What does teledentistry mean? Mapping of current definitions

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Abstract

Access to timely oral healthcare services is paramount for any oral healthcare system, as good oral health contributes to overall quality of life and wellbeing. Despite several initiatives' efforts, there are still persistent deficiencies in accessing oral healthcare. As a result, teledentistry is recognized as a promising and cost-effective intervention to reduce oral health inequalities, enhance patients' outcomes and experiences, improve oral healthcare providers' wellbeing, reduce costs, and contribute to environmental sustainability in dentistry. However, there is confusion in its terminology with many interchangeably used terms referring to this concept. Therefore, based on our research on systematic reviews on teledentistry, we define teledentistry as the use of technology for remote oral healthcare delivery between patients and oral healthcare providers or between healthcare providers. Its goals are to facilitate access to care, reduce oral health inequalities, mitigate the economic impact of oral diseases and treatment, and foster interprofessional collaboration.

Background

Teledentistry stands out as one of the most important innovations in oral healthcare, not only from a technological perspective but also from a cultural and social point of view. Originating from the concept of dental informatics during the 1990s, it was defined as "the practice of using telecommunication technology to make a diagnosis and subsequently provide advice on treatment over a distance."[1] Teledentistry includes two forms of modalities such as the "real-time consultation" and the "store and forwarding" method.[2] Its applications can overcome the socio-demographic and economic challenges such as the ageing population, mobility of citizens, people with special needs, and living in rural, remote, and urban areas by improving access to care, reducing costs, hereby achieving equity and environmental sustainability.[3–6]

In the initial years following the introduction of teledentistry, its implementation was slow and mainly perceived for individuals living in remote and rural regions. However, the COVID-19 pandemic catalyzed the interest and transition toward digital healthcare, where teledentistry was suggested as a necessity to improve the continuity of healthcare anywhere.[7] Since then, publications on teledentistry have risen at an exponential rate.[8] However, this concept remains inconsistently used in the literature with ambiguity regarding its definition, resulting in confusion and challenges to its understanding and communication between various stakeholders.

This inconsistency has been driven by the different purposes (all legitimate) that various stakeholders within care systems attribute to this term. For example, it can be driven by differing points of view (e.g. clinical vs. managerial; professional vs. patient; general vs. specialist; public health, clinician). Teledentistry has been defined in different ways, with a recent study highlighting the critical role that the distance plays between the stakeholders involved.[9]

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Thus, the purpose of this study is to bring clarity to the meaning of teledentistry using the definitions introduced by various authors of systematic reviews on teledentistry. It aims to provide a comprehensive definition of teledentistry to foster effective communication among interested stakeholders and facilitate its implementation for improved access to oral healthcare. A better understanding of the meaning and perspectives of teledentistry could impact its use in research, policy, and practice.

Methods

This short communication is part of a comprehensive overview of systematic reviews on the access to, and the quality of care with teledentistry.[10,11] The search strategy was developed with the support of a librarian and was conducted from the inception of the databases until March 2024. It has been conducted in eight electronic databases such as MEDLINE (Ovid), Embase, CINAHL (EBSCO), Web of Science, The Cochrane Library, Epistemonikos, Academic Search Premier (EBSCO), and Proquest Dissertations & Theses. Teledentistry was considered as encompassing both modalities, along with mHealth, as its subset.[12] There were no restrictions on language or publication date. However, we excluded systematic reviews (SRs) which did not perform formal methodological quality or risk of bias assessment, or those that did not conduct the search strategy in at least two databases.[13–15] Two independent reviewers performed study selection, data extraction, and data synthesis. Any discrepancy throughout the process was resolved by discussion or consultation with a third reviewer.

