

# Tele-orthodontics: Tool aid to clinical practice and continuing education

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## Abstract

**Introduction:** Information technology is revolutionizing interpersonal relations. This new context has made possible the pursuit of professions in the health area, a concept known as telehealth. The essence of this area is the provision of health information at distance. In this context, orthodontics as a specialty can not remain oblivious to advances. **Objective:** This article, through a non-systematic literature review, set out to investigate which of the available technologies are likely to be used in the development of tele-orthodontics services as tools to aid clinical practice and continuing education. The use of technologies already available in the market can enable tele-orthodontics services. Even though this article has analyzed the technical conditions and technologies related to the study object, it tends to the ethical, moral, legal and economical aspects of this process.

**Keywords:** Telemedicine. Orthodontics. Computers. Information technology. Information systems.

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## INTRODUCTION

The Information Technology (IT) has changed interpersonal relations. In a global society, electronically interconnected and with no boundaries, the exercise of professions at distance is among the new experiences.

The development of communication programs, associated with state of the art machines, has allowed quick and efficient information transmission. This new context has made possible the exercise of health professions at distance,<sup>1,2,3</sup> a concept known as telehealth.

According to World Health Organization (WHO), telehealth (telemedicine, teledentistry, etc.) is the provision of services related to health-care where the distance is a critical factor. Such services can be provided through the use of communication technologies, with the goal of continuing education, necessary information exchanging to diagnose, treat, predict and prevent diseases.<sup>4,5</sup>

The essence of this concept is to provide services and information to the patient without leaving home. Thus, in a broader context, telehealth emerges as a new tool to overpass cultural, socioeconomic and geographic barriers.<sup>2,6,7</sup> Benefits include the access to specialists, improved primary health-care and increased availability of resources for education and professional information.<sup>1-7</sup>

Despite the current state of science for the telehealth services development, it is necessary the rational use of available technologies.<sup>8</sup> Currently, numerous projects for the development of at distance service networks are in progress, though most of them use computer programs themselves, a fact which makes them expensive and restricted — for this reason they are subsidized by government agencies, hindering its diffusion.<sup>8</sup>

In this context, orthodontics seeks to advance the use of telehealth tools, aiming to expand and modify the market when it comes to primary care to the patient, access to second opinion and professional at distance education.<sup>2,3,5,6,9</sup>

Brazil, a country of continental dimensions, characterized by the concentration of specialists in urban centers still provides the geographic isolation of many communities and professionals. Tele-orthodontics services can represent an efficient way to reduce these difficulties.

## OBJECTIVE

This study aimed to explore, through a non-systematic literature review, which of the communication technologies available on the market are likely to be used in the development of tele-orthodontics, as a tool to aid clinical practice and continuing education.

## MATERIALS AND METHODS

The investigation was designed as a non-systematic literature review. To conduct the survey of literature sources, we used the MedLine database, accessed through the PubMed search tool available on the National Center for Biotechnology Information site.

## Keywords

The search strategy included the following keywords:

- » Medical Subjects Headings (MeSH):  
*Computer. Informatics. Information systems. Orthodontics. Software. Telemedicine. Teledentistry. Technology.*

## Update

Justified by the rapid scientific and technical progress in IT, the survey was limited to articles published in the last 5 years.

## LITERATURE REVIEW

The paradigm change in patient care is one of the obstacles to the development of the concept of telehealth. To facilitate the interaction between professionals located in difficult access areas and big cities specialists, enabling assistance through tele-consultation represents a

new way of interaction between professionals and patients.<sup>1-9</sup>

### Broadband

The term refers to the networking of two or more computers through fixed telephone lines, mobile or satellite radio (Fig 1). Although some countries still do not have rules on the minimum speed for which a connection is considered broadband, the International Telecommunication Union (ITU) defines as the ability to transmit more than 1.5 or 2 megabits per second.

With this technology, distant transmission of clinical data is possible, allowing a second professional opinion. However, as for the privacy and security of data transmitted, there is still a risk of interception, since the connections are not secure.<sup>10,11</sup>

### Mobile phones

Mobile phone networks are based on cells (transmitting antennas), from which are generated and relayed signals via microwave at several frequencies, allowing the transmission and reception of information.

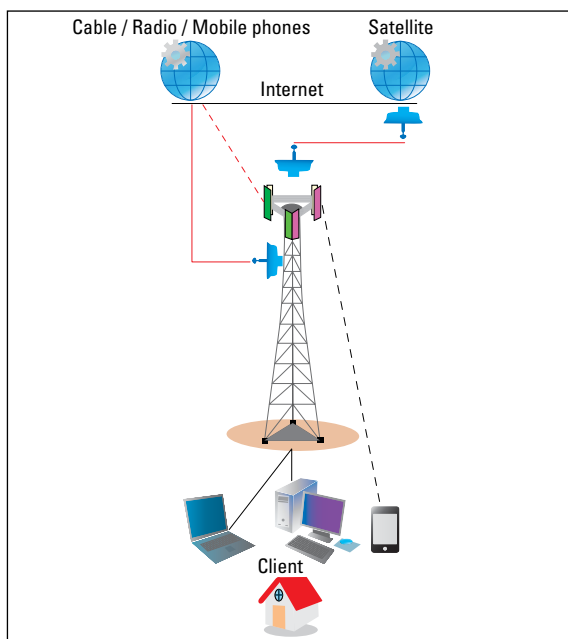


FIGURE 1 - Broadband network.

