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Teledentistry in dental care of children

Primena telestomatologije kod dece

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Introduction

The use of telemedicine in dental care (teledentistry) has markedly expanded in recent years. The benefits it could afford in pediatric oral and dental health maintenance and improvement are numerous, presenting an attractive challenge to both clinicians and researchers. The essence of its popularity lies in a successful distant transfer of patient information and in a correct interpretation of the transferred patient data [1, 2]. In children, teledentistry is convenient in many ways, but its suitability lies primarily in timely and correct distant clinical diagnosis and in distant interspecialist consultations [3]. Nowadays, teledentistry is used in academic medical institutions, health care centres, managed-care companies, hospitals and health facilities in rural areas, and in international support provided to underdeveloped and developing countries [4]. Due to its close functional and technological interconnection with popular social networks and due to widespread use of mobile devices, teledentistry will certainly prove to be easily acceptable by the adolescent population [5].

Regarding the provision of dental health care advancements made in teledentistry applications, there are some new facts in the area of paediatric dental care.

Teledentistry in screening and diagnosis of dental diseases in children

Kohara et al. [6] have compared the performance of two different smartphone models and a conventional camera with direct clinical inspection in detection of caries and staging of the disease (degree of disease progression) on primary molar teeth in children, They concluded that it was possible to establish teledentistry diagnosis of larger carious lesions and to distinguish them successfully from the healthy teeth by using smartphone photographs. However, the method was not shown to be adequate in the detection of incipient and moderate carious lesions. Al Shaya et al. [7] investigated the reliability of mobile phone based teledentistry in the diagnosis and treatment planning for caries in children during mixed dentition period. The photographs obtained were kept on the Google Drive online platform, and sharing links were sent to investigators using a social network application WhatsApp Messenger (Facebook Corp, Mountain View, CA). The study demonstrated better reliability of teledentistry in primary than in permanent teeth. Moreover, it demonstrated that if used without radiography, teledentistry was not as precise as a clinical examination, but that mobile phone-based teledentistry afforded quite acceptable reliability in the initial diagnosis of caries in children.

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Estai et al. [8] investigated whether traditional clinical dental examination of caries detection in school children could be reliably replaced by a new method – teledentistry examination. The study showed a suboptimal distribution of resources dedicated to dental health care. Specifically, for the children with higher socioeconomic status (predominantly urban dwellers), half of the resources dedicated to dental health care was spent on direct dental examinations. The obtained results suggested that the use of teledentistry methods to examine children with low caries risk had the potential to save around 40 million US dollars a year, so that these resources could be redirected for dental care improvement of children affected by caries.

Teoh et al. [9] investigated the use of teledentistry in specialist dental care at the Royal Children's Hospital for rural and patients dwelling in the region, performing a cost-effectiveness analysis of a teledentistry consultation in comparison to standard consultations in this paediatric health care institution. They found that teledentistry represented an economically viable alternative to the standard practice of face-to-face consultations in this hospital.

Subbalekshmi et al. [10] assessed the reliability and feasibility of teledentistry in screening and diagnosis of dental caries in children aged three to six years. The study enrolled school children in whom the diagnosis of caries was made visually and with digital photographs taken by two investigators using an intraoral camera. It was concluded that in early childhood it was possible to screen for dental caries using digital photography at school-based dental examinations. The road to the use of teledentistry as an effective tool in the diagnosis of dental caries was thus open.

AlKlayb et al. [11] compared effectiveness of mobile phone applications in the education of mothers with children under six years of age within preventive dental care programs. The results showed significant improvement of their knowledge after using the mobile phone application, but even higher effectiveness in mothers with more children compared to those with one child. The study also suggested that the appropriate mobile phone application was able to improve the knowledge of mothers regarding paediatric oral and dental health preservation.

Estai et al. [12] compared the costs of teledentistry approach with those of traditional dental examination among the Australian school children. The cost analysis was accomplished from the perspective of an oral health system, developing a model which simulated the costs incurred by both of these methods for school children aged 5–14 years in Australia. Both fixed and variable expenses were taken into account, expenses for the wages, traveling and accommodation costs, and expenses for the supplies.

It was estimated that the method of teledentistry was able to reduce the overall expenses, and that efforts should be made by dental care service providers to adopt this approach based on new technology.

Pentapati et al. [13] examined reliability of intraoral teledentistry camera in screening oral conditions. They found that intraoral camera was a reliable tool to diagnose common oral diseases, and suggested further research to confirm reliability of teledentistry to diagnose following conditions: sealant retention, pre-malignant lesions, recurrent aphthae, gingival recession and dental malocclusion.

de Almeida et al. [14] used intraoral mobile phone-based photographs as a tool in distant diagnosis of traumatic dental injuries. These diagnoses were compared to the gold standard – in-person dental examination. The degree of agreement between these two methods showed that the accuracy of distant diagnosis was comparable to that made at in-person examination.

Purohit et al. [15] evaluated reliability of a video-graphic method, as a dental caries inspection tool, among 12-year old school children in a rural region in India. The results were compared to the direct visual-tactile examination of children, and the obtained results showed that teledentistry was comparable to clinical dental examination in screening caries among school children. Furthermore, the study provided evidence that teledentistry could be used as an alternative in distant assessment of dental caries and in treatment planning.

