

# Impact, Utility and Need for Tele Orthodontics in Recent Times-A Systematic Review

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## Abstract

**Introduction:** Tele orthodontics uses information technology to provide remote, global healthcare advice and treatment. This approach allows the exchange of patient-related information with healthcare providers and/or related organizations using digital technology such as radiographs and healthcare-related consultations. This is in contrast to the traditional methods of healthcare management, which rely on direct patient contact and communication. Furthermore, Tele orthodontics has been shown to be a valuable means of monitoring patients and facilitating patient-dentist communication, especially in the present COVID-19 pandemic that has challenged the existing global healthcare systems and all forms of healthcare policy.

**Objective:** To evaluate the impact, relevance and utility of tele orthodontics in today's era.

**Methods:** In this systematic review, the articles search was performed on relevant studies collected through systematically developed and executed search strategies for the past 10 years in the following databases: PubMed, Google Scholar, Ebsco, Medline etc. The research was carried out by online and offline surfing and 10yrs database records. 442 records were screened, out of which 8 articles were narrowed down to be included for the systematic review.

**Results:** There are eight articles, which suggested the impact and relevance of teleorthodontics in recent times.

**Conclusion:** Based on eight articles teleorthodontics is a go-to modality and an adjunct to traditional orthodontic diagnosis, consultation and treatment therapy.

**Keywords:** Teleorthodontics, Orthodontic Malocclusion, Digital Orthodontics

## Abbreviations

**WHO:** World Health Organization

**PICO:** Population Intervention Comparison Outcome

**DMTM:** Dental Monitoring Treatment Monitoring

## 1. Introduction

Telehealth (telemedicine, tele orthodontics, etc.) defined by the World Health Organization (WHO) as "The provision of healthcare services where distance is a key issue. "The usage of communication technology can be used to deliver such services. The idea behind this approach is to give services and information to

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patients without requiring them to leave their homes. Tele orthodontics, therefore, emerges as a new technique to overcome cultural, social, and geographic obstacles in a larger context. Access to experts enhanced primary healthcare, and more resources for education and professional knowledge are all the advantages it incorporates in itself.

Tele orthodontics refers to the delivery of dental medicine care, consultation, or treatment through the internet or virtual mode, instead of through direct physical interaction; or an associate orthodontist seeking peer advice by exchanging digital records and chatting via the net. Tele orthodontic consultations and coverings together with general dentists can ease dental medical aid. Diagnosis, planning, specialist consultation, education, research, and support for persons and professionals who are unable to travel are chief reasons for the very advent of tele orthodontics.

Orthodontists, similar to general medical practitioners delivering treatment care in real time, have evolved and encouraged modalities to deliver dental medicine treatments to people with restricted access to dental medicine care had encouraging outcomes within the early to mid-2000s.

In this global age of technology where the world is becoming smaller in context of connectivity, the concept of tele orthodontics is a direct reflection of increasing demand and growth in this field. This can be evidently seen by the changes created by mobile and telephone circuit phone suppliers once they began giving broadband access to the planet-wide internet. This technique sealed the method for the creation of devices that may create tele orthodontics additional accessible and effective (smartphones, netbooks, tablets etc.). Building a tele-orthodontics services portal is currently feasible because of the provision of low-priced technology and access to the net.

Moreover, telemedicine is not only able to facilitate communication and interaction between the healthcare provider and the patient, but also between the providers themselves. Indeed, it can, to a certain extent, remove geographical barriers, bridging gaps in the heterogeneous distribution that the healthcare system offers. Therefore, it can provide care for more people, enabling them to benefit from healthcare services, especially those who live in remote areas and/or have poorly developed healthcare facilities. It can simplify online transmission of diagnostic tests and reduce waiting lists for consultations through an enhanced organization of appointments. This makes these technologies a great resource in optimizing and reducing in-office visits and does not compromise necessary check-ups.