Results

The overview included 30 systematic reviews that met the eligibility criteria (Table 1).[3,4,16–43] Among them, only 21 SRs (70%),[3,16–26,28,30,31,34,37,41–44] provided definitions of teledentistry, whereas 6 SRs,[4,27,35,36,39,40] emphasized the goals of teledentistry and 3 SRs did not define teledentistry.[32,33,38] Overall, teledentistry was used as an umbrella term for the delivery of oral healthcare using digital technologies. The terms referring to teledentistry included remote oral healthcare, mHealth, e-oral healthcare, telehealth, or telemedicine in dentistry, and just as telemedicine. Among the 21 SRs, 9 SRs (43%),[16,17,19,21,22,25,29,34,41] referred to teledentistry like telemedicine or a subset or extension of telemedicine. Five SRs (24%) defined mHealth,[18,20,27,42,43] among which four SRs,[18,20,27,43] cited the World Health Organization's definitions of mHealth. One SR[45] referenced Eysenbach's definition of eHealth.[3] Other SRs described teledentistry as an integration of communication technology (ICT) and dentistry,[16,25,27,30,44] or a combination of clinical processes, organizational arrangements, and digital technologies.[16] Several SRs referred to teledentistry using the words "remote/distance/at the globe/without in-person/online space."[17,19,21–23,28,31,34,37,43,44] Among these, the concept of "remote" was commonly cited.[19,22,23,28,31,34,37] The term "technology" was explicitly mentioned by various authors in their definitions of teledentistry.[3,16,17,21–25,27,28,30,31,34,37,41,42,44]

Some digital devices were reported such as information and communication technologies,[16,25,27,30,44] digital technology, electronic dental records,[16] store-and-forward technology,[25] dental photography,[25] and audio and videoconferencing technologies.[37] In addition, the authors indicated the tools used such as fax, scanners,[41] and digital imaging tools.[16,37] Some definitions highlighted the process of care and the outcomes. The applications of teledentistry included oral healthcare delivery, specialist consultations, education, management, treatment planning, and diagnosis.[16,19,21,23,24] The relationships between people involved in these clinical interactions were addressed in a few SRs, which mentioned the interactions between patients and healthcare providers,[22] only between healthcare providers[17] or including both.[28,29] The reported goals of teledentistry were to facilitate access to dental care and reduce time, travel, loss of productivity, costs and inequalities in dental care access.[23,30,31,44] Reflecting on the variations among the definitions and perspectives, it is evident that teledentistry can be used in different contexts and has many purposes for oral healthcare (clinical and public health). As a result, teledentistry should not be solely regarded as a means to managing oral health diseases since its principles extend to the wider definition of promoting health and wellbeing.[17]

Discussion

The purpose of this study was to provide a comprehensive definition of teledentistry to foster effective communication between interested stakeholders to improve its use in research, policy, and practice. Our research provides a thorough and timeless analysis of the definitions of teledentistry to capture the full range of meanings and interpretations. As the understanding of teledentistry continues to evolve and be debated, these compilations of definitions serve to broaden the researchers' perspectives. Drawing on the definitions included in our overview of SRs,[7] we define teledentistry as "the use of technology and various devices (e.g. video, audio, secure message) for remote oral healthcare delivery between patients and oral healthcare providers or between healthcare providers, aiming to facilitate access to care, reduce oral health inequalities, mitigate the economic impact of oral diseases and treatment, and foster interprofessional collaboration." This definition presents teledentistry as a comprehensive approach to oral healthcare delivery, encompassing four fundamental components: (i) separated location between stakeholders

Table 1. Characteristics of included systematic reviews and their definitions about teledentistry.

