures reported the use of FFP2/N95 rather than FFP3 face masks. We have found few

confirmed cases of transmission linked to dental healthcare and the reported compliance with use of recommended PPE is variable (Table 1). There is insufficient evidence to establish a clear link between level of PPE and COVID-19 infection. However, these findings suggest that, except when treating patients known or suspected to be infected with SARS-CoV-2, use of the higher level FFP3 masks routinely might be unnecessary.

At the start of the pandemic, there was concern that dentistry was high risk for COVID-19 transmission due to the close contact with patient and extensive use of aerosol generating procedures. However, it is notable that within the global evidence there are few reports of SARS-CoV-2 infections confirmed to be associated with dental healthcare after the COVID-19 pandemic was declared. The absence of a significant body of evidence suggests that this concern may have been unfounded.

In most studies that reported or commented on prevalence of COVID-19 infection in different groups, infections in dental professionals were no greater than the general population. Therefore, despite the very low certainty of the available evidence, dental healthcare is unlikely to present a greater risk of infection than elsewhere in the community.

Finally, we have been aware of a relevant unpublished study carried out in Scotland in which several hundred infections linked to dental settings have undergone epidemiological investigation. A paper describing this study is now available on the medRxiv pre-print server.[40] While still subject to peer review, in 752 confirmed cases this study found that there was no evidence of staff to patient transmission or vice versa using contact tracing methods.