Estai et al. [16] estimated effectiveness of teledentistry approach with smartphone camera in distant examination of dental caries. An Android application was designed to collect photographs and upload them to an online server. The photographs were carefully inspected and a diagnosis was established to be compared to the findings obtained by direct clinical dental examination. It was found that, in spite of certain inherent limitations, mobile teledentistry had a possibility of detecting occlusal caries in photographs taken with mobile smartphones, and a combination of telemedicine technologies was recommended to produce a cheap and reliable tool for caries screening.

McLaren et al. [17] performed a study to evaluate accuracy of prediction of dental treatments modalities in children examined by video-based teledentistry. Retrospective reviews of the available dental records were performed in rural paediatric patients. The results indicated that video-based consultations in real time can be an effective way to help us determine the best treatment approach in children with dental diseases. Moreover, the study suggested video-conferencing for consultations in formulation of complex treatment plans for children.

Daniel and Kumar [18] performed a study to compare dental caries identification by dental hygienists using teledentistry compared by dentists using conventional method of clinical examination. The obtained results showed that dental hygienists were able to identify dental caries in photographs of children aged 4–7 years at the same level of accuracy as dentists in clinical settings.

Estai et al. [19] estimated if dental caries could be diagnosed in a valid and reliable way using intraoral digital photographs. In that study, smartphone cameras for taking the photographs and a cloud-server for uploading were used. The obtained results showed that such a teledentistry model had a potential for distant diagnosis of dental caries.

Estai et al. [20] performed a study to assess validity of online cloud-based teledentistry in oral diseases diagnosis. They used a store-and-forward telemedicine system. Their results suggested that such a telemedicine system could be a

valid and reliable alternative to traditional oral examination. They also pointed out a need for further improvement, refinement and robustness testing of such systems.

Torres-Pereira et al. [21] evaluated applicability of telediagnosis in oral medicine using e-mail transfer of digital clinical photographs made by electronic graph and digital camera, which were e-mailed. A distant diagnosis was established and compared to the gold standard. They found that such an approach was able to improve the accuracy of consultations in oral medicine.

Miladinović et al. [22] evaluated the use of telemedicine methods in pathology of odontogenic infections. Their results showed a satisfactory agreement between the diagnoses established using telemedicine and those made by in-person method. Furthermore, in their study, acceptable clinical diagnoses of odontogenic infections could be made using the method of telemedicine, providing a deeper insight into their nature, so that adequate patient management could be planned.

Živković et al. [23] investigated practical use of teledentistry in the diagnosis and routine management planning of endodontic-oral surgery patients and evaluated reliability of telemedicine diagnosis made from a distance. Further, they evaluated a possibility of adequate therapy planning within endodontic-oral surgery treatments. Their results showed that teledentistry can be successfully used in the diagnosis and planning of therapy for periapical lesions affecting frontal teeth, reducing the incurred costs and enabling patient dental management at distant locations. Živković et al**.** [24] studied validity of endodontic-oral surgery consultations using the store-and-forward method of telemedicine. They found that the accomplished consultations between endodontists and oral surgeons were absolutely acceptable and certainly comparable to visual-tactile dental examination of patients.

Comment on previous research in paediatric teledentristy and future research directions

The duty of all doctors is to provide to their patients, especially children, the best they can at the moment. Adverse treatment consequences are primarily the result of incorrect diagnosis, which can be avoided and prevented by using interspecialist consultations [25]. Here, teledentistry emerges as the most convenient method of choice, since it enables rapid, cheap and high quality distant consultation [26].

From a review of the available literature, the focus of teledentistry investigation in children can be seen in early caries diagnosis. The authors agree that a satisfactory distant diagnosis of caries can be obtained and treatment procedures can be decided upon this way as well [6, 8, 10, 12, 15, 16, 18, 19]. It is something to be expected, naturally, since the absence of caries constitutes a basis of oral health in children [27]. Screening for caries using teledentistry approach is possible even at locations without dental health services, while at the same time this approach reduces the costs related to diagnosis and treatment planning.

When other oral conditions are concerned, the authors agree that most of them can be successfully diagnosed from a distance [9, 11, 13, 17, 20, 21]. The situation is similar with the presence and assessment of odontogenic infections treatment [22]. Concerning periapical lesions, it has been reported that distant diagnosis based solely on intraoral examination is not sufficient; it has to be supplemented with radiography [23, 24].

Our opinion and suggestions for further research relate primarily to possibilities of teledentistry in the area of jaw orthopaedics. Further, future research should focus on practical use of distant interdisciplinary consultations in children (especially those with special needs). Then, there is the issue of practical use of teledentistry for interdisciplinary consultation in high risk paediatric dental patients, from the point of view of dentistry and other medical specialties.

Conclusion

Teledentistry has been increasingly used in its different forms in paediatric dental care. Studies designed to assess validity of such supplemental methods report high performance rates and high degrees of practical applicability. All the findings obtained so far encourage further development and use of teledentistry in children.

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