

Monkeypox resurgence and its implications for Dentistry – A scoping review

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ABSTRACT

Introduction: Monkeypox caused by the Monkeypox virus, a member of the Orthopoxvirus genus, is currently considered a major concern among healthcare authorities due to its high transmissibility rate. Currently, no specific treatment is available for this disease, due to which healthcare professionals, specifically Dentists, are required to look out for symptoms at early stages to prevent its spread.

Objective: To analyze the role of dentists in identifying Monkeypox cases and limiting its spread.

Methods: We conducted a scoping review on monkeypox and its oral manifestation. PRISMA protocols were observed in data collection. The relevant literature search was conducted in relevant databases like PubMed, Scopus, Web of Science, Embase, CINAHL, and Google Scholar. Relevant articles related to Monkeypox, and Dentistry were included in the final review. Articles published from March 2022- September 2022 were included in the review. Keywords and Mesh words related to monkeypox, and dentistry were used as part of the search strategy.

Results: A total of 1881 articles were reviewed, among which 7 articles were included. Dentists were strongly advised to be on high alert for Monkeypox symptoms due to their close contact with patients. Around 70% of Monkeypox cases reported oral lesions at early stages, which requires a differential diagnosis from other oral lesions. Considering this, dentists should be well-versed in this new and emerging threat.

Conclusion: Although dentists have been shown to play an important role in the treatment of monkeypox, there is insufficient data available. More research on dentistry and monkeypox will be needed in the near future.

INTRODUCTION

Monkeypox (MPV) is a highly contagious viral disease caused by the Monkeypox virus (MPXV) first reported in the 1970s in humans (1). Monkeypox virus belongs to the Poxviridae family, under the subfamily of Chordopoxvirinae and Orthopoxvirus genus, which primarily causes Monkeypox disease in rodents and can transmit to humans (2). Monkeypox can transmit to humans directly from infected humans or animals or indirectly from contaminated objects (2). Human-to-human transmission of smallpox is via direct contact with infectious respiratory droplets, skin lesions, bodily fluids, or contaminated objects (3). The first human case of monkeypox was identified in the Democratic Republic of Congo in 1970. Since then, isolated outbreaks of the disease have been reported in African countries, with occasional cases limited to endemic areas and travel history to such places leading to the spread of the virus in non-endemic regions (4). The 2022 outbreak of MPV in multiple countries across the globe without specific travel history has led to major concerns among health authorities. The WHO declared a Public Health Emergency of International concern in response to the current situation of Monkeypox on July 23, 2022 (5). As per the WHO reports more than 50,000 people have been infected, among which 16 deaths have been reported. The epidemic exhibits a low fatality rate of 3% to 6%. However, it has been declared highly contagious (6). The virus can be transmitted through respiratory secretions, infected skin lesions and contaminated materials. Close association with the smallpox virus (variola virus) is usually reported with an incubation period of 6 to 13 days (7). Clinically fever and lymphadenopathy followed by a rash appearance is seen in patients infected with the Monkeypox virus. The rash usually appears on the face, followed by the lower extremities, and is reported to be self-limiting (8). Oral lesions are also reported in patients infected with the Monkeypox virus; however, limited data is available. As per previous data reported smallpox vaccine provides 85% protection against Monkeypox. However, following the eradication of smallpox, the use of the vaccine is no longer indicated (9).

The global outbreak of Monkeypox and the limited supply of vaccination warrants healthcare professionals, especially dental professionals, to play a significant role in the early diagnosis of the disease because of the nature of the work, thereby limiting the spread of this virus. Given the complexity of clinical dental practice, which demands extended contact with the patient's mouth while working, leading to substantial propagation of respiratory droplets, the higher risk of disease transmission in dental settings should not be disregarded. Furthermore, dentists can play a vital role in assisting public health surveillance by early detection of intraoral symptoms of infectious diseases, such as smallpox and Monkeypox. According to reports from the 1972 smallpox outbreak in Yugoslavia, oral mucosal ulceration, tongue enlargement, and bleeding were identified as early oral manifestations 24 hours before the fever (10). However, the limited availability of data regarding oral manifestations has led to a major challenge for dentists to clinically diagnose and differentiate MPV lesions from other oral lesions. If Monkeypox becomes a pandemic, dental practitioners may be faced with ambiguity and may be compelled to rely on a broad knowledge of Monkeypox transmission channels and other guidelines followed by essential frontline workers to prevent disease transmission among themselves and the patients. Its inception in the COVID-19 period has heightened the threshold for adopting extra precautions in addition to universal infection control basic precautions.