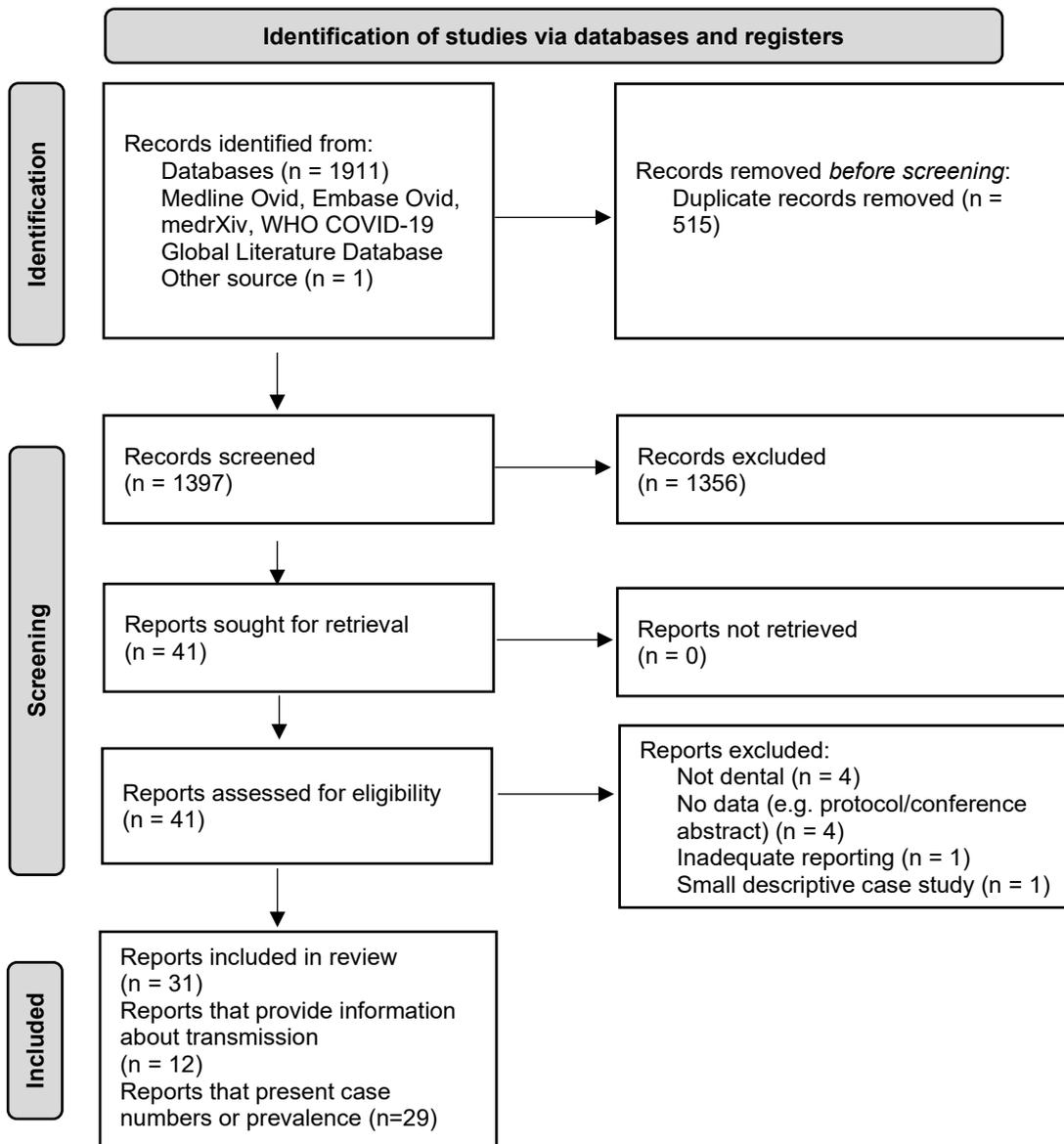


Figure 1: Flow diagram illustration of selection of articles for the rapid review

Table 1: Key features and main findings of 31 included studies

A: studies that include information about COVID-19 transmission

First author & year	URL	Country	Study period	Study type	Setting	COVID-19 precautions	Main findings of study	Transmission information
Abu-Hammad 2021 [7]	https://www.mdpi.com/1660-4601/18/20/10911	Saudi Arabia	Mar-Aug 2021	Cross-sectional survey	Dental Hospital	Not stated	Prevalence: 98 staff and 218 students self-report of COVID-19 infections (method of confirmation not specified). 19.6% (n=62) reported COVID-19 positive during the collection period. 85.6% of these were symptomatic.	Perceived source (unconfirmed): 33.9% unknown; 40.3% Family/friends; 24.2% dental hospital; 1.6% marketplace
Alterman 2021 [11]	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7861154/	Israel	Feb-Aug 2020	Retrospective case series analysis	Medical Center Oral and Maxillofacial Surgery dept	Patients triage/screening protocol: telephone questionnaire, temperature measurement, mask and gloves, clinical triage on arrival, pre-procedural mouthrinse. PPE based on CDC guidance: AGPs: N95 mask (multiple use) + regular surgical mask (single use); face shield; log sleeve disposable waterproof gown; disposable head covering. Non-AGP: Regular surgical mask (single use); face shield; log sleeve disposable gown; disposable head covering.	Weekly PCR testing of staff for COVID-19. Patients tested pre-operatively and results collected from patient records. 193 staff tests performed. Of 37 staff, one tested positive. No patients tested COVID-19 positive	From independent epidemiologic investigation likely source of 1 staff infection was social contact outside of hospital. No patients tested COVID-19 positive.

