



## Teleodontology as a Tool in the Care of Pediatric Patients: Narrative Review

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### Abstract

**Introduction:** The explosive development of technology allows obtaining information and communication instantly. Telehealth is a tool that has advanced in all its areas, especially in dentistry, where new trends, programs, materials, equipment, and additionally an adapted care model have been developed. Pediatric dentistry finds in teleodontology, multiple uses and benefits in pediatric patients.

**Objectives:** To describe teleodontology as a tool in the care of pediatric patients in terms of its uses, applications, contribution, and benefits.

**Method:** A literature review was carried out in the following electronic databases: PubMed, Epistemónikos, EBSCO, Scopus, Chocrane Library, SciELO and Google Scholar. An electronic and manual search of scientific journals was included.

**Results:** The electronic search gave a total of 413 articles, after applying selection criteria, title reading and elimination of duplicates, 53 articles were relevant, the inclusion and exclusion criteria were applied to them, giving a total of 16, to which were added 5 articles by retrograde search and 8 by manual search, giving a result of 29 articles in this review.

**Conclusion:** There is a need to incorporate teleodontology as a fundamental part of comprehensive care in pediatric dentistry, due to its multiple uses, applications and benefits for children with and without disabilities, being a contribution to dentistry thanks to the reception of information under a familiar, comfortable and related method.

**Keywords:** Remote Consultation; Teleconsultation; Teledentistry; Odontopediatría; Pediatric Dentistry

### Introduction

Throughout history, health care has been described as a highly complex link between professional and patient, characterized by providing help in a humanitarian and sensitive manner, generating trust in the other for the development of the necessary activities. This relationship is fundamental in the work of promotion, prevention, and restoration of health, being measurable by the state of satisfaction of the patient after the service [1].

Every act of health care is carried out under a specific interpersonal communication, where two or more people, endowed with

cognitive faculties and freedom, share relevant information regarding the state of general health [2]. The interaction of both characters is enhanced by the development of an exhaustive examination, where, throughout the consultation time, the senses are used, allowing, through the gaze, verbal expression, manual contact and the instrumental relationship, to carry out a diagnosis and subsequent treatment plan [3].

Little by little, this face-to-face relationship between the health professional and the patient was updated by the arrival of certain technological means, slowly being introduced into what we now

call telehealth. Although the concept may sound recent, the first antecedents in this care modality are reported with the use of the telegraph around the year 1900 and later in the 50s, with teleconsultations in space missions and remote medical monitoring in intercontinental ships [4].

Today, the explosive development of technology during the 21<sup>st</sup> century makes it possible to obtain information and communicate instantly. These globally accessible media have altered the way medicine and dentistry are practiced [5].

Technological availability and the increase in social access to electronic devices during this last century, has allowed the emergence and establishment of telehealth [6]. It has been seen that, in the modern society of the 21<sup>st</sup> century, the use of the technological tools available for care has many advantages such as the optimization of resources, improvements in management, reduction of hospitalizations, less repetition of acts, reduction in displacement, better communication for consultations and better access for patients [4].

Telehealth is a tool that has advanced in all its areas, especially in dentistry, where new trends, programs, materials, equipment, and additionally an adapted care model have been developed. Teleodontology brings the development of ICT to dental practice, from a different and current approach [7].

On the other hand, in December 2019 the first cases of respiratory disease caused by SARS-CoV-2 were detected, which at the beginning of 2020 had spread throughout the world and was characterized as a pandemic [8]. The public health problem defined that during the stages of confinement, dental care should be reduced to only emergencies that cannot be postponed, promoting a growing development in the field of teleodontology [9].

Pediatric dentistry finds in this mechanism, multiple uses and benefits in pediatric patients given the better reception that children and adolescents present to digital media. The so-called “digital natives” are characterized as “native speakers of digital language, computers, video games and the Internet”, who have ease in understanding audiovisual material, adherence to communication by technological means and like to be informed through the Internet [10].

Today, there are different dental teleconsultation guides and routes created by various associations that allow algorithms for remote care to be followed [9]. In pediatric dentistry, digital care opens up a wide range of possibilities for carrying out comprehensive and multidisciplinary treatments, ranging from promotion and prevention to consultations in different specialties and disciplines. The study of this topic allows the dentist to expand care to those who were previously limited by distance and generate useful audiovisual material for the patient, which also allows reinforcing face-to-face care [11].

The narrative review presented here is due to the importance of the use of teleodontology and the extensive benefits that we could obtain, not only in the pediatric population but also in its general environment, by directly influencing comprehensive health and quality of life. The work proposes to describe teleodontology as a tool in the care of pediatric patients.

That is why, to carry out this monograph, the following research question was asked

Is teleodontology a good tool for the care of pediatric patients in terms of its uses, benefits and contribution?

- **General Objective:** Describe teleodontology as a tool in the care of pediatric patients.
- **Specific Objectives:** Describe teleodontology and its uses/applications, benefits in the care of pediatric patients and describe teleodontology and its contribution to the dentist in a SARS-CoV2 pandemic in the care of pediatric patients.