Keeping in view the complex nature of the disease, lack of knowledge and possible harbour in dental settings, this scoping review was conducted to identify the oral manifestations of monkeypox and explore the role of dentists in minimizing its spread in their daily practice.

METHODOLOGY

DOCUMENT SEARCH

This systemic review was performed using the PRISMA statement (11). Two independent reviewers searched through the titles and abstracts of all identified papers to check for relevant articles that matched the predefined inclusion criteria (Table 1). The search databases included Scopus, Web of Sciences, PubMed, CINAHL, Embase, and Google Scholar until September 30, 2022, to identify relevant papers addressing the subject under consideration. The mesh terms searched included (Dental or Oral or Mouth or Dentistry and Oral Manifestation or Oral Ulcers) And (Monkeypox). The last date for the search was September 30 2022. For systemic analysis, PRISMA literature quest guidelines were followed. By reviewing the abstracts of relevant publications, the researchers thoroughly assessed all articles depending on the intended outcome(s). Full texts were reviewed if there was insufficient evidence to make a clear judgement based on the inclusion criteria. The relevant studies discussing Monkeypox, and dental practice implications were identified using a logical and organized approach to the literature search. We also contacted experts to identify any missing studies and settled any possible differences through third-review author negotiation.

Inclusion Criteria	Exclusion Criteria
English language only	Language other than English
Peer-reviewed and indexed journals	Articles published in non-indexed journals.
All studies related to oral manifestation and monkeypox were eligible for consideration	All studies with insufficient data related to oral manifestation were excluded from the analysis.

Table 1: Inclusion and Exclusion Criteria

The specifications used by the reviewers were: English language, at least a keyword matching title/abstract, and studies based on clinical trial assessment. Furthermore, any books or online materials relevant to the subject were identified and reviewed. A researcher (Dr RA) conducted a secondary analysis utilizing a traditional technique that included reviewing the title and abstract of the publication and choosing fewer than 10% of the papers discovered. The literature on dental implications of Monkeypox or oral symptoms of Monkeypox was limited, with the majority of papers concentrating on non-oral manifestations of Monkeypox. We also followed PRISMA 2009 (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) for the research selection criteria and search strategy processes (Prisma flowchart Figure 1) (11). The number of non-English research was insignificant, and language limitation does not result in systematic bias according to a systematic review. Finally, publications with the terms Dental or Oral or

Mouth or Dentistry and Oral Manifestation or Oral Ulcers) And (Monkeypox in the title and/or keywords were excluded.

Source of Data

The following keywords were used in a sequencing literature search on the PUBMED, Google Scholar, and CINAHL databases: "Monkeypox" (n = 1850), "Monkeypox and dentistry" (n = 13), "Monkeypox and oral manifestation" (n = 14), and "dental practice and Monkeypox" (n = 4). Due to the diverse and emerging nature of the topic related to oral health manifestation of Monkeypox, we only included publications from peer-reviewed journals for final evaluation to give the greatest level of evidence to dental practitioners. We collected a significant number of research articles which may serve as a foundation for implementing safe practices in a dental setting. The retrieved references were organized using Endnote 8.0. The preponderance of the study articles included in the final sample were reviews, editorials, and discussions primarily based on case reports; however, some reviews were included due to limited data on the topic and for adequate scientific evaluation, one may assess other supplementary or systematic reviews.

Quality Assessment

Study & Year	Selection					Comparability		Outcome			Overall Score (*)	
	1	2	3	4	5	6	7	8	9	10		
Scott M. et al	*	*		*		*			*	*	*	7
Català A et al	*	*			*	*		*	*	*		7
Kaur A et al	*	*	*	*	*	*		*	*	*		9

Table 2. Newcastle-Ottawa scale Quality assessment form for Non-Randomized Studies included in the review.