Araujo 2021 [12]	https://j.ada.org/article/S0002-8177(21)00204-X/fulltext	USA	Jun- Nov 2020	Longitudinal survey	Private or public dental practice	AGPs: N95 mask or equivalent and eye protection with a statistically significant decline in dentists reporting sometimes or always wearing N95 or equivalent masks and eye protection during AGPs over time from 92.4% in the first survey to 88.0% in the final survey (P < .01) Non-AGPs: wearing of surgical mask and eye protection remained consistent throughout (range 75-86%) Screening patients and staff members for COVID-19, disinfecting between patients, and encouraging social distancing between patients. Compliance 99.7%	In 6 rounds of survey of 2196 dentists (785 completed all 6); based on self-reported COVID status; cumulative prevalence of COVID-19 infection of 2.6% (57 dentists), either confirmed (tested) or probable. Incidence ranged from 0.2% to 1.1% each month. Prevalence in dentists is notable lower in this study than in studies of other US HCWs at the same time.	In the study period, the likely source of COVID-19 was identified via contact tracing by a health agency or clinic in only 23 cases among dentists; in 2 instances, the dental practice was identified as the likely infection source.
Diakonoff 2021 [8]	https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0261439	France	Jul- Aug 2020	Cross-sectional survey	Dental personnel, mainly private practice	After suspension of lockdown, public transport use to work reduced by 41%. Decrease in number of patients seen (77.1%) and dental procedures (17.3%). FFP2/FFP3/(K)N95 masks for by 94.4% respondents for AGPs	3497 (~9%) dentists in France self-report of COVID-19 infection (one third had received quantitative RT-PCR and/or serology tests). 3.6% prevalence, lower than the French population at the time (5.2%). Univariate and multivariate analysis carried out on the levels of PPE reported in this sample showed that a surgical mask was associated with	32.5% of those who tested positive suspected that transmission took place in their workplace. Of those who tested positive 85.7% were suspected to have been infected prior to 11/05/2020 when lockdown was suspended.

						and 63.5% for non AGPs. Similar trends for other of PPE use (gown, eye covers, hairnets, shoe covers).	increased risk of infection for AGPs and non-AGPs.	
Estrich 2020 [13]	https://j.ada.ada.org/article/S0002-8177(20)30658-9/fulltext	USA	Jun-Nov 2020	Cross-sectional survey	Dentist in public or private practice	CDC interim guidance for PPE: basic PPE and eye protection with N95 respirator for AGPs, 59% always followed CDC guidance. In all 72.8% of dentists used PPE according to CDC interim guidance (AGPs and non-AGPs).	2195 dentists self-report of COVID-19 infection: 0.9% (95% CI 0.5-1.5) (n=20) reported a positive test or probable diagnosis in the previous month. In the sample, 3.7% of the 244 respondents tested with nasal or throat swabs tested positive, i.e. substantially lower than the general population (10.3%).	Transmission was only formally investigated in 25% (n=5) cases with none being linked to dental practice.
Jungo 2021 [9]	https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0246586	France	Apr 2020	Cross-sectional survey	Any dental setting	75% had treated patients with only mask and gloves; FFP2 masks 8.8% dentist, 3.9% assistants Goggles 62% dentists, 39.2% assistants	In 4172 dentists and 1868 dental assistants (~10% workforce), the prevalence of laboratory confirmed COVID-19 was 1.9% dentists and 0.8% assistants, but only 4.8% or dentists and 1.9% of assistants received a test. The prevalence of COVID-19-related clinical phenotypes was 15.0% (n = 626) for dentists and 11.8% (n = 220) for dental assistants. The prevalence of symptomatic dentists was similar to that reported for the French population at the same date (14%).	Among symptomatic responders 373 (45.9%) suspected a transmission within their work environment, whereas only 130 (11.9%) suspected transmission within private sphere.
Levit 2021 [18]	https://pubmed.ncbi.nlm.nih.gov/34191900/	Global	Dec 2019-May 2020	Systematic review	Any dental setting	Not stated	31 articles identified that were concerned with risks related to dental practice and recommended infection management protocols for dental staff. Only one study found providing anecdotal data on transmission.	One article[19] reported that 9 dental staff who were using standard precautions were confirmed with COVID-19 infections, including 2 dental nurses from the same department that could be occupational exposures.