## Materials and Methods

### Search strategies

In this descriptive narrative study, a literature review of the available evidence on studies related to teleodontology in pediatric dentistry was carried out, through an electronic search of full texts, during the months of March to June 2021, through databases. online data such as PubMed, Epistemónikos, EBSCO, Scopus, ChocraneLibrary, SciELO and Google Scholar. An electronic and manual search of scientific journals was included, such as the Revista de la Sociedad Chilena de Odontopediatría, Revista de Odontopediatría Latinoamericana, International Journal of Clinical Pediatric Dentistry and the European Journal of Pediatric Dentistry.

Likewise, a retrograde search of references was carried out in the same bibliography of the articles found.

To accomplish this task, thesauri were used such as the MeSH terms “remote consultation” and “p?ediatric dentistry”, and keywords such as “teledentistry” and “odontop?ediatrics”, in combination with the Boolean terms “AND” and “OR”. The sign “?” was used to broaden the search in relation to the British and American spelling of the words.

Based on the above, in the collection of the articles the following search boxes were used in the different databases

PubMed
((“teledentistry”[All Fields] OR (“remote consultation”[MeSH Terms] OR (“remote”[All Fields] AND “consultation”[All Fields]) OR “remote consultation”[All Fields])) AND (“paediatric dentistry”[All Fields] OR “pediatric dentistry”[MeSH Terms] OR (“pediatric”[All Fields] AND “dentistry”[All Fields]) OR “pediatric dentistry”[All Fields])) OR “odontopediatrics”[All Fields]

Table a

Epistemonikos, EBSCO, Scopus, CochraneLibrary, SciELO
title:(“teledentistry”) OR title:(“remote consultation”) AND title:(“p?ediatric dentistry”) OR title:(“odontop?ediatrics”)

Table b

Google Académico
title:(“teledentistry” OR “remote consultation”) AND title:(“pediatric dentistry” OR “odontopediatrics”)

Table c

For access to the databases, the subscription of the library of the Universidad de los Andes was used, in the section of the Dentistry career.

**Inclusion and exclusion criteria**

The inclusion and exclusion criteria were the following

**Inclusion criteria**

- Articles that describe the use, benefits and contribution of teleodontology for the care of pediatric patients.

- Articles available in full text.
- No language restriction or year limit.
- Studies carried out in the population of children and adolescents.
- Studies that answered the research question.
- Studies that present surveys answered by parents, guardians, or attorneys.

**Exclusion criteria**

- Studies conducted only in adult population.

**Selection strategy**

The articles obtained from the databases were selected and reviewed by a single person. The full-text availability filter was applied to each of the searches, then a first scan of the literature was performed by reviewing the title, eliminating duplicates. Then a second selection by reading the abstract. Finally, those documents that met the inclusion criteria were obtained, discarding those that included the exclusion criteria through reading the full text.

All the articles found, following the previously mentioned search strategy, were downloaded in PDF format, and later stored with the Zotero reference manager.

**Critical analysis of the literature**

**Level of evidence**

The analysis of the level of scientific evidence of the studies was carried out using the criteria proposed by the Center for Evidence-Based Medicine (CEBM) of Oxford [12].

**Report quality**

The evaluation of the reporting quality of the selected articles was carried out using the guidelines:

- PRISMA for systematic reviews [13]
- STROBE for case-control, cohort and cross-sectional studies [14]
- CARE for case reports [15]

For each one of the items of the guidelines, of a dichotomous nature, a score of 1 was given if the criterion was met and 0 if it was

not met. Then, after adding all the points, the percentage of compliance with the guidelines was calculated and interpreted as follows

Compliance percentage	Interpretation
100%	Excellent reporting quality
80% - 99%	Very good reporting quality
60% - 79%	Good reporting quality
40% - 59%	Regulate report quality
20% - 39%	Poor reporting quality
0% - 19%	Very poor reporting quality

**Table 1:** Report quality interpretation

**Source:** self-made. Modified from: Primo J. Levels of evidence and grades of recommendation (I/II). *Inflammatory bowel disease daily* 2.2 (2003): 39-42 [12].

**Risk of bias**

The risk of bias of the present narrative review was not assessed due to the non-inclusion of clinical trials.

**Ethical aspects**

An evaluation of the ethical aspects of the selected studies was carried out, using as a basis the international ethical guidelines for biomedical research in human beings, prepared by the Council for International Organizations of Medical Sciences (CIOMS) (16). The parameters evaluated were the following

- Request for informed consent for each patient participating in the research.
- Assent of the children included in the studies.
- Approval of the study by an ethics committee.
- Declaration of absence of conflict of interest by the authors.

According to the presence of these variables, a score was assigned, giving it a value of 1 if it was made explicit and 0 if it was not stated. Then, a sum of points was made, assigning a final score, which was considered adequate if it presented a sum of 3 points, moderate if it added 2 points and inadequate when obtaining a result of 0 - 1 points (Table 2). It should be noted that the analysis of ethical considerations was not performed in the narrative reviews.

Total score	Interpretation
0 - 1	Inadequate
2	Moderate
3 - 4	Suitable

**Table 2:** Interpretation evaluation ethical aspects.

**Source:** self-made.

**Organization of results**

To organize the articles found, an ordered table was made.