Quality of studies - Poor (0-4*), Moderate (5-6*) Good (7-9*)

Quality of studies—Poor (0-4*), Moderate (5-6*) Good (7-9*); * Category Scoring criteria Selection—Representativeness of exposed group (Maximum score: 5 stars) low selection bias (1 star)—acknowledged selection bias (1 star)—Highly selected group (0 stars)—No description (0 stars) Selection of non-exposed group (maximum 1 star)—Same source population as exposed group (1 star)—Drawn from different source (0 stars)—No description (0 stars) Ascertainment of exposure (maximum 1 star)—Secure record (e.g., pathological record) (1 star)—Structured interview (1 star)—Written self-report (0 stars)—No description (0 stars) outcome demonstrably absent at baseline (maximum 1 star)—Yes (2 Star) No (0 star); Comparability—Maximum 2 stars—Comparability of cohorts, controlling for confounders (Maximum score: 2 stars)—Controls for key confounders (e.g., Gleason grade) (1 star)—Controls for related factors (1 star)—Cohorts incomparable, confounders uncontrolled (0 stars); Outcome assessment (Maximum score: 3 stars)—Large studies/panels—secured records or directly measured (1 star)—self reported information (0 star), single target/objective (0 star). Adjusted for missing data of follow-up (1 star). No follow-up or statement about missing data (0 Star). Clear specification of outcomes (Yes—1 star, No—0 stars).

RESULT

SEARCH OUTCOMES

Figure 1 below shows the results of this study. A sum of 1881 articles were obtained from various databases, among which 360 articles were removed due to duplicates. Seven articles were considered for eligibility after the removal of 3 irrelevant articles.

STUDY CHARACTERISTICS

Table 3 summarizes 10 included studies after assessment. All studies were in the English language. Among these were review articles, case reports and editorials.

Three of the articles were review articles (12-14), four of the articles were editorial (15-18), two were cross-sectional studies (19, 20), and one case report was included (21). A review article published in July 2022 reported reemerging of the Monkeypox virus with 22000 cases throughout the world. Initial signs and symptoms of the virus were reported in the oral cavity; however, the disease has a low mortality rate and is also self-limiting (12). Another review article also emphasized oral lesions that were initially found on the tongue and were called enanthems. No specific treatment for this virus has been reported to date, and only supportive treatment is indicated (13). Lastly, a review by IA maroon A et al. emphasized the early onset of oral lesions such as angular cheilitis, ulcers and pharyngitis compared to skin lesions (14). An editorial letter was also reported, emphasizing the initiation of oral lesions as an early sign of the Monkeypox virus (15). Another letter to the editors revealed circumscribed lesions, ulcers and enanthema in a majority of the cases (16-18). A case report was also considered, highlighting the oral lesions in Monkeypox cases and urging dentists to consider monkeypox in differential diagnosis with other oral lesions. This would help in early disease management, as per the report (21). A cross-sectional study carried out in Spain also reported 185 cases of the Monkeypox virus. The study emphasized oral manifestations in the viral disease and reported that such patients were infected with sexually transmitted diseases (19). In another cross-sectional study, dentists' knowledge regarding monkeypox was evaluated in which Only 31.2% of dentists were aware of the oral signs of the condition. Only 28% of people claimed to have a high degree of competence (20).

Title article	Authors	Date of publication	Type of Study	Sample size/ Target Population	Result	Conclusion
The Monkeypox outbreak and Implications for Dental practice (12)	Lakshman Samaranayake, Sukumaran Anil	July 13 2022	Concise Review	-	MPX has reemerged with 22000 case reports to date. (as of July 2022). Initial signs of MPX appear during the prodromal period in the oral cavity as single or multiple macular lesions on the oral mucosa, accompanied by generalized lymphadenopathy. Followed by a characteristic rash that appears on the skin. MPX is a self-limiting disease with very low mortality.	MPX is a significantly travel-related disease. Dentists should be able to diagnose premonitory signs in the oral cavity, thus preventing the further spread of disease. Implementing standards, contact, and droplet infection control measures, patient isolation, and referral are important, particularly during a local outbreak.