COVID-19 made it clear that we couldn't cease following up on orthodontic patients, thus the usage of tele-orthodontics became an interesting alternative, even if it isn't suitable in every instance and for extended periods of time. This clinical experience indicates that only tele-orthodontics may be used to manage functional appliances and alignments (such as Invisalign), which only take

follow-up to the treatment. Tele-orthodontics became necessary during the COVID-19 incident because it became clear that we could not cease following up on orthodontic patients. However, tele dentistry's intensive hands-on nature limits its ability to continue multibracket therapy. Even when it comes to oral hygiene or troubleshooting issues, almost all needed follow-ups involve direct participation from the doctor.

In recent years, the number of patients who wish to undergo orthodontic treatment requiring fewer in-office visits, while at the same time allowing the specialist to maintain control over the progress of their treatment, has grown. Tele orthodontics as a means to further reduce unnecessary journeys to the orthodontic practice while maintaining control over treatment is allegedly one of the main reasons tele orthodontics has gained ground over the past few years.

The development of clear aligners and lingual custom prescription brackets with robotic multi-wires has significantly reduced chair-side time and in-office visits. As a rule, aligners or wires are changed during in-office visits at pre-established appointments that have been made based on personal experience and common knowledge of an approximated time span for the wire to have exhausted its biological efficacy. However, a one-size fits all approach is not always ideal, as average values do not consider a patient's individual biological response. Tele orthodontics allows for tailor-made scheduled in-office visits through remote monitoring, promoting a more productive workflow.

These procedures are capable of reducing chair time and improving patient convenience. During the pandemic outbreak, orthodontists had to significantly reduce, and suspend follow-up visits of patients currently under active treatment schedules. We can therefore say that the use of applications for monitoring orthodontic therapy could be an effective solution to continue to keep deferrable orthodontic patients under control during the closure of dental practice due to COVID-19 pandemic and to reduce unnecessary in-office appointments.

As no reviews have yet been carried out on the efficacy of teleassistance in orthodontics as a way to manage patients at a distance, we would like to report on the evidence available regarding the possibility of implementing new technologies in tele orthodontics to help in remotely monitor patients' conditions.

## **2. Material Method**

Research was carried by online and offline surfing and 10 yrs database records based on following inclusion and exclusion criteria.

### **2.1. Inclusion Criteria**

- A) Cohort Study
- B) Randomized Control Trial
- C) Cross-Sectional Studies
- D) Survey Based Study

## 2.2. Exclusion Criteria

- A) Patients with Comorbidities
- B) Studies other than English Language
- C) Animal Studies
- D) Historic Reviews
- E) Commentaries
- F) Case Report
- G) Letters to the Editor

Relevant studies were collected through systematically developed and executed search strategies in the following databases: PubMed, Google Scholar, Ebsco, Medline etc.