Finally, different tables were prepared summarizing the level of evidence, degree of recommendation, analysis of the quality of the report and analysis of the ethical considerations of each article, ordered according to the author and year of publication.

**Results and Discussion**

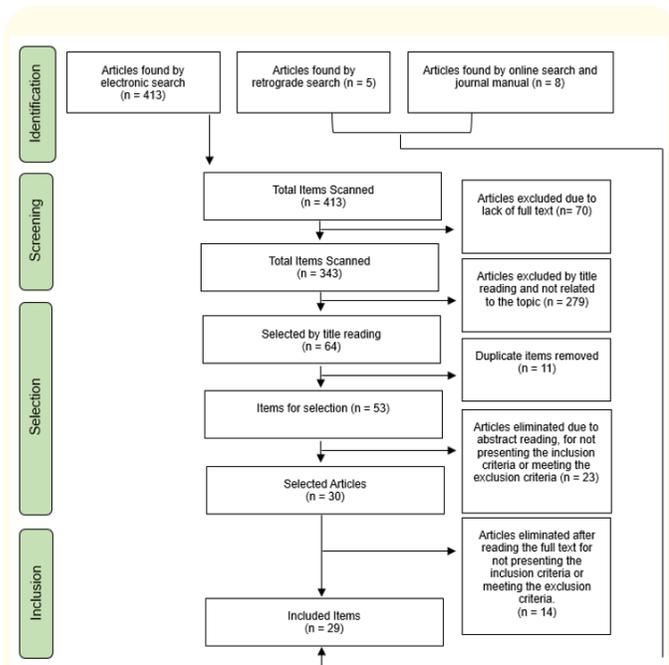
**Electronic search results**

Through the electronic search in the aforementioned databases, a total of 413 articles were found: 47 in PubMed, 52 in Epistemionikos, 88 in EBSCO, 85 in Scopus, 9 in CochraneLibrary, 38 in SciELO and 94 in Google Scholar (Figure 1).

From them, the full-text availability filter was applied to each search, leaving 343 articles for title scanning. 64 documents were selected, of which 11 were eliminated because they were found to be duplicates, leaving a total of 53 for abstract reading. Of these, 23 documents were eliminated when applying the inclusion and exclusion criteria, obtaining 30 for full text reading (Figure 1).

After fully reading the 30 selected articles, 14 were eliminated by applying the inclusion and exclusion criteria again, finally obtaining a total of 16 documents. Then, by performing a retrograde search for specific documents based on the references of those previously selected, 5 texts were added. The articles found through a manual and online search in the journals mentioned above were a total of 8 (Figure 1).

Of the 29 articles included, 3 are systematic reviews [18-20], of which only 1 corresponds to a systematic review with meta-analysis [19], 6 are narrative reviews [9,17,20-23], 13 observational studies of cross-sectional type [24-36], 1 prospective observation-



**Figure 1:** Flow chart. It explains the selection process of articles included in the monograph.

**Source:** self-made.

al study [37], 1 retrospective observational study [38] and 5 case reports [39-43].

Within these studies, 3 speak of teleodontology and pediatric emergencies, 10 of teleodontology diagnosis and treatment plan, 3 of teleodontology and promotion and prevention in oral health, 5 of teleodontology and the SARS-CoV2 pandemic, 3 of teleodontology and its benefits and 5 teleodontology and patients with disabilities. All this applied to the care of child and adolescent patients.

### Critical analysis of the literature

#### Level of evidence and grade of recommendation

According to the CEBM evaluation guideline of the University of Oxford, of the total of 29 articles (100%), 4 were classified with a level of evidence 2a (13.7%), 13 with a level of evidence 2b (44.8%), 1 with evidence level 3b (3.4%) and 11 with evidence level 5 (37.9%).

18 articles were classified with grade of recommendation “B” and 11 articles were classified with grade of recommendation “D”.

### Report quality

An analysis of the reporting quality of the observational studies, systematic reviews and case reports was carried out, with the guidelines named before, which were interpreted with percentages.

Of the 23 articles evaluated (100%), 11 articles were obtained with very good reporting quality (47.8%), 5 articles with good reporting quality (21.7%), 7 articles with regular reporting quality (30.4%) and 0 of excellent, poor or very poor quality (0%).

### Ethical aspects

To analyze the ethical aspects, 6 studies corresponding to narrative reviews were excluded.

Regarding the remaining 23 article studies (100%), 8 articles were qualified as adequate in terms of ethical aspects (34.7%), 1 of them complied with the total of 4 variables (4.3%) and 7 with 3 variables (30.4%), 1 article was qualified as moderate, complying with 2 variables (4.3%), 12 articles fulfilled 1 variable (52.1%) and 2 articles did not comply with any variable of ethical aspects (8.6%), qualifying these last two groups as inadequate (60.7%).

### Uses, applications and contribution of teleodontology in the care of pediatric patients

#### Teleodontology as a tool in the treatment of dental emergencies in pediatric patients

Outpatient dental emergencies comprise a set of oral and maxillofacial pathologies, of sudden onset, of multiple aetiology, which are mainly manifested by acute pain and cause a spontaneous demand for care, both in primary health centers and in health care services. secondary and tertiary level. The most common, established by research worldwide, point to dentoalveolar trauma (DAT) in children under 7 years of age, commonly caused by falls and bicycle accidents [44].