The 3G phones allow you to access the World Wide Web through devices known as smartphones, making it possible to access websites, to send e-mail and video conferencing.<sup>1-11</sup>

### Digital photography

The high quality digital photography is an aid for the development of telehealth services, mainly in specialties that often use imaging techniques (photographic and radiographic), such as orthodontics. In this context, digital images, along with the patient's medical history, help in the diagnosis and allow one to request a second professional opinion at distance.<sup>1,2,3,12-15</sup> It's important to consider as limiting factors of this system: The quality of images, which can vary depending on the lighting, photographic equipment, operator skill and technical expertise.

### Websites

Websites are sets of pages (hypertext) or applications (Application Service Provider - ASP) accessible through the World Wide Web, addressed through the Hypertext Transfer Protocol (HTTP). Compared with other technologies, websites have the following advantages:

- » Can be accessed using all computer operating systems.
- » Are available online, consuming very little computer memory.
- » Allows running on older equipment and mobile phones.
- » Allows the exchange of information between users in real time.
- » 24/7 availability, which facilitates communication among different time zones.
- » These are technologies of rapid evolution and adaptation.
- » They are not linked to large corporations.

Among the limits of technology

- » Vulnerability regarding confidentiality of data transferred.

- » The need for constant maintenance.
- » Dependence on a database.
- » Dependence on a broadband access point to be accessed.
- » Slow at times of high demand for access.

The use of websites in health-care allows to inform and educate the patient, and to establish two-way communication<sup>4,5,8,12,13,14</sup>

## DISCUSSION

Although there is no definition for tele-orthodontics in literature, it can be — based on the context studied through a set of quotes — suggested that it is the area of telehealth which studies the application of telecommunication and information technologies for the practice of orthodontics, without demanding the specialist presence, with the potential to develop actions such as: Diagnosis, planning, specialist consultation, education, research and assistance to people and professionals which can not easily travel.

Given the contemporary nature of this subject and its scarcity in the orthodontic literature, it is necessary an exploratory research to understand it. For this reason, in the present study a non-systematic literature review was adopted.<sup>16</sup>

## On the strategy and the results of the non-systematic review

After preliminary analysis of the recovered sources (Table 1), repeated sources were excluded, obtaining 28 sources as final result, which were submitted to the inclusion/exclusion criteria, resulting in 19 articles of interest to the study.

## As for the accessible technologies

The analysis indicated, among the actually available technologies, four with low cost and possibility of immediate use: Broadband, digital photography, mobile telephones and websites. However, for the tele-orthodontics exercise, there is still the need for development of the processes, specialists training and development of interconnection methods between professionals and patients (Fig 2).<sup>1-23</sup>

The convergence of communication technologies indicates the trend of development in this area. This is signaled by the changes that mobile and fixed telephone companies provided when they started providing access to the World Wide Web via broadband connections. This process made possible the development of products that will facilitate and enhance the exercise of tele-orthodontics (smartphones, netbooks, etc).

TABLE 1 - Results of the literature search strategy in the Medline database on May 3, 2010.

DATA SEARCH STRATEGY			
Descriptors relationship	Time criterium *(last 5 years)	Found sources	Selected sources
Teledentistry and orthodontics	*	5	5
Teledentistry	*	16	16
Telemedicine and orthodontics	*	6	6
Telemedicine and orthodontics and software computer	*	0	0
Telemedicine and orthodontics and software computer and information systems and informatics and technology	*	0	0
Telemedicine and orthodontics and software computer and information systems and informatics	*	0	0
Telemedicine and software computer and information systems and informatics and technology	*	12	12