Lewis 2021 [14]	https://www.cdc.gov/mmwr/volumes/70/wr/mm7013a2.htm?s_cid=mm7013a2_w	USA	Sep 2020- Jan 2021	Case report	Dental clinic in correctional facility	Dental staff wore PPE including eye protection, gown, gloves and N95 respirators (fit testing and function unknown).	RT-PCR confirmed COVID-19 two positive cases as patients who received dental treatment from a visiting dentist later confirmed to have COVID-19. The outbreak progressed rapidly with 46 people infected 11 days after first potential introduction. As of 31 January 2020, 1368 (52%) of residents and 88 (16%) cases among 550 staff members were reported. Epidemiological investigation is described.	Of 10 patients treated by a COVID-19-positive visiting dentist (asymptomatic at time of treatment), two experienced symptoms and/or tested positive several days later. Despite efforts to isolate positive cases, an extensive outbreak occurred. Viral genome sequencing was not performed, therefore linkages between infections were not ascertained definitively. Consequently, SARS-CoV-2 might have been introduced into the correctional facility by a dental professional or another staff member with community-acquired infection.
Lucaciu 2021 [10]	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8124498/	Romania	Dec 2020- Mar 21	Cross-sectional survey	Dental practice, private and public	Initially dental care much reduced (7.7%) then new protocol implemented by 97.8% of dentists: included UV lamps, time gaps, patient temperature checks, protection for patients, phone triage	507 dentists completed the survey for staff in clinics representing 3735 dental practitioners. Based on self-report of PCR positive tests (n=238), the calculated infection rate for dentists was reported as 6.37% for March 2020-March 2021. Concluded that the SARS-CoV-2 infection rate among dental practitioners is similar to the “second wave” infection rate for the general population group.	Most contamination reported to have occurred outside the dental office (home 47.8%). In 13 dental offices, 21 infections at work were declared (8.82%).
Malsam 2021 [15]	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8508029/	Germany	Mar 2020- Feb 2021	Observational prospective cohort surveillance study	Any dental setting	Not reported	155 COVID-19 claims were registered for dental HCWs, and 47 cases were confirmed as occupational diseases (compared to only 2 in 2019). Infection risk in dental HCW is lower than in hospital workers. Designating an occupational disease means that	47/155 cases were confirmed as occupational diseases which is indicative of transmission in the dental setting. No information on whether between staff/staff or patient/staff.

							there is a reasonable suspicion that is sufficient to agree to a compensation claim.	
Meng 2020 [16]	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7527907/	China	Jan-Mar 2020	Observational prospective cohort surveillance and cross-sectional survey	Hospital, dental hospital, community and private practice	67.7% wore standard PPE up to 20/01/2020. Subsequently, some used disposable gowns & masks, goggles, and gloves. N95 or KN95 masks were rarely available. Two administrators did not use PPE routinely.	27/31 Oral HCWs were positive for COVID 19 (PCR, chest Xray or CT). 19 Oral HCWs (61.3%) reported contact with confirmed or suspected cases in healthcare or home setting, including 5 who had contact with dental patients suspected to have COVID-19. Concluded that there were few clusters of COVID-19 in dental settings.	Contact tracing of the 5 Oral HCWs who had contact with COVID-19 positive patients identified likely transmission routes from dental patient to staff in dental settings. Follow up of patients treated by COVID-19 infected dentists were incomplete. Viral genome sequencing was not performed, therefore linkages between infections were not ascertained definitively.
Natapov 2021 [17]	https://www.sciencedirect.com/science/article/pii/S0300571221002141?via%3Dihub	Israel	May-Sep 2020	Observational prospective cohort surveillance study	Dental clinics	Most dental staff reported using 'full PPE' i.e. concurrent use of surgical mask, face shield/ protective glasses and water-resistant gown during the entire treatment time (91.8% of exposures to positive dental workers; 85% exposures to positive patients)	During the study period, the SARS-CoV-2 incidence rate in dental clinics was significantly lower when compared to the population e.g. cases per 100,000 in September 2020 were population: 1301.56; dental worker: 141.65; patient 6.2. 962 dental personnel were exposed to 508 SARS-CoV-2 positive patients in dental settings. PCR testing found 7 dental personnel were positive with a cumulative prevalence of 0.7%. 507 patients were exposed to 43 SARS-CoV-2 positive dental staff. 3 patients were SARS-CoV-2 positive with a cumulative prevalence of 0.6%. Contact tracing was used to establish if transmission took place in the dental setting and if exposure	For positive dental workers and patients, contact tracing established potential exposure in the dental setting only. Transmission levels between staff and patients were found to be extremely low: cumulative transmission rate <1%. Positive dental workers were exposed to more patients so presented a greater risk than a COVID-19 positive patient. High compliance with PPE use was proposed to be effective in minimising infections.