De Almeida, *et al.* [25], Mohan, *et al.* [26] and Ilyas, *et al.* [37] agree that for a correct diagnosis and better prognosis, ADD must be adequately treated within the first hours after the trauma. De Almeida, *et al.* [25] also mentions that the availability and competence of health professionals are important factors for managing ADD in emergency services. If these are missing, treatment and prognosis will be negatively affected.

The three authors, De Almeida, *et al.* [25], Mohan, *et al.* [26] and Ilyas, *et al.* [37], present teleodontology as a means of mitigating the limitations of traditional care in the face of ADD, such as the impossibility of immediate consultation, the lack of specialists, and the saturation of a dental emergency unit.

De Almeida, *et al.* [25] and Mohan, *et al.* [26] propose the use of Smartphones for diagnosis and treatment planning in cases of dentoalveolar trauma in pediatric patients.

In their study, De Almeida, *et al.* [25], evaluated a total of 40 patients from 3 to 39 years old who consulted for ADD (97.5% children and adolescents between 3 and 21 years old) through frontal and occlusal photographs taken with a Samsung Galaxy S50 smartphone, proposing teleodontology asynchronous as an excellent tool for the identification, diagnosis, registration and control of patients suffering from ADD. The author recommends a third photo with occlusal view that can be decisive in decision making and treatment plan. The highest incidence occurred in the group of children between 8 and 10 years old.

On the other hand, Mohan, *et al.* [26] used the Injured Tooth mobile app developed by Ignobilis Terrain LLP. which provides an image-based diagnosis of traumatic injuries to teeth and a series of questions using the Andreasen classification of traumatic injuries to teeth and supporting structures. After examining 201 teeth in 176 child and adolescent patients between 0 and 15 years old, the application coincided in 197 cases (98%) with the diagnosis given in the traditional examination. Cohen's kappa statistical test was performed and a kappa value of 0.973 was obtained for the Injured Tooth application compared to the diagnosis provided by experienced personnel. The value indicates that the application has a very acceptable correlation with the compared standard. Tools like the Injured Tooth app can provide remote help to students and dentists in diagnosing and treating traumatic dental injuries, especially during the early stages of their career and during emergencies where there is a lack of specialists to provide proper diagnosis and management. such injuries.

Ilyas, *et al.* [37], evaluated the possibility of screening (triage) 420 patients by means of telephone calls, defining the need for face-to-face consultation for the different types of ADD and facial trauma, which was 40% (171 patients). The telephone screening system allowed most consultations for suspected less complicated dentoalveolar injuries (those that do not involve dental displace-

ment or pulp involvement) or facial trauma, to be managed with advice and self-help guides. Also turning out to be an excellent tool for remote monitoring of patients after face-to-face care.

The need for calibrated examiners is common to all three authors, De Almeida, *et al.* [25], Mohan, *et al.* [26] and Ilyas, *et al.* [37], being essential to obtain adequate results compared to face-to-face care.

### Teleodontology as a tool in diagnosis and treatment plan

Teledentistry is a widely described tool in relation to its application for the diagnosis of oral diseases and treatment plan.

Authors K.C Pentapati *et al.* R. Amavél, *et al.* AlShaya, *et al.* Estai, *et al.* 2017, B.M Purohit, *et al.* Estai, *et al.* 2016, Morosini, *et al.* Kopycka-Kedzierawski, and R.J. Billings 2011 and Kopycka-Kedzierawski and R.J. Billings 2013 [27-34,38] evaluated the use of teledentistry for caries diagnosis within their studies. K.C Pentapati, *et al.* and R. Amavél, *et al.* [32,34] also evaluated the use of this technological means in the diagnosis of other oral conditions present in pediatric patients such as; calculus, bacterial plaque, erosion, fluorosis and stains. On the other hand, McLaren, *et al.* [38] evaluated the prediction of the treatment modality by means of videoconferences compared to face-to-face examination.

McLaren, *et al.* [38] in their study highlighted that through synchronous teleodontology, through videoconference, the treatment modality indicated for the pediatric patient can be correctly defined, referring to whether the care will be performed with local anesthesia, nitrous oxide or under anesthesia. general.

McLaren, *et al.* [38] like the authors [27-34,38,45], determined that teleodontology improves the adherence of patients and caregivers to treatment since it allows effective and adequate referral of patients, greatly reducing number of incorrect referrals and face-to-face consultations.

K.C Pentapati, *et al.* [32] evaluated the use of images obtained by an intraoral camera and asynchronous teleodontology (store and forward) as a reliable tool to identify most of the most common oral pathologies in pediatric patients. In their study, the sensitivity and specificity of the diagnosis of calculus, bacterial plaque, erosion, fluorosis, and stains ranged between 90 and 100% and between 66.7 and 100%, respectively, for the different oral condi-

tions. The percentage of agreement between both diagnostic methods ranged between 93.33% and 100%, with a Kappa coefficient between good and very good ( $\kappa = 0.7-1$ ). In relation to the COPD index, there were significant differences, being overestimated in the diagnosis through images than in the clinical examination ( $p < 0.05$ ;  $p = 0.001$ ).

