Communication through telemedicine: home teleassistance in orthodontics

ABSTRACT

**Aim** The aim of the study is to codify both a methodological and communication standard based on teleassistance, and the emergencies that can be treated from a remote location along with the related clinical applications, limitations, medicolegal considerations and the patients' opinion on this new opportunity of assistance. **Materials and methods** To codify a distance communication method, ten young patients aged 10-16 years, equipped with a mobile videophone and after clear instructions, asked the advice of the orthodontic specialist to deal with minor orthodontic emergencies. Upon completion of the treatment they filled out a questionnaire on satisfaction level and difficulties encountered with the use of this technology. **Results and discussion** Most of the orthodontic emergencies can be solved at home: rubber ligature displacement, discomfort due to the appliance, irritation of cheeks. Those patients who used the videophone to handle the orthodontic emergencies considered it an easy and useful method, possibly due to the young age of the subjects involved, who are familiar with the new technologies. **Conclusions** Telecommunications applied to medicine and dentistry is currently a subject of topical interest. The most developed countries are investing resources in order to improve assistance and communication between physicians and patients and among specialists. The possibility of sharing videos and images is particularly useful in the orthodontic field, as minor emergencies can be solved easily at home, reassuring patient and parents on one hand, and limiting visits to the dental office to cases of real need.

**Key words:** Home teleassistance; Orthodontics; Orthodontic emergencies.

Introduction

In the dental practice office, verbal and nonverbal communication are key tools for engaging, motivating and promoting patient loyalty. The dentist is no more judged only for his medical performance, but also for the interaction of the dental team members, the atmosphere during the visit and for many other services which improve the quality appreciated by the patients (Vissink and Brand, 2006).

Video telephony and other informatics supports connected on web are new technologies which are essential for the medical profession [Mupparapu, 2007; Pololny, 2002; Currel et al., 2000]. The quality of telemedicine depends on the technology employed, on the clarity of sound, and on transmission quality and image resolution. Mobile phones of the latest generation are certainly not inferior, as regards technology, to digital cameras. It is therefore possible to send radiographic images of excellent quality and complete clinical documentation from a remote location, and set up real “teleconferences”.

Teledentistry represents a powerful means for continuing professional education and meetings between specialists working in areas very far from each other. It allows the exchange of information and knowledge sharing in real time, providing an opportunity for both personal and professional growth [Chen et al., 2003]. Many authors have spoken favourably about the use of this new technology [Bradley et al., 2007; Wallace et al., 1998].

In the most developed countries telemedicine, particularly teledentistry, are innovative fields and are spreading rapidly. The possible medical applications of this new technology are wide and not yet fully developed, especially when comparing different nations.

It was estimated that 40% of rural American communities had no dentists. Teledentistry therefore was seen as the solution to shorten distances and allow contact between these communities and the specialists operating in urban centers [Birnbach, 2000; Bauer and Brown, 2001]. As an example it is possible to remember the project called Total Dental Access (TDA) devised by the Department of Defense in 1994 [Rocca et al., 1999; McGee and Tangalos, 1994] and the project of the University of Minnesota, started in 2004, about remote consultation by videoconferencing and the submission of medical data via an electronic on-line system [Hong Chen and James, 2007].

Europe’s physical geography differs considerably from America’s: the assistance is more widespread throughout the region, so research focused in particular on the following.

- The possibility of providing home care to elderly patients who are difficult to move to specialised centers (Savenstedt et al., 2003).
- The possibility of immediately addressing any dental emergency, differentiating cases that actually require timely care from those that can be solved without the immediate intervention of the specialist [Parfitt and Rock, 1996; O’Brien and McComb, 1996].
- An opportunity for refresher training for dentists, thanks to an online exchange of experience and knowledge.
- The possibility of real-time data transmission about patients’ clinical history, given the creation of databases only accessible to authorized medical personnel [Cook et al., 2001].