First author	Years of publication	Country of publication	Definitions about teledentistry
Abdul	2023	Saudia Arabia	Telemedicine, also known as telehealth, involves the use of technology to deliver healthcare services remotely. It is used to improve access to care and save money for patients and caregivers. Telemedicine, which involves the use of technology to deliver healthcare services remotely, has the potential to improve access to care, reduce costs and improve patient outcomes, as evident by the observations of our review
Alabdullah	2018	United States of America	Teledentistry, a branch of telemedicine, is defined as using telecommunication technology, electronic medical records, video, and digital images to facilitate dental services delivery for distant or isolated people or for consultations among specialists. Teledentistry does not only encompass technology or a varied set of related forms of technologies but is also a collection of clinical processes and organizational arrangements combined with technologies
Aquilanti	2020	Italy	Teledentistry, defined as the use of health information technology and telecommunications for oral care, was addressed to have the potential to identify high-risk populations; facilitate patient access to dental care; and reduce waiting lists, unnecessary travel, loss of productivity, and also inequalities in dental care access and costs for national health systems
Chau	2023	China	Mobile health or mHealth is defined by the World Health Organization (WHO) as "the use of mobile devices (mobile phones, patient monitoring devices, and personal digital assistants) for medical and public health practice." ...The application of mobile electronic devices may allow dentists to provide remote clinical instructions and support oral health behavior change
Choi	2020	South Korea	Mobile healthcare is defined as a "medical and public health practice supported by mobile devices such as mobile phones, patient-monitoring devices, personal digital assistants, and other wireless devices ... Mobile device refers to devices that are intended to be carried on the person (phone, smartphone). Active reminders in any form or media aimed at changing oral health status, including text messages, mobile phone applications
da Costa	2020	Brazil	Teledentistry (TD) is a new branch of telemedicine that is dedicated to dentistry. It makes use of Information and Communication Technologies (ICTs), especially of the internet, to exchange clinical information and associated images to provide consultation services among professionals and health care provider over long distances
da Silva	2021	Brazil	Teledentistry (a subunit of telehealth along with telemedicine) is the remote facilitating of dental care, guidance, education, or treatment via the use of information technology rather than through direct face-to-face contact with any patient. Over the years, teledentisty has proved to be beneficial for remote dental screening, making diagnosis, providing consultation, and proposing treatment plan
De lima	2024	Brazil	m-Health consists of a mobile technology tool with the purpose of providing or supporting remote care to improve the health of the population. Mobile technology tools can contribute to the early diagnosis of oral cancer or potentially malignant diseases at the primary care level, facilitating communication between specialists and professionals at that care level
Emami	2022	Canada	Eysenbach's definition, "E-Health is an emerging field in the intersection of

Table 1. Continued.

First author	Years of publication	Country of publication	Definitions about teledentistry
			medical informatics, public health and business, referring to health services and information delivered or enhanced through the internet and other related technologies."
Estai	2016	Australia	Teledentistry is a new field of telemedicine which results from the incorporation of information and communication technology and dentistry. Teledentistry incorporates a store-and-forward technology and dental photography into oral care services, where clinical data (e.g. radiographs and photographs) can be acquired by oral health professionals and then stored and forwarded for later evaluation by dental experts
Estai	2018	Australia	Teledentistry is a domain of telemedicine that is specifically dedicated to dentistry, and it emerged from the combination of digital and telecommunication technology and dentistry. Teledentistry is an innovative method of oral health service delivery that can connect dental practitioners and patients with a dental consultant anywhere on the globe
Flores	2020	Brazil	Teledentistry can be generically described as the use of information technology in dental practice, education, research, and management. It has provided access to dental care in rural and geographically disadvantaged areas
Fortich Mesa	2020	Colombia	Similarly, in dentistry, an innovative method called teledentistry has been developed, providing clinical care through electronic dental records and remote ICTs as an opportunity to raise awareness, promote education and provide patients with professional services
Lin	2022	Malaysia	Teledentistry, like telemedicine, is the distant or remote delivery of dental care, counseling, education, or treatment using digital technologies rather than physical face-to-face interaction with patients. Telediagnosis, teleconsultation, teletriage, electronic patient records and referrals, and telemonitoring are just a few of the main modalities in modern dentistry practice
Priyank	2023	India	Teledentistry has recently emerged as a promising method for overcoming the difficulties involved with conventional dental examinations due to developments in communication technologies. Teledentistry involves the remote delivery of oral healthcare services using telecommunications and digital imaging tools. Teledentistry is a relatively recent advancement that leverages various forms of technology, including video conferencing, digital imaging, mobile health applications, and other remote communication tools. It allows dental professionals to interact with patients, diagnose oral health issues, provide consultations, and offer treatment recommendations, all without the need for an in-person visit. This innovative approach allows for the evaluation, diagnosis, and management of oral health conditions, including dental caries, without the need for in-person visits
Rouanet	2022	France	...Type of remote medical practice wherein between a patient and a healthcare provider (telemonitoring or teleconsultation) or several HCP (using digital technologies)
Saccomanno	2022	Italy	Teledentistry is, in fact, a specialized extension of telemedicine that was first developed at the military level and subsequently found application mainly in the management of patients living in remote rural areas whose movements need to be limited to those necessary for reasons of greater fragility—for

Table 1. Continued.

