Review Article

A Systematic Review on the use of Teledentistry in Pediatric Dentistry

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ABSTRACT:

Delivering oral healthcare to children can be challenging due to anxieties, access limitations, and geographical barriers. Teledentistry, the use of telecommunication technologies for dental care, has emerged as a potential solution. This systematic review evaluates the effectiveness of teledentistry in pediatric dentistry. A comprehensive search of electronic databases, including PubMed, EMBASE, Scopus, and Web of Science, was conducted to identify relevant studies published with no time frame. The validity of teledentistry for oral screening varies with sensitivity and specificity. Studies also reported acceptable agreement between teledentistry and in-person examinations, with Kappa statistics. Teledentistry shows promise as a comparable tool to traditional methods for oral screening in pediatric dentistry. It holds particular value for school-based programs, remote areas, and long-term care facilities, potentially improving access to dental care for children. Further research with robust methodologies is needed to definitively determine the effectiveness of teledentistry across the full spectrum of pediatric dental care.

KEY WORDS: teledentistry, pediatric dentistry, anxiety

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Submitted: 03.02.2024, **Accepted:** 19.05.2024, **Published:** 10.06.2024

INTRODUCTION:

Great oral well-being includes the capacity to eat, talk, associate, and partake in a solid eating routine and makes a significant commitment to personal satisfaction. Dental sicknesses, generally preventable, are predominant. Dental specialists additionally assume a significant part in treating abnormalities of the teeth and jaws and recognizing oral appearances of foundational sicknesses.[1]

In the early long stretches of 2020, Corona virus 2019 **(COVID-19)** had spread universally and was before long classified as a pandemic by the World Health Organization **(WHO).**[2] It was accepted to have begun in Wuhan, China, and is brought about by the profoundly contagious novel Covid **(2019-nCoV or SARS-CoV-2)** causing serious intense respiratory symptoms.[3] By the finish of October 2020, the sickness was accepted to have impacted more than 47 million individuals overall and guaranteed no less than 1.2 million lives.[4]

Dentistry has been considered as the most defenceless calling to get impacted by the COVID-19 pandemic, as it includes close investigation, assessment, analysis, and restorative intercessions around the naso-oropharyngeal locale.[5] This immensely forceful novel Covid SARS CoV-2, whose

Access this article online

Quick Response Code:

Website: www.pjsr.org

DOI:

How to cite this article: Suganya M, Mali S, Rao USM. A Systematic Review on the use of Teledentistry in Pediatric Dentistry. PJSR. 2024;17(1):24-31.

focal point was Hubei territory in China, was proclaimed as a well-being crisis of worldwide worry by the World Health Organization **(WHO)** on January 30, 2020.[6]

Teledentistry has been characterized by Cook in 1997 as "the act of utilizing video-conferencing innovations to analyze and exhortation about treatment over a distance".[7] Teledentistry, a type of telehealth containing a synergism among broadcast communications and dentistry that includes the trading of clinical determined data and important pictures for interview and treatment arranging. The idea has demonstrated to be a help for the ceaseless conveyance of essential medical care administrations during tough spots of the pandemic.[8] Innovations as portable applications and other specialized improvements have facilitated the learning and reference convention important to limit direct contact among patients and specialists.

Teledentistry can be advantageous in oral well-being schooling and advancement among kids, analysis and checking pediatric dental patients over significant distances with restricted admittance to dental consideration and in conduct direction of pediatric patients. This technique can be especially valuable during the ongoing pandemic circumstance to restrict patient-to-patient contact by keeping a protected separation. Simultaneously, it forestalls openness of dental staff, dental specialists using cell phones, webcams, intraoral camera and dental applications associated through web.[9]

ADVANTAGES & DISADVANTAGES:

The Advantages & Disadvantages of Teledentistry are depicted in [Table 1]:

Table 1:

S. No	Advantages	Disadvantages
1	Admittance to care for under-served and under-treated population	Treatment requires a visit to the clinic
2	Cost-effective	Technique sensitive and time-consuming
3	Less time consuming	Initial investment
4	Boosted communication	Decreased accuracy
5	Timely diagnosis	Legal issues
6	E-prescription	Language barrier
7	Service in training dental employees at the remote site	Treatment Requires Visits to the Clinic
8	Storing of data	Virtual Examination
9	Management of Preliminary Emergencies	
10	Aiding in Specialist Consultations	
11	Follow-Up Visits Can Be Avoided	

TELEDENTISTRY IN PEDIATRIC DENTISTRY:

Teledentistry can be valuable in oral well-being training and advancement among kids, observing pediatric dental patients over significant distances with restricted admittance to dental consideration and in conduct direction of pediatric patients. This strategy can be especially valuable during the ongoing pandemic circumstance to restrict patient-to-patient contact by keeping a protected separation. Simultaneously, it forestalls openness of dental staff, dental specialists using cell phones, webcams, intraoral camera and dental applications associated through web.