In orthodontics, the most common domiciliary emergencies are the detachment of single parts of the appliance, the irritation of lips and cheeks and
microlesions related to the placement of the brackets. These problems can be faced very easily, but they involve a remarkable waste of time for the patient, who must join the dental practice office, and for the dentist, who has to devote a unit to the emergency case.

The aim of the study is codify both a methodological and communication standard based on teleassistance, and the emergencies that can be treated from a remote location along with the related clinical applications, limitations, medicolegal considerations and the patients’ opinion on this new opportunity of assistance.

Materials and methods

For testing and codification of the new method of communication, ten patients undergoing fixed orthodontic treatment were selected. The age of the subject at the time of placement of the orthodontic appliance ranged between 10.2 and 16 years.

After placement of the appliance, each patient was thoroughly instructed, with the aid of a mirror, on the composition and nomenclature of the orthodontic components. The purpose of the clarification was to provide clear information on the specialised terminology so as to facilitate communication between patient and dentist without misunderstandings, in case of breakage of specific components of the appliance.

Then the patient was instructed about the most frequent issues he/she might encounter at home and was provided an informative sheet with pictures, descriptions and solutions for specific problems (Table 1).

Patients were given a mobile videophone in order to consult the staff of the study, who were also equipped with the same device, in case of specific orthodontic emergencies between checkups. The patient was therefore able to present the problem to the operator, who was able to assess the seriousness of the case and then give practical advice for its resolution, or at least for improving the existing clinical problem.

At a later date, patients had to fill out a questionnaire on the use of the new method of communication and rate their level of satisfaction.

Results

The orthodontic emergencies are summarised in Table 2. All videocalls made by the patients were successful.

The most frequent orthodontic emergencies were loss of an elastic ligature (4 out of 10 cases) and irritation of lips and cheeks in the days immediately following placement of the appliance (3 out of 10 cases). Two cases involved debonding of a bracket, and in a single case displacement of the orthodontic archwire.

Five out of ten patients were able to deal effectively with the emergency without having to go to the dental office. The latter were cases of microlesions of lips and cheeks, solved by the application of orthodontic wax to the metal components of the appliance, and two cases of displacement of the elastic ligature, which was repositioned with the aid of tweezers. In the remaining

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**Table 1 - Management of orthodontic emergencies.**

<table>
<thead>
<tr>
<th>Case 1</th>
<th>Food impaction between teeth</th>
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<tbody>
<tr>
<td>Not a real emergency, but it can be annoying and embarrassing. It can be easily solved by using dental floss, an interproximal/interdental brush or a toothpick.</td>
<td></td>
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<table>
<thead>
<tr>
<th>Case 2</th>
<th>Ligature displacement</th>
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<tbody>
<tr>
<td>Ligatures keep the arch in place. They can be of two types: metal ligatures and rubber ligatures. When a rubber ligature is displaced, it can be repositioned with tweezers (i.e. eyebrow tweezers) or a toothpick. If a metal ligature has been displaced, it can either be removed with tweezers or, if it is untied and irritating the lip, it should be pressed with an object, i.e. with the rubber end of an eraser pencil, to remove the irritating factor.</td>
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<tr>
<th>Case 3</th>
<th>Discomfort due to orthodontic appliance placement</th>
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<tr>
<td>In the days immediately following the placement of the orthodontic appliance, small inconveniences such as tenderness and pressure sensations are the norm. Consumption of soft and fresh food is advised.</td>
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<table>
<thead>
<tr>
<th>Case 3</th>
<th>Displacement of the archwire</th>
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<tr>
<td>Occasionally, the end of the wire can be displaced from its site and irritate the mouth. In this case, try to push it with the eraser of a pencil against the tooth and, if it does not move in a more comfortable position, try to cover it with a piece of wax. If the archwire was extremely annoying and going to the orthodontist within a short time is not an option, another solution is to cut the archwire.</td>
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<table>
<thead>
<tr>
<th>Case 3</th>
<th>Bracket detachment or band debonding</th>
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<tr>
<td>If the appliance is debonded, the patient or the parent(s) should consult the orthodontist to agree on the actions to undertake. Brackets can become detached if the patient is not careful, such as if he/she eats or bites something hard. These kinds of food should be consumed with care. If the detached bracket twists around the archwire and protrudes outward, one should try to reposition it if the patient cannot be immediately seen by the orthodontist. The bracket can be slid between two teeth with the aid of tweezers and carefully rotated and repositioned against the buccal aspect of the middle third of the tooth.</td>
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cases of misplacement of the elastic ligature, the patients reported having lost them. Therefore, it was advised to reposition the orthodontic archwire and to go, without any particular urgency, to the dental office for the application of a new ligature. Even in the cases of bracket debonding, it was possible to guide the patients via videocall in repositioning the bracket in order to avoid irritation of lips and cheeks before going to the dentist for a new cementation. The patient whose archwire had been displaced was not able to reposition it properly. Therefore he was advised to cut it and to go to the dental office for its replacement. Upon completion of the orthodontic treatment, patients filled out a questionnaire on ease of use and level of satisfaction with the new method (Fig. 1).