The author [32], concludes that teleodontology is a reliable method for the diagnosis of the vast majority of the most common oral pathologies in pediatric patients, coinciding with R. Amavél, *et al.* [34] who points out that this technological method is useful in the early diagnosis of the most prevalent oral problems. Also, both authors [32,34], describe as a difficulty for the diagnosis the restricted vision of posterior areas in the images, especially the distal face of the last molar present in the mouth.

In relation to the diagnosis of caries by asynchronous teleodontology (store and forward) compared to visuo-tactile examination, Estai, *et al.* 2016 [18] in a systematic review, points out that sensitivity and specificity are the most common criteria for the evaluation of dental caries. method. Authors AlShaya, *et al.* Estai, *et al.* 2017, B.M Purohit, *et al.* Morosini, *et al.* and Kopycka-Kedzierawski and R.J. Billings 2011 [27,29-31,33,45] refer to the sensitivity and specificity in their studies. AlShaya, *et al.* [33] declares more sensitivity than specificity, describing both with values above 80%. Estai, *et al.* 2017 [31] presented results ranging from 60% to 63% for sensitivity and 96% to 99% for specificity, the latter being highly comparable to the face-to-face method. B.M Purohit, *et al.* [30] exhibited 86% sensitivity and 58% specificity. Morosini, *et al.* [29] reported sensitivity ranges between 48% and 73%, for specificity 97% to 98%. Finally, Kopycka-Kedzierawski and R.J. Billings 2011 [27] report a sensitivity of 100% and a specificity of 81%. The heterogeneity of these results and of the methodology of these studies converges in inconclusive results.

Studies by B.M Purohit, *et al.* Kopycka-Kedzierawski, and R.J. Billings 2011 and Kopycka-Kedzierawski and R.J. Billings 2013 [27,28,30] used intraoral cameras for caries detection in children. B.M Purohit, *et al.* [30] were the only authors to make a standardized video of the oral cavity for evaluation without the use of photographs. The 3 studies obtained results comparable to the visuo-tactile examination, deriving that teleodontology is a valid and reliable method for the detection of dental caries. Kopycka-Kedzierawski

and R.J. Billings 2013 [28] highlighted that the use of teledentistry is even more comparable and cost effective when seeking to detect early childhood caries.

Morosini, *et al.* [29] used a professional extraoral camera, pointing out the need for studies testing the use of more accessible cameras, such as cell phone cameras. AlShaya, *et al.* [33] in their reliability study stated that asynchronous teledentistry performed using smartphones is a necessary tool for diagnosis, treatment planning, and documentation. He points out that the reliability of this method is relatively acceptable for the diagnosis of cavitated caries. Like the author [33], Estai, *et al.* 2017 [31] evaluated the use of teledentistry via smartphones, concluding that this method has the potential to detect occlusal caries with comparable to moderate confidence and validity. Both [31,33] describe as a limitation of the method, the impossibility of detecting secondary and interproximal caries due to the lack of complementary tests such as X-rays. Estai, *et al.* 2016 [18] presented the use of smartphones as a very available option in the population, light and portable, increasing its applicability to day-to-day dentistry.

B.M Purohit, *et al.* [30] highlighted teleodontology as a method that provides essential services in oral health such as education, diagnosis, treatment plan and collaborative multi- and interdisciplinary work, reducing the access gap in a high percentage.

All the authors mentioned [18,28-34,38] agree on several characteristics of teleodontology without differences in its modality.

In the studies included in this section, there was consensus that teleodontology improves access to health services and care with specialists, presenting greater availability and acceptance by patients and their caregivers [18,28-34,38]. They agree on the applicability of teleodontology for patients in rural and urban areas with limited access, and even Morosini, *et al.* [29] studied its use with adolescent prisoners.

They also highlight the possibility of carrying out rapid and effective follow-up, reducing face-to-face control sessions [18,28-34,38].

It is also mentioned that teleodontology is a low-cost method for the health service and for the patient, since great economic savings are produced in terms of human resources and infrastructure

[18,28-34,38]. The authors [18,28-34,38] point out the reduction in the time spent on dental care, reducing transfers or trips, especially for patients who live in areas far from the health service.

Finally, the possibility is presented that under the asynchronous method (store and forward) the requested images can be taken by trained personnel and not necessarily by dentists, opening the possibility that teachers or personnel from the closest health service perform these actions under public policies or government screening and referral programs in children [18,28-34,38].

### Teledentistry as a tool for the application of promotion and prevention strategies in pediatric patients

The main risk factors for oral diseases are poor hygiene and eating habits. Promotion and prevention represent a health strategy aimed at modifying the determinants of health, mainly focused on improving the material conditions of life and promoting healthy lifestyles.

Toniazzo, *et al.* [19], Al Klayb., *et al.* [24], Hotwani., *et al.* [35] indicate that through various studies the success of telephone applications in providing oral health promotion and prevention activities to children and their parents has been proposed, influencing the behavior of the pediatric patient and the optimal implementation, at home, of the strategies taught by the dentist.