## 2.3. Search Strategy

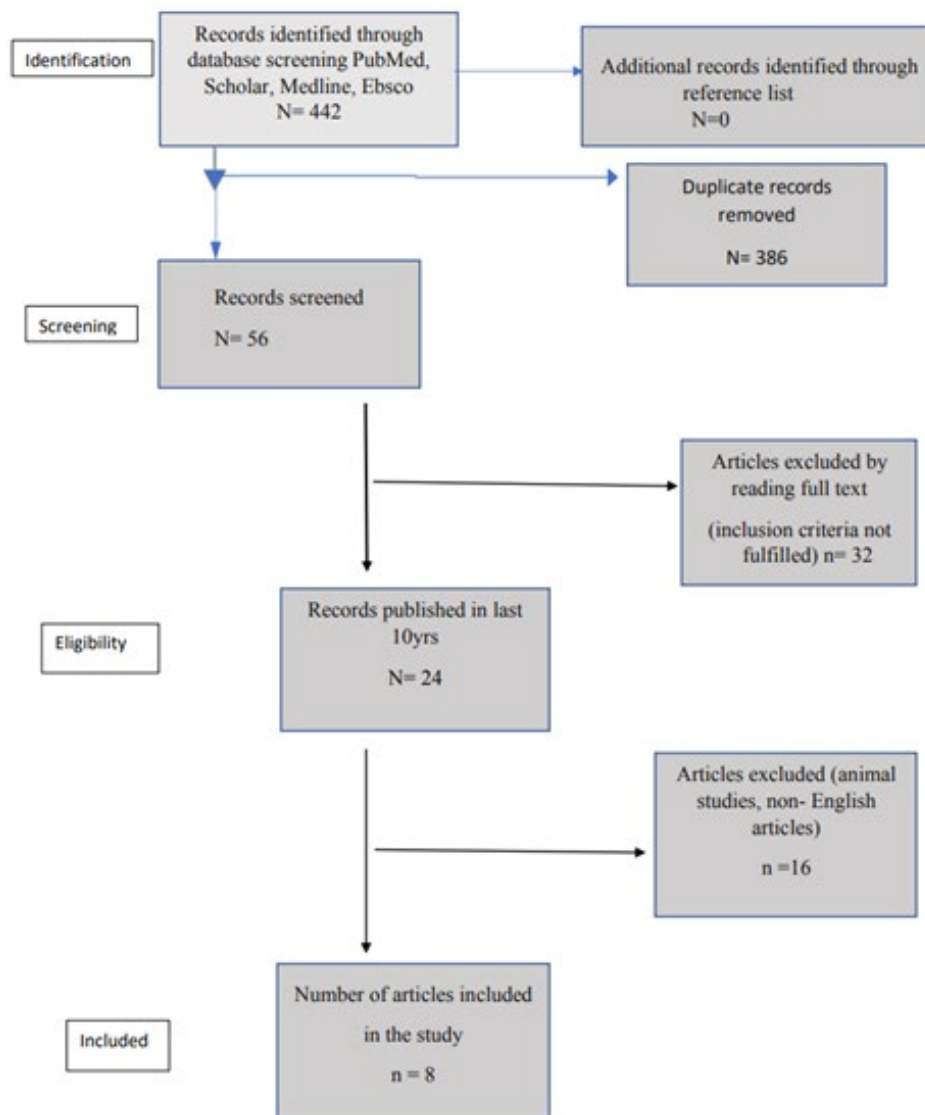
Literature was searched systematically, and studies were identified based on the- PICO (Glossary of Evidence Based Terms 2007)

1. Population is limited to patients with good general health; and having any form of malocclusion or orthodontic problems. Animal studies were excluded and only human studies were considered.

2. Intervention included exposure to various socio-economic variables in terms of income, availability of dental services, education and occupation.

3. Comparison of utility, relevance and impact of teleorthodontics in today's era.

4. Outcomes measured: Relevance and utility of teleorthodontics  
Socioeconomic and sociodemographic factors: Education, Income, Occupation Sex, Gender and nationality



**Figure:** Study Selection and Analysis According to Prisma Chart

### 3. Results

| S.no. | First Author           | Study Design                | Sample Size | Sample Size  | Conclusion  |
|-------|------------------------|-----------------------------|-------------|--|---|
| 1     | Jeff Berndt [1]        | In-Vitro study              | consecutive | Pretreatment and posttreatment orthodontic study models of 30 children treated by a general dentist using teledentistry and 96 children treated by orthodontic residents | The interceptive orthodontic treatments provided by sufficiently prepared general dentists and supervised remotely by orthodontic specialists through tele dentistry are a viable approach to reducing the severity of malocclusions in disadvantaged children when referral to an orthodontist is not feasible |
| 2     | Craig Dunbar [2]       | Cross sectional pilot study | consecutive | UK dental teaching hospital involving 27 subjects  | A change in the diagnostic information format affected treatment-planning reproducibility for half of the observers. Inter-observer reproducibility was greater when using hard copy records in comparison to digital records. No subjects were unsatisfied with their face to-face consultation.               |
| 3     | Ismaeel Hansa [3]      | In Vitro Study              | consecutive | 74 consecutively treated Invisalign patients using DMTM and 85 consecutively completed Invisalign patients   | The number of appointments maybe reduced with teleorthodontics .In addition, there was a positive patient perception on the use of teleorthodontics.  |
| 4     | Marc B Ackerman [4]    | In Vitro Study              | consecutive | A sample of 50 patients determined by inclusion and exclusion criteria were randomly selected from an initial sample of 200 patients                                     | It was noticed that there was no statistically significant difference between treatments supervised by Teleorthodontics delivery. There was no significant association between satisfaction and who the respondent was treated by.  |
| 5     | Alessandra Putrino [5] | In Vitro Study              | consecutive | One hundred orthodontic patients (57 F, 43 M, age 7-46) during quarantine were checked through videocalls and photos sent by patients following proper instructions      | Teleorthodontics is useful in managing orthodontic patients unable to carry out in-person control. When their effectiveness equals other systems, treatments with clear aligners without attachments should be preferred in patients unavailable for regular checks.  |