The most widely recognized pediatric dental crises incorporate dental torment, dentoalveolar sore, and dental injury. These circumstances require quick intercession as the treatment for these cannot be postponed. Not withstanding, during the hours of the COVID-19 lockdown, certain adjustments in the underlying treatment were fundamental. Dental agony, endodontic diseases can cause serious torment and are viewed as a significant classification of dental crises. The dental specialist ought to get some information about the idea of agony and assess the condition based on quiet's set of experiences. In the wake of endorsing a reasonable anti-infection course, the dental specialist keeps a legitimate development of the patient. Assuming that the agony reduced, the treatment of the patient could be deferred till the lockdown was lifted. In the event that the aggravation actually did not subside, then, at that point, the dental specialist could call the patient to the center for the crisis treatment. This choice ought to be made by dental specialist in light of the seriousness of the circumstance and his clinical discernment.

Few studies using mobile apps for oral health education and promoting among children are enlisted below [10,11,12,13,14,15,16]

Author name and year	Name of the Application used	Purpose of application	Methods	Conclusion
Soler et al., 2009	Molarcropolis app	An interactive motivational game aimedat increasing oral health and dentalhygiene literacy among adolescentsemploying persuasion tactics. During thegame, players learn about oral diseasesandtheir causes, behaviours and practicesthat put adolescents at risk, tips on how toImprove their oral health.	Survey of individuals aged 13-24 years was done to check the effectiveness of the app in improving awareness and change in habits related to oral hygiene.	Adolescents indicated that the game is both entertaining and informative, helpfulto learn new aspects regarding oral health, and has the potential to change oralHealth habits.
Levine et al., 2012	My Smile Buddy	1. Diet recalls function. 2. Assess risk ofearly childhood caries due to diet in youngchildren.	Pilot study on mothers (age range not specified) of children with early childhood caries was conducted after training community health care workers (CHW).CHW facilitated use of the app by the mothers. Survey of CHW for ease of navigation and usefulness of the app.	Community Health care Workers rated the app as very easy and funfor the families to use.
Shao et al., 2014	DAYA tooth brushing game	A tooth-brushing game to enhance theefficacy and experience of tooth brushingin children, and helping the parents tomonitor child's dental health andbehaviour towards oral hygiene.	A pilot study involving 6–10-year-olds on usability testing of the mobile application and the game.	The game was better understood by olderchildren (>8 years of age) and found themEnjoyable. Parents were able to completeall the tasks related to monitoring. The game was feasible in enhancing the tooth brushing experience for children andMonitoring by parents.
Underwood et al., 2015	Brush DJ app	1. Provide users evidence-based routines to maintain oral hygiene. 2. Motivation by playing music for 2 min while brushing. 3. Set reminders for rinsing mouth,maintain concentration of fluoride,frequency to change toothbrush, dentalappointment schedule.	Qualitative survey assessed perceptionRegardingexperiences and beliefs regarding oral health app amongst participants aged up to 74 years of age.Majority of the participants (37.1%) werein the 7-12 year age group.	Mobile app is useful for oral hygieneeducation and promotion. It motivated the participants to brush for longer time. The themes weremotivation, education,compliance and perceived benefits.
Alqarani et al., 2018	Your child's smile	Provide information to parents regarding oral health of their child pre-partum and from the period of infancy to adolescence.	Survey to assess improvement in parent's knowledge before and after the use of the mobile app in children up to 15 years ofage.	Significant improvement in knowledge related to dental caries and oral hygiene.
Zotti et al., 2019	1. Time2Brush(Children >5 years). 2. Little MonstersToothbrush time(Children_5 years).	Format of both apps were same. Fictionalcharacters served as motivation topractice oral hygiene along-with a stopwatch to performroutine procedures.Additionally, according to the minutes ofuse, users could customize the summaryaccordingly, as a bonus.	Randomized trial involving study andControl group involving 4-7-year-old children. Chair side instructions on oral hygiene for control group.	Decrease in plaque scores, no new cariesLesions on permanent molars. Bettercompliance for oral hygiene by children,Increase in knowledge level of parents.
Alkilzy et al., 2019	Manual toothbrushwith sensor that islinked to thesmart phone viaBluetooth	Manual tooth brush with a digital motion3D sensor system (gyroscope), so that the tooth brush follows the tooth brushingMovements of the child in real-time. The movements are relayed to smart phone viaBluetooth. Movements are shared withparents for monitoring and as the child reaches optimal movements points are awarded.	A randomised control study evaluatingeffectiveness of using a manualtoothbrush with a gravity sensor and used along with a mobile tooth brushing app inChildren aged 5e6 years. The controlgroup used a manual tooth brush without the smart phone app.	Decline in plaque index was morepronounced in the test group than in the control group, which gives evidence forthe effectiveness of gaming in toothbrushing via a smart phone app.