Title article	Authors	Date of publication	Type of Study	Sample size/ Target Population	Result	Conclusion
Oral Manifestations of Monkeypox: A Report of 2 Cases (21)	Scott M. Peters, DDS, Nicholas B. Hill, DDS, and Steven Halepas, DMD,	July 27 2022	Case Report	2 Cases	Both patients initially reported oral lesions followed by skin rash development. Oral lesions were found at the midline aspect of the tongue. Constitutional symptoms of fever, fatigue, and soreness prior to the onset of the oral lesions were also seen.	Oral manifestations of MPX are less frequently reported but play a role in the diagnosis and management of this condition. It should be considered in the differential diagnosis of acute onset oral ulcerations, especially in patients who are at higher risk for developing this condition.
Monkeypox outbreak in Spain: clinical and epidemiological findings in a prospective cross-sectional study of 185 cases (19)	Catalá A et al	July 22 2022	Cross sectional study	185	initial lesions present as chancriform ulcers leading to oral ulcers (5%), proctitis (22%) and tonsillar ulcers. Mucosal lesions seen as whitlows and single lesions.	The findings in this outbreak differ from previous findings and highly suggest contact transmission and initiation at the entry site. The characterization of the epidemiology of this outbreak has implications for control
Monkeypox: A Comprehensive Review of Transmission, Pathogenesis, and Manifestation (13)	Jasdeep Kaler, Azhar Hussain, Gina Flores , Shehreen Kheiri , Dara Desostiers	March 07 2022	Review Article	-	Initial lesions appear on the tongue and mouth called enanthem	Currently, there is no treatment indicated for infected individuals. However, supportive treatments can be administered to provide symptom relief to individuals; Medications such as tecovirimat may be administered in very severe cases. These treatments are subjective, as there are no exact guidelines for symptom relief.
Identifying monkeypox: do dental professionals have adequate knowledge and awareness? (20)	Kaur A et al	2022	Cross-sectional Study	410	Monkeypox disease was unknown to 24.8% of dental health care practitioners. Only 31.2% of dentists were aware of the disease's oral symptoms. Only 28% of individuals reported having a high level of expertise. Higher levels of knowledge were shown to be substantially connected to the education level and occupational profile of study subjects.	There is an imperative need for dental practitioners to be up to accelerate on the latest information on new developing infectious illnesses.
Oral Manifestations of Monkeypox: Brief review (14)	Iamaroon A et al	2022	Review	-	The oral mucosa is frequently affected, and oral lesions may appear before the rash extends to the face and other regions of the body. Monkeypox is diagnosed primarily by clinical manifestations and laboratory tests.	Oral symptoms may arise earlier to skin eruptions, implying that dentists and dental professionals should be fully informed about the disease's nature.

Title article	Authors	Date of publication	Type of Study	Sample size/ Target Population	Result	Conclusion
The Emerging Monkeypox Outbreak: A Cause for Concern Among Craniofacial Surgeons (15)	Dar-Odeh N et al	2022	Editorial	-	The vascular and pustular rash has been reported to affect the oral cavity within the craniofacial area. Mastication and swallowing difficulties are frequently related to oral lesions. Furthermore, typical lymphadenopathy might be seen in the submandibular lymph nodes.	Since lesions arise in the maxillofacial region, oral surgeons should be knowledgeable about the epidemiological implications of monkeypox.
Monkeypox infection: Relevance of oral health screening (16)	Aishwarya Pandey, Gowtham Reddy Nomula	2022	Letter To The Editor	-	Initial deeply embedded, well-circumscribed lesions reported in the oral cavity	A dentist may encounter enlarged lymph nodes and oral manifestations that may include an erythematous tongue or oral ulcers, and peri-oral lesions. This will not only help in an early diagnosis but would also aid in providing better palliative care.
Monkeypox related oral manifestations and implications: Should dentists keep an eye out (17)	Abanoub Riad, Sameh Attia	2022	Letter To The Editor	-	Enanthema were reported in more than 70% of cases with a high probability among unvaccinated patients against smallpox (73% vs. 37%, respectively; $p < 0.001$) and among primary cases infected by animals than secondary cases infected by humans (74.8% vs. 56.2%, respectively; $p < 0.001$).	Dentists should be well aware of transmission risk through respiratory droplets and the postexposure procedures they have to follow.
Mouth sores and Monkeypox: A consideration (18)	Pathum Sookaromdee* Viroj Wiwanitkit	2022	Letter to the Editor	-	Ulcers reported in the oral cavity, tongue and oropharynx	The initial sign could be only a mouth sore, which may be the first indication of monkeypox. All patients with unexplained mouth sores deserve the finest diagnostic and therapeutic approaches