The authors [19,24,71] agree that the traditional method of educational sessions regarding oral health promotion and prevention is time consuming and requires a full-time dentist. They mention that it is possible to overcome those challenges using teledentistry.

Toniazzo, *et al.* [19] through a systematic review and meta-analysis of 15 studies concluded that the use of teledentistry to improve understanding of conventional oral hygiene instructions significantly improved plaque and gingivitis removal, and increased self-care knowledge. oral, being the population investigated mainly constituted by children and adolescents and the most frequent method of providing teleodontology is text messages. The latter provided clues about actions, warnings, reminders, reinforcements, and feedback; All these important factors promoters of behavioral change and the knowledge acquired about health.

Al Klayb., *et al.* [24] studied 1055 mothers of children under 6 years of age from two cities in Saudi Arabia, for a period of 3

months, who used a mobile phone application (iTeethey) to learn about health and oral hygiene in their children. Although more mothers completed follow-up in Riyadh city compared to Najran city, the chi-square test showed that the differences were not statistically significant [ $P = 0.091$ ]. This final group included 71 new mothers and 545 mothers with more than one child in the Riyadh region and 96 new mothers and 343 mothers with more than one child in the Najran region.

The study concluded that there was a significant improvement in mothers' knowledge after using the app in both regions. Najran mothers showed significantly greater improvement in knowledge compared to mothers from the Riyadh region. The app was also more effective in mothers with more than one child compared to new mothers.

Hotwani., *et al.* [35] selected 6 free-to-download toothbrushing applications available in English that were intended to help with brushing by assessing compliance with behavioral change goals in pediatric patients (According to the CALORE guideline). The behavior change criterion included in all applications (100%) was information provision, goal setting, and rapid practice. Outcome setting, action planning, information on when and where to perform the behavior, and instruction on how to perform the behavior were included in five of the six applications (83%). Setting graded tasks, self-monitoring of behavioral outcome, behavioral demonstration, rapid imagery, and time management were included in four of six applications (66%).

It was defined that teleodontology is a very useful tool for the motivation and prevention of oral health in children using mobile phone applications. However, the results indicate that very few apps have included behavior change criteria in their features. Additionally, the inclusion of a gaming environment with a better focus on individual training based on national guidelines would be desirable for any toothbrushing application. These apps would be an emerging option for oral hygiene behavior change as they would address innate psychological needs while offering intrinsic motivation in the form of fun for the child [35].

Some limitations in the studies by Toniazzo, *et al.* [19], Al Klayb., *et al.* [24], Hotwani., *et al.* [35], with respect to currently available data. The studies show a high variability, suggesting great differences between them, such as the follow-up time, the risk of

bias and in the case of Toniazzo, *et al.* (19) different parameters to assess dental plaque and marginal gingival bleeding. These characteristics may influence the results and thus explain the heterogeneity present in the results. Furthermore, the findings should be treated with caution, as most studies had a short follow-up time. More studies are needed that use standardized methodologies with a longer follow-up, thus elucidating the role of mobile applications and text messages in the application of oral health promotion and prevention strategies.

### Teledentistry as a tool in the care of pediatric patients with disabilities

Urrea T, *et al.* Thiele MP, *et al.* Thiele MP, *et al.* 2\*, della Maggiora, *et al.* Lira T, *et al.* [11,39-43] presented, in 2020, case reports regarding the use of teleodontology in the care of pediatric patients with disabilities. All authors agree that the use of digital media such as synchronous or asynchronous teleodontology is a good alternative to handling by the dentist given its wide benefits and excellent reception in pediatric patients with disabilities. Teledentistry is considered a fundamental educational tool that complements the learning of the pediatric patient.

Urrea T, *et al.* [43] in their work "Impact on brushing technique in patients with disabilities after seeing an educational capsule", presents that the use of distance methodologies, such as asynchronous teleodontology, allow supporting family members and/or caregivers of pediatric patients with disabilities in their routine activities, obtaining successful results. It reports 30 patients with disabilities between 6 and 15 years of age who received an educational capsule called "How do we brush our teeth?" treating the topics: Use of toothpaste, Bass technique and time needed. After this, through a survey of 6 assessment questions and 2 open questions, he determined the usefulness of the material, where with a scale of 1 to 5 an average of 4.8 points was obtained, concluding that the implementation of methodologies is relevant to distance that encourage and promote good oral hygiene habits.

Thiele MP, *et al.* [40], in the context of the SARS-CoV2 pandemic, mention that overcoming fear and anxiety is a challenge and even more so in times of pandemic, being the use of personal protection elements (PPE) a limitation in the communication between the dentist and the patient, presenting a need for innovation in relation to adaptation techniques and the use of digital media for its achievement. Each dentist present at the clinic for care for patients

with disabilities at the University of Los Andes produced videos for 7 patients and their caregivers, showing the placement of all the new personal protection elements, starting the desensitization process. After the visit, a survey was conducted to evaluate the impact of the video before the face-to-face appointment through 8 questions, which were mostly evaluated favorably, presenting caregivers' satisfaction with the initiative and a positive reception in the children that decreased anxiety during the face-to-face session.