The following studies using social networking media for oral health education and promoting among children are enlisted below [17,18,19,20]:

Author name and year	Name of the media used	Purpose of application	Methods	Conclusion
Zotti et al., 2016	WhatsApp	Video tutorials regarding oralHygiene. Self-photographs (selfies)and text messages shared bypatients and their parents viaWhatsApp-based anonymous chatroom .	Randomized controlled trial involvingAdolescent patients (mean age 14.1 years in study group and 13.6 years in control group) undergoing orthodontic treatment requiring maintenance of oral hygiene. Patients and parent were asked to interact via selfies and text messages pre and post oral hygiene practices.	Improved compliance to oral hygiene inpatients noted with lesser white spot lesions recorded during orthodontictreatment.
Scheerman et al., 2019	Telegram	Theory based program consistingof oral health education andbehaviour coaching components topromote regular tooth brushing.	Randomized controlled trial evaluatedeffectiveness of Telegram application inpromotion of oral hygiene and oral health related outcomes in adolescents aged 12-17-years along with mothers. Theoutcomeswere based on improvements intooth brushing behaviour and –plaque scores.	Results supported use of health actionprocess-basedapproach and theory -based program through Telegram with involvement of mothers to improve oral hygiene among adolescents.
Lotto et al., 2020	WhatsApp	Educational text messages relatedto early childhood caries.	Randomized controlled trial including child-parent dyad with in children aged 36 to 60 months and having early childhood caries. The intervention groupreceivedEducational WhatsApp text messages.	Effective to control the severity of ECC in low socioeconomic pre-schoolers,improving parental eHealth literacy andChanging children's dietary patterns.
Simsek et al., 2020	YouTube	YouTube videos describing oralhabits searched	Evaluated videos on oral habits and assessed quality of information available for patients and parents.	Majority was inappropriate withInadequate information.

DENTAL ABSCESS OR SWELLING:

The persistent instances of agony or dental contaminations in some cases fuel as a boil or enlargement. In this condition, the dental specialist can request that the guardians send an extra-oral and intra-oral photo of the kid. This assists the dental specialist

The following studies with telediagnosis using smartphone camera/ digital camera/ web camera in children are enlisted below [21,22,23,24,25,26,27].