Table 3: Characteristics of studies involved in analysis.

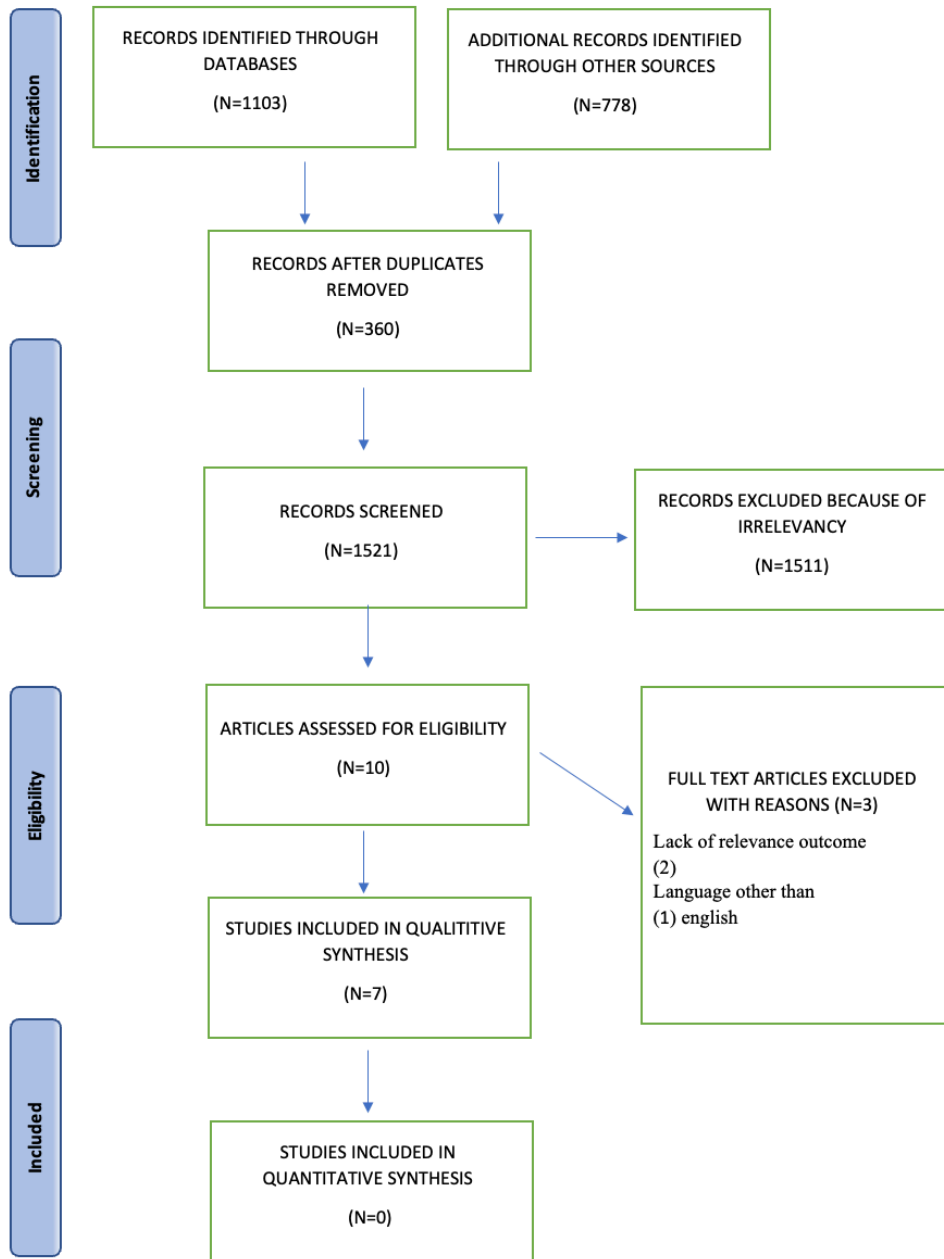


Figure 1: PRISMA

DISCUSSION

Monkeypox and Oral Manifestation

Outbreak of Monkeypox has resulted in a cause of concern across the globe. High transmissibility and lack of treatment availability have led to health organizations worrying about managing its spread (22). This review article was written to emphasize the dentists' role in preventing the spread of monkeypox and managing it at its early stages. As per the literature review with regard to oral manifestations in monkeypox, multiple pieces of research were found that reported early lesions in the oral cavity due to

monkeypox prior to actual disease onset. The characteristic acute febrile illness with skin lesions is also a characteristic clinical manifestation. All patients with unexplained mouth sores deserve the finest diagnostic and therapeutic approaches.

With reported cases of Monkeypox around the world and multiple types of research published in this regard, unfortunately, only a few articles related to oral manifestations and knowledge among dentists regarding Monkeypox were found. This has led to a lack of data availability for dentists with regard to this viral disease and their role in preventing its spread leading to an excessive load on healthcare departments. In general, Monkeypox poses minimal risk to dental practitioners, even though the present outbreak is undoubtedly essential for public health (23). Despite this, a considerable part of the population accesses dental services, and it is probable that some Monkeypox patients will pursue dental care during high community transmission. As a result, it is critical that dental practitioners comprehend the condition and its clinical manifestations. Patients who arrive with an inexplicable rash on any area of their body as well as one or more Monkeypox-like symptoms, should prompt dental providers to investigate MPXV as a potential culprit. In the instance of suspected Monkeypox, the patient should be given a surgical mask and sent home to quarantine and await further instructions (24). The dental practitioner should next seek advice from their local health protection team.