							to positive patient or staff had an influence.	
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B: Other included studies that do not include information about COVID-19 transmission

First author & year	URL	Country	Study period	Study type	Setting	COVID-19 precautions	Main findings of study
Abo-Leyah 2021 [20]	https://openres.com/content/early/2021/04/15/23120541.0080-2021	United Kingdom	May-Dec 2020	Prospective observational study	Hospital HCWs including dental staff	Not stated for dental staff	At recruitment (May/June), seroprevalence: 300/2063 HCWs including 13/50 dentistry staff had positive SARS-COV-2 spike protein antibody test: seroprevalence 14.5% and 26.0% respectively. Dentistry was the HCW group most likely to test positive. 11/231 control sera tested positive: seroprevalence 4.8% making HCWs ~3x more likely to test positive than general population at this time. No information about transmission.
Antoni o-Villa 2021 [21]	https://academic.oup.com/cid/article/73/1/e191/5912602?login=false	Mexico	up to Sep 2020	Surveillance study	Healthcare	Not stated	RT-PCR SARS-COV-2 testing of 57758 HCWs (1.82% dentists n= 1054); Overall positives 32.6%; dentist positives 25.3% (n=267). No information about transmission.
Cagetti 2020 [22]	https://www.mdpi.com/1660-4601/17/11/3835	Italy	Apr-20	Cross-sectional survey	Dentists in practice in Lombardy	Pre-arrival and waiting room precautions were adopted to varying extents; various pre-op mouthrinses were used. Reported PPE use: 74.6% used surgical masks, 63.8%	Prevalence amongst 3599 dentists was 0.86% based on self-reporting of COVID-19 infections (basis for positive not stated). No information about transmission.

						disposable headsets, 21.1% sterile microfibre disposable gown, 54.8% FFP2 or FFP3 facial filters.	
Campus 2021 [23]	https://www.sciencedirect.com/science/article/pii/S0300571221001706?via%3Dihub	36 countries	May-Aug 2020	Survey	Dentists, specialists and generalists	53% reported use of FFP2/N95 masks routinely. More than half reduced footfall in surgeries to enable physical distancing. 57% carried out screening of signs/symptoms of patients	52491 dentists. Self-reported COVID-19 infection status 15% positive. 90% of respondents were clinically active. Gross national income, community positivity rate and N95/FFP2 use were all associated with covid self-reported rate. Face-to-face activity was not statistically significant. 14/36 countries continued routine care during the pandemic. When dentists reported continuing to work in countries with higher community positivity rates this translated to higher positivity rates amongst dentists. When comparing the self-reported rate with the covid positivity rate in the general population for each country, dentists tended to have lower levels of positivity.
Carvalho 2021 [24]	https://www.mdpi.com/1660-4601/18/16/8381/htm	Belgium	Jun-Sep 2020	Cross-sectional survey	Dental private practice, hospital and administration	Most dentists adopted wore FFP2/N95 masks, gloves, and protective glasses/visors (>75%). A total of 82.2% of the dentists reported using FFP2/FFP3 masks, while 16.9% used surgical masks and 0.9% used no masks. The routine use of FFP2/FFP3 masks was reported by 74.3% of dentists, while 19.4% used them only for aerosol generating procedures. In addition, number of patients limited,	In 1436 dentists 9.1% (n=130) were presumed to have COVID-19 infection based on self-reporting including testing (n=25) and agreed symptoms. Rate of infection was comparable to the Belgian population at that time. Several factors impacted the implementation of the recommended protective measures. Some parts of the protective measures protocol were clearly more difficult to apply. However, there was no indication of an increased disease transmission in the dental setting. No information about transmission.