Thiele M. P., *et al.* 2\* [39], in a second case report, presents a female patient aged 9 years 11 months, with Pitt-Hopkins Syndrome treated by synchronous teleodontology in her first session. Remote care allowed an approach with the patient and her caregiver, establishing bonds of trust and recognition prior to the first face-to-face session. In this way, the collection of data referring to the patient's medical and personal history, presumptive diagnoses and indications for their caregiver was obtained, also effectively determining the need for face-to-face care as screening. The author concludes that teleodontology turns out to be a good means for a first approach and multidisciplinary treatment planning, as well as a great help in face-to-face sessions.

Della Maggiora, *et al.* [41], developed audiovisual material to complement the dietary advice given in the dental office to pediatric patients with disabilities. The video "What foods are good for our teeth?" was sent asynchronously to 2 patients, a 10-year-old with Global Developmental Delay and a 21-year-old with Down Syndrome. The video was also shown in a synchronous teledentistry session to a 7-year-old patient with autism spectrum disorder. All in the company of their caregivers who received the videos.

Lira T, *et al.* [42] defined the implementation of teleodontology as; technologies that facilitate the promotion of oral health. Through a video characterized by being playful and directed, exposing in a didactic and educational way the use of dental floss to two patients and their caregivers both with autism spectrum disorder of 9 and 10 years of age in an asynchronous way.

The authors, della Maggiora, *et al.* and Lira T, *et al.* [41,42], agree that audiovisual technology allows teaching in a didactic and entertaining way, capturing the attention of the pediatric patient and facilitating the learning of the educational content provided. Advantages stand out such as: establishing healthy habits, provid-

ing material remotely, attracting the different senses in a particular way, allowing the continuous reproduction of the material and educating in a friendly, educational and entertaining way. Also, it allows the dentist to optimize his clinical time in the consultation, making it more efficient, enabling the permanent reinforcement of promotion measures in face-to-face care and being a support material in synchronous teledentistry sessions.

They also highlight, in their work, promoting the use of teleodontology in promotional and preventive terms, since it would contribute to reducing risk indicators in the population. The need to continue studying the efficacy and long-term results of this type of methodology, to enhance its development and promote its use among dentists with pediatric patients with or without disabilities [41,42].

### Benefits of teleodontology in the care of pediatric patients

Daniel and Kumar [23] argue that advances in information and communication technologies have increased the potential methods and speed with which oral health professionals and patients can communicate. This impressive improvement in communication is the agent that makes teledentistry a beneficial mechanism for both the dentist and pediatric patients.

Some of the benefits exposed by the author [23] are detailed below

- Faster access to an oral health care provider and greater convenience and time savings for patients.
- Better access between primary, secondary, and tertiary care.
- Better quality of care.

Bohm Da Costa., *et al.* [22] share with Daniel and Kumar [23] and Estai., *et al.* 2014 [18] that remote dental care for children and adolescents in rural or low-income areas is a clear benefit for both the patient and the community. the dentist reducing the presence of oral pathologies such as dental caries, providing preventive care and educational promotional content, making referrals and inter-consultations, being a contribution in multi and interdisciplinary work in health and being an element of precision of treatment need.

Bohm Da Costa., *et al.* [22] point out, for example, that teleodontology is a beneficial tool for reducing malocclusions through

remote supervision of interceptive orthodontic treatments in patients who cannot be referred to the orthodontist.

Estai., *et al.* 2014 [18] mention the absence of geographical barriers as the main benefit of teleodontology, and it can be used globally.

The authors [22,23] also highlight that teleodontology used as the first session prior to face-to-face appointments increases the knowledge of the pediatric patient in terms of oral health and there is greater collaboration for work in the dental chair. Synchronous or asynchronous teledentistry turns out to be a familiar and friendly first approach with pediatric patients who consult a dentist for the first time. The use of technology is an element known by children and adolescents.

The reduction of costs is also a point highlighted by all the authors [18,22,23], this since costs are minimized in transfers to sectors with a rural population.

Estai., *et al.* 2014 [18] likewise point out that most studies available in the literature are short-term analyzes that evaluate cost minimization and do not present data in relation to cost-effectiveness and cost-benefit.

Daniel and Kumar [23] affirm that there are no studies in relation to the reduction of costs in urban populations or in the private sector, which is contrary to what was mentioned by Bohm Da Costa., *et al.* [22], who emphasize that this reduction in cost is both in rural and urban populations and referring to the public and private sector of pediatric dental care.

The authors [18,22,23] mention that most dentists and patients have reported experiencing optimism and satisfaction regarding DT and its integration into current dental practices due to the resulting possibilities of saving time and having easy access. faster to the medical case and a recommended treatment plan.

### Teledentistry as a tool in the SARS-CoV2 pandemic in the care of pediatric patients

The SARS-CoV2 pandemic had a great impact on dentists around the world, initially limiting face-to-face care to emergency situations and later implementing a series of measures for care and precaution against exposure to contagion. Different strategies were

developed to meet the needs of the population and continue providing services to maintain and improve the oral health of patients.