|    |                  |                |             |   |  |
|----|------------------|----------------|-------------|---|--|
| 6  | Xin Xiong [6]    | In Vivo Study  | consecutive | A total of 48 orthodontists were taken into account to evaluate anxiety levels in their patients                                | Teleorthodontics proved to be a viable option to reduce the anxiety in orthodontic patients and increase the accessibility for consultation in remote provinces. |
| 7  | Nour Basati [7]  | In Vitro Study | consecutive | 388 orthodontic patients (291 females and 226 males)  | orthodontists could easily deal with their patients who had problems related to their appliances when possible.  |
| 8. | P. P. Cotrin [8] | In vitro study | consecutive | Sample comprises of patients from private dental clinics of two orthodontists that were undergoing active orthodontic treatment | Teleorthodontic consultation played a major role in lowering anxiety level of patients   |

#### 4. Discussion

“Necessity is the mother of invention”. The very concept of tele orthodontics was devised as a demand and time based modality. Its need arose due to varied reasons ranging from treatment access in remote locations, peer review of malocclusion cases, ease of patient visits to de-stress psychological accelerations in patients due to pandemic kind of emergencies [3].

Teleorthodontics generally refers to any orthodontic consultation delivered through information technology like social media platforms. A common and relevant example could be that of colleagues being able to discuss the digital records of clinical cases over the internet and to exchange advice and share experience.

The first studies on teleorthodontics dates back to the early 2000s. A remarkable example that yielded promising results was a paper investigating the possibility to deliver orthodontic treatments through the remote real-time supervision of an orthodontic specialist for general dentists so as to reach patients with limited access to orthodontic care [5].

In the midst of the COVID-19 emergency, dental offices suspended all deferrable procedures in order to reduce the spread of the pathogen. As of now, dental emergencies are managed via remote triage (phone calls, e-mail or other online modalities) but digital techniques can help us in the prosecution of our clinical activity during prolonged emergency lockdowns. After Covid-19, pandemic digital platforms came to play a significant role in orthodontic practice and management. In this systematic review, we have exclusively included all the scope, need and effectiveness of teleorthodontics.

The scientific literature about tele dentistry is wide, mainly focusing on the prevention of dental caries by checking on people living in isolated areas, while literature about the use of tele dentistry in orthodontics is quite scarce and limited to the diagnosis and treatment planning phase via following media.

|   |
|---|
| INSTRUMENTS OF THE TELE-ORTHODONTICS                            |
| 1. Videocalls   |
| 2. Dedicated application (Smile consult, Align Technology Inc.) |
| 3. Sharing of photos (Intraoral, Extraoral)                     |
| 4. Instant messaging  |

Considering our experience with COVID-19, there is a clear evident need to propose a model of orthodontic care that combines the traditional way of treatment with tele-orthodontics, dividing the appointments into different types depending on the possibility of being performed in a telematic way, not only for aligners, palatal expanders and functional appliances, but also for multibracket appliances, considering that there may be phases where for example where progress can be obtained only by the use of elastics, without the direct intervention of the clinician.