Although it is improbable that dental practitioners may interact with a Monkeypox patient in the dental environment, either consciously or unwittingly, the significant peril of transmission would be through direct contact with skin lesions or clothing that has come into contact with lesions. As a result, basic infection prevention and control (IPC) procedures, such as the usage of gloves, gowns, face masks, and protective eyewear as needed, would safeguard against contact transmission (25). There isn't enough evidence yet to confirm or deny airborne transmission as a key transmission route. However, because droplet transmission is known to occur, using high-speed handpieces and ultrasonic instruments increases the likelihood of transmission. In patients with potential, suspected, or confirmed Monkeypox, any elective dental treatment should be postponed until the monkeypox is eliminated or the patient is no longer contagious.

Recommendations for Dental Settings

During dental treatments, adequate operatory disinfection and preparation, hand hygiene, use of pre-procedural antimicrobial oral rinse, use of rubber dam and high volume evacuators, single visit treatment and limiting aerosol-generating procedures, and proper sterilization and disinfection (26). Conventional contact and droplet infection control procedures can be used to treat patients with Monkeypox symptoms to avoid transmission in dental care settings (27). Furthermore, due to the possibility of airborne transmission, airborne measures should be taken, and accompanying dental personnel should wear N95 masks. Treatment should be provided in isolation to prevent exposure to dental personnel and other patients.

Conclusion

MPX has been reported outside disease-endemic regions, suggesting the highly contagious nature of the disease and human-human transmissibility. Healthcare professionals, including dental professionals, should be vigilant and well-informed to avoid its dissemination. Indeed, the method by which MPXV has appeared in numerous countries simultaneously is quite intriguing, but the current outbreak is of great importance.

Understanding risk factors, routes of transmission, and clinical presentation along with oral manifestations of the monkeypox disease may help dentists and other dental professionals prevent the spread of the disease during the outbreak.

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