						patients' health status checked, pre-procedural mouthwash, ventilation, surface cleaning.	
Conway 2021 [38]	https://journals.sagepub.com/doi/pdf/10.1177/00220345211004849	United Kingdom	Aug-Oct 2020	Observational surveillance study of patients	Various dental centres	Not stated, but Health Protection Scotland recommendations applied at the study period	Surveillance of asymptomatic dental patients found overall 22/4032 (0.5%; 95% CI, 0.5%–0.8%) tested positive for SARS-CoV-2. The positivity rate increased over the study period (0 for first 6 weeks to 0.7% in later 7 weeks), commensurate with uptick in community prevalence identified across all national testing monitoring data streams. Unable to report population prevalence. No information about transmission.
Egbunah 2021 [25]	https://www.npmj.org/article.asp?issn=1117-1936;year=2021;volume=28;issue=4;epage=247;epage=254;aulast=Egbunah	Nigeria	Oct 2020-Jan 2021	Cross-sectional survey	Dental education settings	General precautions such as hand washing, public health posters, distancing, use of 'facemask' described with low to moderate compliance with pre-treatment, during treatment and post-treatment guidance.	131 dental personnel, 6.1% self-reported being diagnosed with COVID-19 in 3 months to Jan 2021. No information about transmission.
Esquivel-Chirino 2021 [26]	https://www.mdpi.com/1648-9144/57/12/1353	Mexico	Jan 2020-Apr 2021	Surveillance study (retrospective)	HCW and non-HCW	Not stated	In the national epidemiological surveillance system, RT-PCR and antigen tests showed 2,329,534 cases of which 235,343 were HCWs. Of these 1.6% were dentists. Case numbers are reported. Concludes that there were no differences regarding new cases and deaths, the transmission rate, the epidemic curve, and the death rate between HCWs and non-healthcare workers. No information about transmission.

Estrich 2021 [27]	https://jdh.adha.org/content/jdenthyg/95/1/6.full.pdf	USA	Sep-Oct 2020	Cross-sectional survey	Dental hygienists	CDC interim guidance for PPE: eye protection and mask with N95 respirator for AGPs. 55.7% always followed CDC guidance	4776 dental hygienists self-report of positive COVID-19 test or probable case. 3.1% reported having ever been positive for COVID-19. No information about transmission.
Ferreira 2021 [28]	https://www.sciencedirect.com/science/article/pii/S020653921001015	Brazil	Jan-Oct 2020	Surveillance study	Dentists, oral health technicians/assistants	Not assessed but stated from another source that 95.5% of professionals reinforced their biosafety protocols (e.g. increased use of face shields, single use PPE, improved suction, pre-procedural mouth rinsing, rubber dam, time between appts).	Considering all types of tests, the proportions of positive results (laboratory confirmed) in the general population and oral health professionals were 33.85% and 21.67%, respectively. Age standardised incidence: General population 17.71/1000; oral health professionals 18.7/1000 i.e. similar but cumulative incidence was 5% higher in OHPs. No information about transmission.
Gallus 2021 [29]	https://www.mdpi.com/1660-4601/18/7/3711	Italy	May-Sept 2020	Cross-sectional survey and testing	Dental staff - public and private practice	Not stated	Rapid serological diagnostic test of 499 dental staff. Positives: Dentists 10.9%; technicians 13.0%, Hygienists 7.1%, Assistants/nurses 8.4% Admin 16.7%, students & others, 15.4%. Overall positive rate was similar to other HCWs in region. Clinical staff infections were not higher than admin staff.
Madathil [30]	https://jada.ada.org/article/S0002-8177(21)00658-9/fulltext	Canada	Jun 2020-Feb 2021	Prospective cohort study	Dental practice	Precautions were reported, including use of N95 or higher specification masks increased from approximately 40% to 60% during follow-up	644 dentists self-reported COVID-19 status. 6 positive cases during follow up, an incidence rate of 5.10/100000 person days (95% CI=1.86-9.91 /100000 person days). Incidence proportion was estimated at 1084 per 100,000 dentists (95%CI = 438-2011) while it was 1864 per 100,000 persons (95% CI = 1859 to 1868 per 100,000 persons) in the Canadian population during the same period. No information about transmission.
Magnusson	https://www.eurosurveillance	Norway	Feb-Dec 2020	Observational prospective	Norwegian population	Not reported	Within this population study, 3854 dentists were compared with other professions. 46 dentists tested COVID-19 positive during the study period, equivalent to 12/1000, compared 9/1000 in all working individuals age 20-