First author	Years of publication	Country of publication	Definitions about teledentistry
			example, in the case of cancer patients…telemedicine is a set of technologies, especially ICT, specifically aimed at providing healthcare services from a distance to lessen the need for contact between the patient and the healthcare provider
Toniazzo	2018	Brazil	The use of mobile technologies … has been defined by the World Health Organization (WHO, 2011) as "a medical and public health practice supported by mobile devices such as mobile phones, patient monitoring devices, personal digital assistants and other wireless devices"
Troconis	2018	Colombia	Like Telemedicine, teledentistry is an alternative service model that integrates dentistry and technological tools such as internet services, fax, scanners, digital imaging (extraoral, intraoral, laboratory, radiographs, medical reports), audio and videoconferencing technologies by "Real Time consultation" or "Store and forward method"
Uhrin	2023	Hungary	Teledentistry, as part of telemedicine, is an information technology-based diagnosis, treatment, and education delivery system in the dental field. Teledentistry involves store-and-forward (SAF) solutions, which allow the patient–doctor communication to take part both a different time point (e.g. via a chat application) and in real-time (RT) solutions that require both the patient and the doctor to be simultaneously present in the online space (e.g. videoconference). Through these solutions, the transfer of electronic health records, teleconsultation, telediagnosis, online therapy planning, follow up, remote patient monitoring, online research, and tele-education can be applied to dentistry
Wang	2022	Hong Kong	Mobile Health (mHealth), defined as "mobile device-supported medical and public health practice," has been widely utilized for the last few decades due to its personalization and cost-effectiveness (WHO)

engaged in the patients' oral healthcare, (ii) use of information technology as a substitute for in-person interactions, (iii) staffing to carry out required functions (including dentist, dental hygienist, and other healthcare providers), (iv) the goals of these interactions. Therefore, teledentistry represents a complex and social innovation where both human and technological factors play a necessary role. A review of the definitions of teledentistry is essential to ensure clarity, consistency, and a comprehensive understanding, which will contribute to rigorous research, effective practice, and informed decision making in dentistry.

Overviews of systematic reviews offer a powerful means for synthesizing evidence from a broad area of research in an efficient and readily accessible way. Thus, from this context, reviewing various definitions of teledentistry will help to reduce the inconsistencies in how the concept is defined, allowing for better comparison and replication of studies informed by previous studies. This compilation and the proposed definition can also improve the communication and collaboration between various stakeholders for translating research into practice and advancing digital technologies in dentistry. A comprehensive definition can assist researchers and policymakers in developing and implementing effective strategies to successfully increase the uptake of teledentistry, as well as in evaluating its sustainability and widespread application. Researchers across various disciplines and settings can benefit from the standardization of teledentistry-related interventions and their applications, allowing them to effectively communicate their findings.

This review of teledentistry definitions can also provide oral healthcare providers (OHCPs) greater insights into teledentistry and the related interventions for diagnosis, treatment planning, and preventive care. The OHCPs and their patients can greatly benefit from a clear definition, which can improve their understanding of the concept, inform decision making and enhance the quality of care. The results of this study underscore the critical need to clarify teledentistry for stakeholders, as this clarity is essential for delivering patient-centred oral healthcare. The diversity

of opinions and limited perspectives in some studies highlighted the importance of this compilation on teledentistry to ensure its effective implementation and minimize adoption failures.

Limitations

Although this short communication is relevant, it only includes the definitions from the SRs that conducted the search strategy in at least two databases and performed quality assessments.

Consequently, definitions of teledentistry from authors' knowledge synthesis that did not meet our inclusion criteria or from other primary studies have been excluded. However, teledentistry definitions in SRs are often derived from primary studies, potentially encompassing aspects reported from multiple studies. It is still important to note that the proposed definition is comprehensive, underscoring the tools, involved stakeholders, various mechanisms, modalities, and desired goals, and can be useful for research, policy, and practice.

Conclusion

The results of this research reported the different meanings and interpretations of teledentistry, highlighting knowledge gaps about this concept. This compilation is a contribution to the advancement of research to ensure a common understanding and a shared foundation of teledentistry. Through our results, effective communication between interested stakeholders on teledentistry would be facilitated. It is particularly valuable to stimulate discussion and further research, highlighting the importance of teledentistry in research, policy, and practice. However, the successful implementation of teledentistry necessitates the adoption of an inclusive and multifaceted approach to policy and design to ensure that no one will be left behind, as its benefits contribute meaningfully to oral healthcare.

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