Shantanu, *et al.* [20] describe teledentistry as an extremely beneficial method in emergency situations, mentioning as one of its main characteristics the possibility of determining the need for face-to-face treatment. A greater susceptibility to rapidly evolving infectious processes stands out in the pediatric population, which triggers a high concern of caregivers regarding oral and systemic signs and symptoms, teleodontology would be the means by which unnecessary face-to-face visits would be reduced through a virtual consultation, being extremely useful in periods of public health crisis. Eliza DeDea, *et al.* [21] describe teleodontology as indispensable in the face of geographic or health restrictions.

In the same way, the author [21] characterizes the pediatric population as those who do not present severe signs and symptoms against SARS-CoV2, having a better prognosis. Together with Rahman, *et al.* [36], they mention teleodontology as a means of determining face-to-face service, mainly considering that pediatric patients often present as relatively asymptomatic cases and attend accompanied by their caregivers, increasing the risk of contagion by close contact in the dental care.

The Latin American Association of Pediatric Dentistry [9,17] proposes, in agreement with the authors mentioned above [20,21], that during periods in which there is a large number of active cases, face-to-face care is limited only to emergencies described as orofacial pain, inflammation, dentoalveolar trauma and hemorrhage. In this way, teleodontology would be used as the first consultation, synchronous or asynchronous, with a main focus on defining the need for face-to-face care and the symptomatic management of patients.

Eliza DeDea, *et al.* [21], like the authors [17,20], indicates that the teleodontology consultation in a SARS-CoV2 pandemic should ideally be carried out by videoconference, telephone call or other digital platforms, requesting the patient's caregivers as much as possible. number of images, videos, previous radiographs, or any material that could complement the presumptive diagnosis.

The author Eliza De Dea, *et al.* [21] agree with the Latin American Association of Pediatric Dentistry [18], in which the pediatric dentist or general dentist must maintain a soft, calm tone of voice that conveys confidence in order to establish a bond between the

professional and the pediatric patient, providing quality care. higher quality. Both authors recommend that the dentist explain to caregivers the scope, benefits, limitations, and responsibilities of this type of care given the health context in which he or she might be involved.

The authors Shantanu, *et al.* [20], Eliza De Dea, *et al.* [21] and the Latin American Association of Pediatric Dentistry [9,17] describe the actions to be carried out during the virtual consultation in a SARS-CoV2 pandemic, these range from screening for Covid19 under a standardized questionnaire, collecting a complete anamnesis and clinical history, delivering a presumptive diagnosis, provide therapeutic guidelines regarding the reason for consultation, symptomatic management, prescribe drugs if the case warrants it (under the considerations required by a pediatric patient), carry out promotion and education activities in oral health, indicate referrals and interconsultations if necessary. necessary and determine the need for face-to-face care. They also highlight that teleodontology is defined as the main means of monitoring and controlling patients after a virtual or face-to-face emergency consultation.

The Latin American Association of Pediatric Dentistry [18] highlights the increase in domestic violence as a global phenomenon during the SARS-CoV2 pandemic. For this reason, it strongly recommends reporting any sign of violence or physical abuse that could be investigated in the teleconsultation, maintaining the dentist's obligation to provide the information collected in this type of situation.

Rahman, *et al.* [36] in their study, evaluated the perspective of caregivers of pediatric patients treated with teleodontology in periods of greater SARS-CoV2 crisis. The patients were satisfied with 5 domains evaluated, which are presented below

- Patient satisfaction.
- Easy to use.
- Effectiveness in increasing access.
- System reliability.
- Utility for the patient.

The author [36] concludes that teleodontology facilitates the patient's access to medical-dental care, access to specialists and re-

quires less time and risk to obtain the service, preventing unnecessary exposure. It also defines screening and follow-up as the main approaches to teleodontology in health crises.

### Limitations

In relation to the limitations of the study, it is worth noting the heterogeneity in the articles included in terms of types of studies used, level of evidence and quality of the accepted reports, differences in the methodology and parameters of comparison and/or evaluation of the articles analyzed and diversity in the sample number and ages of the participants. There are also no long-term studies or randomized controlled clinical trials.

### Conclusion

In view of the evidence available in the literature, the importance and need to incorporate teleodontology as a fundamental part of comprehensive care in pediatric dentistry is revealed, due to its multiple uses, applications, and benefits for the child population with and without disabilities, being a contribution for dentistry thanks to the reception of information under a familiar, comfortable, and related method.

Despite the heterogeneity in the included studies, teleodontology is described as a widely developed tool in pediatric dentistry, defining its use and application for the pediatric population in the emergency area, diagnosis and treatment plan, promotion and prevention, care of patients with disability and in a SARS-CoV2 pandemic.

Teledentistry plays a key role in the provision of pediatric dental services, its main benefits being the absence of geographic gaps and a decrease in economic ones, multi- and interdisciplinary collaborative work, and being an element known to children and adolescents. Videoconferences, mobile applications, and audiovisual material allow expanding the knowledge of patients and their caregivers through oral health education.

Although the evidence has shown that teleodontology is an effective method in all the applications mentioned in this study, randomized controlled clinical trials with at least 1 year of follow-up are required in order to determine which method is the most effective and, therefore, the best way to perform teledentistry in the future.

### Conflict of Interest

The Authors declare no conflict of interest.

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