The perceived level of satisfaction ranged from a minimum score of 6 to a maximum of 9 (mean 7.7).

FIGURES 2-8 show the operating sequence of a typical case of videocalls for orthodontic emergency.

Discussion

The videocalls made were characterised by good quality images, with no signal jamming, which is a fundamental prerequisite for a suitable remote orthodontic consultation. Patients presenting the problem and the operator had no particular difficulty in assessing the extent

<table>
<thead>
<tr>
<th>PAT.</th>
<th>SEX</th>
<th>AGE</th>
<th>TYPE OF EMERGENCY</th>
<th>THERAPEUTIC MEASURE</th>
<th>RESOLVED AT HOME</th>
<th>SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M</td>
<td>16</td>
<td>Archwire displacement</td>
<td>Cutting and replacement of the wire</td>
<td>no</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>M</td>
<td>15.7</td>
<td>Irritation of lips and cheeks</td>
<td>Orthodontic wax</td>
<td>yes</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>F</td>
<td>15.2</td>
<td>Displacement of elastic ligature</td>
<td>Archwire repositioning and ligature replacement</td>
<td>no</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>M</td>
<td>14.9</td>
<td>Displacement of elastic ligature</td>
<td>Repositioning</td>
<td>yes</td>
<td>9</td>
</tr>
<tr>
<td>5</td>
<td>F</td>
<td>14.3</td>
<td>Bracket debonding</td>
<td>Temporary repositioning and recementation at a later time</td>
<td>no</td>
<td>8</td>
</tr>
<tr>
<td>6</td>
<td>F</td>
<td>12.10</td>
<td>Displacement of elastic ligature</td>
<td>Archwire repositioning and ligature replacement</td>
<td>no</td>
<td>7</td>
</tr>
<tr>
<td>7</td>
<td>F</td>
<td>12.3</td>
<td>Irritation of lips and cheeks</td>
<td>Orthodontic wax</td>
<td>yes</td>
<td>8</td>
</tr>
<tr>
<td>8</td>
<td>F</td>
<td>10.9</td>
<td>Bracket debonding</td>
<td>Temporary repositioning and recementation at a later time</td>
<td>no</td>
<td>8</td>
</tr>
<tr>
<td>9</td>
<td>M</td>
<td>10.7</td>
<td>Irritation of lips and cheeks</td>
<td>Orthodontic wax</td>
<td>yes</td>
<td>7</td>
</tr>
<tr>
<td>10</td>
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<td>10.2</td>
<td>Displacement of elastic ligature</td>
<td>Repositioning</td>
<td>yes</td>
<td>9</td>
</tr>
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TABLE 2 - Type of emergency and therapeutic measure.