2021 [31]	nce.org/content/10.2807/1560-7917.ES.2021.26.40.2001875			e cohort surveillance study			70. Nurses, doctors and dentists had highest odds of confirmed COVID-19 during the first wave. This was not the case in second wave. No information about transmission.
Mksoud 2022 [32]	https://link.springer.com/article/10.1007/s00784-021-04363-z	Germany	Jan-Dec 2020	Cross sectional study	Private dental practice	FFP mask use increased through 2020 (quarter 2 48% to quarter 4 75%). Use of visors (60%) and goggles (80%) were unchanged. Other changes included reduced AGPs, more protective measures, increased ventilation, pre-treatment mouthwash, increased room size.	In 2784 individuals, prevalence of SARS-CoV-2 IgG antibodies was 5.2%. Combined laboratory and self-reported information 6.5% of participants were positive, which varied by region (2.2%-10.8%). Concluded that the risk of SARS-CoV-2 transmission was not higher among the dental team compared to the general population and proposed that dental teams are not at higher risk for patient-dentist transmission of SARS-COV when other studies are considered. Widespread use of PPE etc is likely to contribute to this. To information about transmission.
Molvik 2021 [33]	https://tidsskriftet.no/en/2021/02/originalartikkel/sars-cov-2-health-and-care-staff-norway-2020	Norway	Feb-Mar 2020	Observational prospective cohort surveillance study	Healthcare	Not stated	In 2941 dentists, PCR test reported incidence was 1.19%. In all HCWs this was 1.48%. Infection incidence in dentists are not the highest for HCWs and are similar to the estimated incidence for the Norwegian population at the time (1.11%). No information about transmission.

Natto 2021 [34]	https://www.dovepress.com/infection-control-practices-at-the-dental-clinics-in-jeddah-saudi-arab-peer-reviewed-fulltext-article-JMDH	Saudi Arabia	Nov-20	Cross-sectional survey	Dental clinics	Long appointments, patients' temperature checked, patients wear surgical mask and maintain 2m distance and use hand sanitiser. Most dental staff members used gloves 98.1%, gowns 96.2% and face masks 94.3%. No one reported using the N95 or FFP2/3 or equivalent mask.	1087 dental HCWs self-report of COVID-19 test (type not specified). Prevalence was highest amongst reception/security staff (18.7%) then nurses (14.3%) and dentists (11.8%) - overall ~13%. No information about transmission.
Saraputseva 2021 [35]	https://journals.sagepub.com/doi/full/10.1177/2380084421993099#:~:text=Conclusion%3A,dissipate%20aerosols%20into%20specialized%20areas.	Russian Federation	May-Aug 2020	Retrospective cohort study	Private and public dental clinics	Social distancing, 2-step patient management (remote and face-to-face). Patients wore surgical mask, hands disinfected, body temperature recorded. Staff were to wear PPE medical suit, surgical gown and cap, N95/FFP2 respirator, face shield or safety glasses, disposable gloves, socks, waterproof show covers, disposable towels. and performed	157 dentist and dental assistants were tested weekly for antibodies to SARS-CoV-2. Estimated prevalence of COVID-19 infection was 11.5% (n=19), which is higher than the general population (7.4-9.3%). Regional or temporal differences might account for this. The number of SARS-CoV-2 infections was significantly higher in the clinic without aspirator HEPA filtration/external evacuation. No information about transmission.