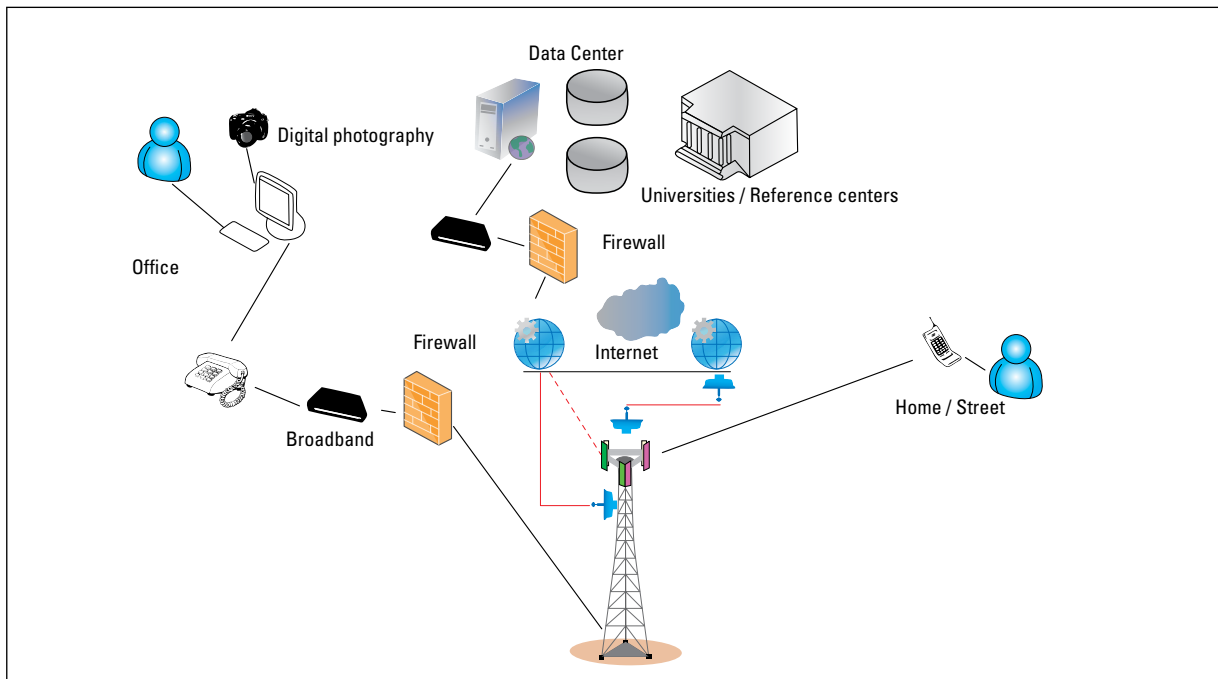


FIGURE 2 - Interaction of technologies to form a network.

Due to the availability of low cost technology and the connection to the World Wide Web, building a services portal aimed at tele-orthodontics becomes feasible. Online software can be developed using the PHP programming language, which is free and have multiple safe development environments. It also allows the use of open source softwares.<sup>1-23</sup>

A portal focussed on tele-orthodontics brings hope that, in a near future, general practitioners will be allowed to consult experts to better diagnose patients with dentoskeletal deviations, or it will even allows at distance consultations and teleconferences. It would be a way to overpass geographic barriers for the treatment of patients living in difficult access areas or that have locomotion difficulties.<sup>1-23</sup>

### Technical definitions for the practice of tele-orthodontics

Observe deployment costs, local availability, users technical knowledge and the need of professionals and patients, these are important factors for effective implementation and dissemination of tele-orthodontics services. Due to the trend of development of online tools (websites) and technical advances allowing greater security in data transmission, it appears consistent the use of these resources, since it does not require significant investments in equipment.

P2P communication programs (MSN, Skype, etc.) can be used as auxiliaries, however, they alone are not viable options, since they are linked to large corporations, which may, at any time, change its technology or charge for services.

This argument reinforces the indication of use of websites because, besides having great versatility, they don't need to be installed on each computer or phone.

As for the safety factor, the problem can be minimized through the use of tools such as anti-virus programs and firewalls, coupled with the use of digital certification. There are also issues of vulnerability when it comes to online applications, addressed to the present, with the development of digital signatures and data encryption.<sup>17,22</sup>

### **Validation of tele-orthodontics**

Experiments conducted by many institutions demonstrate the opportunities for the field of tele-orthodontics.<sup>2,3,5,6,7,11-14,23</sup> The results of the comparative studies developed between the Yakima Valley Farm Workers Clinic and Odessa Brown Children's Clinic (Washington) showed no significant differences between the groups submitted to clinical treatment and using tele-orthodontics.<sup>2</sup> According to this study, the outcomes of cases remotely handled suggest the clinical validity of the technique.

The level of the present technologies enables the development of tele-orthodontics, because they are accessible and affordable. From the scientific point of view, identifying the limitations of these services, legal implications and impact over the professional/patient represents the first steps to take advantage of opportunities generated by this new concept.<sup>6,7,9,23</sup>

The actions to be performed to implement these services are: The development of tools that enable scheduling, diagnosing, planning, data transferring and conference calls to facilitate the process of continuing education. However, the digitalization of clinical data and its transmission through the worldwide network of computers still generate discussions regarding safety. For this reason, emphasis has been given to seeking resources for certification and digital signature.

Finally, we see that not only the development of computer technology (hardware and software) will consolidate the tele-orthodontics. This new reality also changes the context of social relations, opening a vast field of ethical, moral, legal and economic questions.

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