**FIG. 1 -** Questionnaire on satisfaction level.

**FIG. 2 -** The patient looks at herself in the mirror.

**FIG. 3 -** Debonded bracket. Upper right central incisor.

**FIG. 4 -** The patient videocalls the dental office.
of the emergency through the screen of the videophone. Each patient was advised to make the videocall under adequate light conditions, possibly using the flash of the phone to improve image resolution.

The use of this new technology allowed discrimination between emergency situations requiring the swift intervention of the orthodontist, from those that could be solved at home, even if under the guidance of the dentist. This is beneficial, both for the patient, who feels taken care of by the specialist and is not compelled to go to the dental office for minor issues, and for the orthodontist, who promptly solves minor issues while assessing in person, through a video or a picture, the real extent of the problem.

Users welcomed the use of dental teleassistance. The completed questionnaires showed that all patients felt more comfortable and protected. None of the interviewed subjects, probably due to their young age, reported difficulties with the use of the mobile videophone. All of them were familiar with the technology and they felt at ease using it. Therefore this new method is particularly suitable for orthodontic patients, who are usually young, while for other dental specialties its use can be less immediate.

The newly proposed teleassistance has medicolegal implications that should be taken into consideration by the specialist and the patient before the routine introduction of this method. In detail, the problems include:

- confidentiality of messages (protection from third parties trying to hack the adopted systems);
- message integrity (protection from third parties who hack protection systems and modify digital contents);
- authentication (verification of the identity of sender and recipient);
- digital signature (to avoid repudiation of the message);
- the consent of parents/guardians in the case of minors, and the ability to inform parents of the emergency call. The transmission of any information by telephone and via the internet entails the risk of interception by unauthorized individuals. The patient should be aware of this possibility, despite the efforts of the dentist/orthodontist to avoid it with any available means in order to protect the confidentiality of the data sent.

Data stored in digital format must be protected from any alterations, erasures, manipulations by computer viruses, any unauthorised person or accidental damage [Andersen, 1993; Hodge et al., 1999]. Even in Italy, there is an ongoing debate about the privacy safety standards of health information sent over the web. Currently it is left up to the individual to decide the best technological measure for the protection and exchange of health data.

The patient should also be informed and understand the inherent risk of inaccurate diagnosis or therapy following a failure of teledentistry technology beyond the dentist’s control. In the case of a bad connection, the information sent or received by the orthodontist may be distorted or incomplete. Therefore, a thorough explanation of the system, stressing both the undeniable benefits and the possible risks arising from the use of this new technology, is advisable.

From a medicolegal standpoint, the use of mobile videophone communication in orthodontics is more problematic since users are often minors. There are issues concerning the consent of parents/guardians, the correctness of the transmitted data and the informative feedback on the therapeutic advice given. However, it should be underscored that orthodontic teleassistance involves clinical emergencies, but that these are usually simple and easy to manage without major consequences for the final outcome of the treatment.
Clearly, these aspects of telemedicine and teledentistry must be clarified before the routine use of this new and powerful communication tool between physician and patient. Dentists who decide to include teledentistry in their practice should be aware of the legal, technological and ethical issues that its use entails (Daniel et al., 2000; Kuszler, 1999; Borowitz and Wyatt, 1998; Granade, 1995).

Conclusions

Teledentistry and dental videophony represent a new and powerful means of communication between physician and patient and among specialists. They allow the exchange of information between colleagues, and they can be used as cutting edge screening systems in order to reduce the waiting time of patients for specialist advice. If properly set up, their use can improve service and working conditions and possibly reduce costs.

From the study conducted, it emerges that teledentistry is a valuable tool in the case of orthodontic emergencies.

The legal aspect of electronic transmission of information should be carefully evaluated before employing these new technologies, in order to reduce risks, protect the patient’s privacy, and provide quality care.

References