						hand hygiene. Compliance with precautions was not reported.	
Shields 2021 [36]	https://journals.sagepub.com/doi/pdf/10.1177/00220345211020270	UK	Jun 2020-Feb 21	Longitudinal seroprevalence analysis	General dental practice	Standard PPE until June 2020. Enhanced PPE as per IPC guidance on reopening.	1507 dental care professionals' baseline seroprevalence in June 2020 was 16.3%, compared to estimates in the regional population of 6% to 7%. Investigated persistence of seropositivity and susceptibility to infection. No information about transmission.
Zhang 2021 [37]	https://link.springer.com/article/10.1007/s00784-021-03886-9	China	Jan-Apr 2020	Retrospective cohort study	Dental hospital	Patient triage questioning and temperature monitoring. Details of recommended peri- and pre-operative preventive procedures for various clinical situations are provided but compliance with these is not reported.	757 staff had SARS-CoV-2 RT-PCR detection and serological testing. All staff were negative for both (in 28-29 April 2020), suggesting that the prevention strategy was effective. No information about transmission.

Abbreviations used in Table 1: AGP, Aerosol Generating Procedure; CDC, Centers for Disease Control and Prevention; FFP, Filtering Facepiece; HCW, Healthcare Worker; IPC, Infection Prevention and Control; PCR, Polymerase Chain Reaction; RT-PCR, Reverse Transcriptase PCR; PPE, Personal Protective Equipment

Appendix 1: Literature database search terms

MEDLINE (Ovid platform) Search strategy

- 1 exp Incidence/
- 2 Incidence.mp.
- 3 exp Prevalence/
- 4 Prevalence.mp.
- 5 Seroprevalence.mp.
- 6 exp Epidemiologic Studies/
- 7 exp Epidimiology/
- 8 Epidimiolog\$.mp.
- 9 or/1-8
- 10 Infection.mp.
- 11 Transmission.mp.
- 12 Exposure.mp.
- 13 Risk.mp.
- 14 Spread.mp.
- 15 or/10-14
- 16 exp Dentists/
- 17 exp Dental Care/
- 18 Infection Control, Dental/
- 19 exp Dentistry/
- 20 Dental Hygienists/
- 21 Dental Facilities/
- 22 Dental Staff/
- 23 Dental.mp.
- 24 Dentist\$.mp.
- 25 Hygienist\$.mp.
- 26 or/16-25
- 27 COVID-19/
- 28 SARS-CoV-2/
- 29 Covid-19.mp.
- 30 SARS-CoV-2.mp.
- 31 or/27-30
- 32 9 and 15 and 26 and 31

EMBASE (Ovid platform) Search strategy

- 1 exp Incidence/
- 2 Incidence.mp.
- 3 exp Prevalence/
- 4 Prevalence.mp.
- 5 Seroprevalence.mp.
- 6 exp Epidimiology/
- 7 Epidemiolog\$.mp.
- 8 or/1-7
- 9 Infection.mp.
- 10 Transmission.mp.
- 11 Exposure.mp.
- 12 Risk.mp.
- 13 Spread.mp.
- 14 or/9-13
- 15 exp dentist/
- 16 exp dental procedure/
- 17 exp dentistry/
- 18 exp dental hygienist/
- 19 exp dental assistant/
- 20 dental facility/
- 21 Dental.mp.
- 22 Dentist\$.mp.
- 23 dental staff/
- 24 or/15-23
- 25 coronavirus disease 2019/
- 26 Severe acute respiratory syndrome
coronavirus 2/
- 27 COVID-19.mp.
- 28 SARS-CoV-2.mp.
- 29 or/25-28
- 30 8 and 14 and 24 and 29

medRxiv Search strategy

"(covid OR sars) AND (dentist* OR dental) AND (incidence OR prevalence OR seroprevalence OR epidemiolog*) AND (transmission OR exposure OR risk OR spread OR infection)"

WHO COVID-19 Global Literature Database Search strategy

(dentist* OR dental) AND (incidence OR prevalence OR seroprevalence OR epidemiolog*) AND (transmission OR exposure OR spread)

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