Moreover, it can be useful to do an initial general screening of patients who cannot have a well-timed appointment at the dental office. Video meetings, in particular, allows to grossly monitor their respiratory habits (open-mouth breathing vs. nasal breathing), their chewing and swallowing patterns, their overall oral health, to document an evident malocclusion and draw an initial diagnosis [9].

| Advantages For Practitioner              | Advantages For Patient                      |
|--|---|
| Reduced personal contact                 | Saving time in travelling and office visits |
| Less risk of contamination               | Frequent reminders to maintain oral hygiene |
| Fewer missed appointments                | Possible troubleshooting                    |
| More counselling Opportunities           | Reduced anxiety in phobic patients          |
| Motivation and prevention re enforcement | Shorter appointments                        |
| Less chair side time and relative costs  | More time for counselling and prevention    |

| Telematic appointments                         | Traditional appointments           |
|--|------------------------------------|
| Screening<br>Treatment planning<br>explanation | First visit<br>Diagnostic testing  |
| Delivery of aligners                           | Dental impressions                 |
| Delivery and explanation<br>of elastics        | Bonding and unbonding              |
| Follow up                                      | Stripping                          |
| Orthodontic counseling                         | Changing of wires (fixed brackets) |
| Emergency consults                             |                                    |

| Appointments               | Office time | Tele-orthodontics |
|----------------------------|-------------|-------------------|
| Invisalign control         | 30 min      | 15 min            |
| Palatal expander control   | 15-40 min   | 5 min             |
| Brackets and wires control | 15-20 min   | 5 min             |

Tele-orthodontics is fundamental not only for the possibility to continue the orthodontic therapies but also, from a psychological standpoint, to reassure the patients and his/her parents about the development of their smile.

In the present systematic review, effectiveness of teleorthodontics has been explored in varied arenas including:

1. Patient Care and Convenience
2. Accessibility of Orthodontic Treatment to Remote Areas
3. Psychological Effects and Mental Health
4. Go-to Option During a Crisis like Pandemic
5. Clinicians' Convenience to Provide Quality Treatment
6. Cost-Effectiveness

## 5. Conclusion

In this era of uncertain pandemics and the need for a better health-care system, which is consumer-friendly and doctor-friendly, teleorthodontics is like a ray of hope. Its utility lies in the varied aspects of outreaching remote area patients to reducing anxiety

levels in orthodontic patients. It also reduces the follow-up visit workloads on the already drained healthcare staff. With the novice, advent in state-of-the-art infrastructure across the globe teleorthodontics is the new go-to option.

Teleorthodontics has a major utility and relevance in current times. Teleorthodontics is the go-to modality to be helpful to the clinician, especially in the time immediately after the emergency, when only two patients would be able to be visited in one hour and so the indirect cost for every patient will double up: all the check-ups that do not require a direct intervention of the orthodontist can be performed remotely, thus permitting to the orthodontist to perform the required number of check-ups and to the patient to save time and reduce the risk of infection; tele-orthodontics also allows to save time and money for both the dentist and the patient, reduce the number of missed appointments and to perform more controls in the phobic patients, especially in the patients who need to be monitored during the evolution of the physiological occlusion.

In all the emergency phases, tele-orthodontics is fundamental not only for the possibility to continue the orthodontic therapies but also, from a psychological standpoint, to reassure the patients and his/her parents about the development of their smile or correction of their malocclusion. It also aided in lowering the anxiety levels of orthodontic patients. Teleorthodontics is useful in managing Dental Centers and for planning health policies regarding prevention, education and economic support [10-14].

Proactive use of teleorthodontics permits forward thinking to reach and assure patients in need of orthodontic care in a new way as the current crisis evolved. The gradual advances in the dental scientific community have been possible because of the visionary approach to envisage such adversities as opportunities. The current situation has aided in gaining momentum in novel fields in orthodontics that are dedicated to optimal treatment modalities, embracing issues of accessibility, availability and affordability.

Teleorthodontics is bound to make a gigantic leap, considering its aptitude and impact, transcending spatial and temporal affairs, and establishing itself as a prime means of connectivity and its effectiveness can never be undermined to make our lives easier and for holistic social development.

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