Author name and year	Device for diagnosis	Methods	Conclusion
Am_avel et al., 2009	Digital camera, Web-based system(MedQuest)	Validity of the remote diagnosis of dental problems in 4–6-year-old children was done by dentists using digital camera. Screening and referrals were decidedbasedon images obtained via web-based application.	Use of photographs is a valid method for remote diagnosis of dental problems. Specificity of this method of screening can be enhanced by improving feedback on dentist's evaluation.
Torres -Pereira et al., 2012	Smartphone camera	Non-Randomized study wherein intra-oral images of first 60 patients (irrespective of age) who visited thedental clinic after ethics committee approval were uploaded on cloud-based servers by dental assistants for mid-level practitioner's and dentists to screen for dental caries.	Photographs taken with 18-megapixel DSLR were able to provide adequate diagnostic information with sensitivity and specificity. Photographic assessment accelerated referrals to specialists that reduced delayed treatment and increased patient inflow.
Kopycka-Kedzierawski et al., 2013	Intra-oral camera	Randomized comparative evaluation between conventional dental examination and teledentistry aided examination in assessment of early childhood caries prevalence in 12e60-month-olds.	No difference between either type of examination. Provision of coloured pictures of child's cariously exposed teeth helped in motivating parents forgetting their children examined.
Purohit et al., 2017	Smartphone camera	Dentists involved in this cross-sectional surveyconducted a clinical versus video-graphicexamination to assess DMFT index in 12-year-old children.	Clinical and video-graphic methods of assessmentwere proven to be comparable for screening of dental caries in school children.
Estai et al., 2017	Remote mobile Teledentistry system for Android phones with 'Remote-i' cloud server that collects, transmits and reviewsdental photographs.	Study compared cost-effectiveness of conventionalvisual-tactile examination with teledentistry approach. Trained tele-assistants carried out dentalscreening of all age groups, including children, using recorded photographs that were later shared via'Remote-i' system.	Teledentistry is cost-effective method that can be used for mass dental screening in distant locations.
de Almeida Geraldino et al., 2017	Mobile phone camera	Cross sectional study involving patients between 3-39 years of age with traumatized teeth. RemoteExamination by paediatric dentists using electronic records and photographs. Agreement with in surgery and remote diagnosis was evaluated.	Precision of remote diagnosis was comparable to the diagnosis conducted in person. Mobile phone camera can be a useful tool to capture images for remote diagnosis of traumatic dental injuries.
Kale et al., 2019	Smartphone camera, social networking application (WhatsApp)	Mothers' ability to diagnose dental caries in 3- to 5-year-oldvia smart phone camera post health educationwas assessed. The captured photographs were shared with dentists via WhatsApp.	The method recorded good sensitivity, specificityandaccuracy. Children were more cooperative forExamination with smart phone in comparison to conventional visual examination as they are familiar with the former.

with assessing the degree of the enlarging in a vastly improved manner. In the event that the expansion is intraoral and not broad, a standard anti-infection course can be given to the patient. This generally is adequate for decrease in size of the expanding and mediation can be deferred. In the event that the enlargement is extra-oral and broad, a crisis dental arrangement should be planned.

DENTAL TRAUMA:

During the hours of the lockdown, most kids would generally play at home. This invigorated the requirement for additional energetic methods of play in youngsters and cause an expanded gamble of dental awful wounds. In the event of an episode of dental injury with negligible draining and aggravation, the use of strain to the draining site and appropriate mitigating medications could be endorsed. In serious cases, for example, separation, confounded crown and root break or injury to the encompassing tissues, crisis mediation is required.

CONCLUSION:

Teledentistry, the underpinning of which lies in the web and advances in data innovation can be an enhancement to eye-to-eye techniques for pediatric dental consideration, at last prompting better quiet administration. Pediatric dental specialists can use this innovation for patient/parent training, checking preventive consideration and post treatment follow-up, evaluation of dental turn of events, analysis of dental illnesses, treatment arranging and pre-arrangement conduct direction to diminish nervousness among youngster patients. This mechanical progression in dentistry can make a critical commitment in diminishing the hole between the organic market of pediatric dental experts where oral medical services offices are restricted. The utilization of teledentistry during the pandemic extends the capability of this innovation to lessen the spread of infection. Further examination is expected for protected, compelling and proof-based utilization of teledentistry in the field of pediatric dentistry. Notwithstanding the disadvantages, teledentistry can be a device to give long haul oral medical services to the pediatric populace, defeating the imbalances in admittance to expert consideration. This requires shared endeavours by the wellbeing specialists and pediatric dental specialists. With every one of the mechanical advancements occurring in the field of teledentistry, experts may ultimately connect up to virtual dental well-being facilities and an altogether new time of dentistry can be made. The future could likewise see far off telemedical control of robotized instruments in circumstances with long haul inaccessibility of dental consideration, e.g., during space flights, on overseas ships, and in different rustic regions. The outcomes accomplished so far are exceptionally uplifting, setting the street finishes paperwork for future examinations. Notwithstanding, various things must be addressed before teledentistry can ascend to its pinnacle. Further investigations including more prominent number of members will be expected to approve the different parts of teledental applications.

Financial Support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

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