DentalMonitoring

The benefits of using DentalMonitoring in fixed appliance orthodontic therapy:

Improved efficiency, early detection, and management of emergencies.

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Dr. Manzo graduated with honours in Dentistry in 1997, with a thesis on the correlation between occlusion and posture. In 2004, he specialised in Orthodontics and Gnathology cum laude. In 2007, he became a Ph.D. in Odontostomatological Sciences at the University "Federico II" of Naples. From 2009 to 2016 he was Visiting Professor at the School of Specialisation in Orthodontics at the same University.

Dr. Manzo is an international speaker and teaches courses and lectures and collaborates in postgraduate and Masters University programmes around the world on a wide range of topics, including interdisciplinary treatments, lingual orthodontics, low friction and self-ligating treatment, skeletal and non-skeletal class II therapy, biomechanics and skeletal anchors. He is the author and co-author of articles published in international scientific literature and of editorials, interviews, and scientific posters with which he has won awards and passed competitions. He has obtained the Certificate of Excellence and is therefore a member of the Italian Board of Orthodontics (I.B.O.) since 2007, the European Board of Orthodontics (E.B.O.) since 2011, and the European Board of Lingual Orthodontics (E.B.L.O.) since 2014. He was President of the Italian Academy of Orthodontics in 2020 and the Leading Alliance Society (European board of Italian members) from 2018 to 2020. He is currently President of the Scientific Committee of the Italian Academy of Orthodontics (AIdOR). He was a member of the Board of the Italian Dental Association from 2010 to 2014 and of the European Federation of Orthodontics from 2011 to 2015. In 2016, he was the Scientific Coordinator of the Italian Academy of Orthodontics.

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Abstract

Aim

The aim of this study was to explore the use of DentalMonitoring (DM), an advanced AI-powered remote monitoring system, for the purpose of increasing the efficiency of braces treatments in orthodontics. More specifically, we sought to study the impact on reducing the need for unnecessary in-person visits, timely triaging of emergency appointments, and hygiene improvement.

Materials and methods

Twenty patients undergoing braces treatment were included in this study and they were separated into 2 groups: Group A were monitored with DentalMonitoring and Group B had traditional office visits with no remote monitoring.

At the end of an 11-month period, the following data were collected for a statistical analysis: the total number of in-office appointments, the total number of emergency appointments (planned and unplanned), the number of hygiene alerts/instructions sent to the patients, the total number of hygiene visits scheduled.

Results and conclusion

The patients who used DentalMonitoring had 24.5% fewer in-office visits, 80.8% fewer unscheduled emergencies, they received 312% more hygiene instructions and alerts through the DM app, and they had fewer overall hygiene visits scheduled.

This study came to the conclusion that using DM with braces treatments can be a very efficient way to detect and manage emergencies remotely and as a result improve hygiene and overall treatment efficiency.

Introduction

In recent years, the field of orthodontics has seen a significant shift towards remote treatment monitoring.

This trend was accelerated by the COVID-19 pandemic, which led many orthodontists and researchers to explore the use of remote technologies to continue providing care for their patients by remotely managing check-up appointments, triaging emergencies, and keeping an open line of communication.

The preliminary results of these studies were mostly positive, showing that teleorthodontics can manage most emergencies that would have otherwise necessitated in-office visits, help in anticipating treatment needs and preparing necessary treatment resources, and replace regular check-up visits with patient-provided information accompanied by high-resolution images [1-2-3].

The promising results of these efforts have led to a continued focus on remote monitoring in the post-pandemic world [4]. However, it is important to note that most of these studies explored the use of basic digital communication tools like WhatsApp and Zoom, which are not best suited for the medical environment. One should keep in mind the limitations and inconveniences of basic tools that can be used for teleorthodontics purposes. Some of these barriers could be a concern for the security of data/health records, lack of hardware/software compatibility, lack of patient training, accuracy and quality of the information, and time-consuming for the practice especially when everything has to be manually reviewed [5].

The aim of this study was to explore the use of DentalMonitoring (DM), an advanced AI-powered remote monitoring system designed to monitor all orthodontic treatments, for the purpose of increasing the efficiency of braces treatments in orthodontics. More specifically, we sought to study the impact on reducing the need for unnecessary in-person visits, timely triaging of emergency appointments, and hygiene improvement.

Materials and methods

Twenty patients undergoing orthodontic braces therapy were included in the study. The sample was composed of 14 females and 6 males with a mean age of 20.5 years for group A (7 males/3 females) and 23 years for group B (7 males/3 females).

Group A was monitored with the Dental Monitoring System™ (A) and group B was monitored through traditional live appointments (B). Both groups had upper and lower full arch bonded fixed traditional appliances.

The treatment observation period for all patients was 11 months, during which the efficiency of the therapy and oral hygiene were assessed. The following parameters were evaluated:

- Number of in-office appointments.
- Number of in-office emergencies.
- Number of hygiene alerts received on DM for group A.
- Number of written notes in the patients' folder related to oral hygiene for group B.
- Number of scheduled hygiene sessions for group A and group B patients.

All data were collected and analyzed using appropriate statistical methods.

Results

A total number of 156 remote virtual emergencies for group A were handled remotely through DM. These emergencies were resolved by providing automated and personalised instructions to the patients, eliminating the need for an in-office visit.

For group B, only 81 out of the 121 (66%) scheduled emergencies were "real emergencies" necessitating a practice visit. Forty visits (34%) could have been avoided.

Group A received 103 automatic oral hygiene notifications based on the AI assessment through the DM app, compared to 25 oral hygiene notes written in the patients' folder by the Doctor for group B.

The number of oral hygiene sessions needed for group A during the observational period was 16 compared to the 27 scheduled for the group B patients in the same time interval.

Comparing the two samples, the results showed that there was a significant difference (p<0.05) with the following parameters:

- Group A patients attended 24.5% fewer visits. (Table 1)
- Group A patients recorded 80.8% fewer scheduled emergencies. (Table 2)
- Group A patients received 312% more hygiene instructions than group B. (Table 3)

The number of oral hygiene sessions scheduled was significantly different between the 2 groups, with group B necessitating 40.4% more hygiene visits. (Table 4)

TABLE 1 - *Total number of appointments for DM group (A) compared to group B*

	Coefficients	Standard error	Stat t	Significant value	Inferior 95%	Superior 95%	Inferior 95,0%	Superior 95,0%
Intercept	9.590909091	1.304097959	7.354439152	**0.00007959845737**	6.583653804	12.59816438	6.583653804	12.59816438
Variable X 1	-0.1818181818	0.7529213079	-0.241483645	0.8152547908	-1.918057831	1.554421468	-1.918057831	1.554421468

TABLE 2 - *Total number of emergency appointments for DM group (A) compared to group B*

	Coefficients	Standard error	Stat t	Significant value	Inferior 95%	Superior 95%	Inferior 95.0%	Superior 95.0%
Intercept	8.577777778	0.4563678395	18.79575429	**0.0000006633212512**	7.525391653	9.630163903	7.525391653	9.630163903
Variable X 1	1.444444444	0.5454638982	2.648102742	0.0293420498	0.1866024397	2.702286449	0.1866024397	2.702286449

TABLE 3 - *Total number of hygiene notifications for group A vs group B*

	Coefficients	Standard error	Stat t	Significant value	Inferior 95%	Superior 95%	Inferior 95.0%	Superior 95.0%
Intercept	9.382579934	1.14340089	8.20585327	**0.00003635322554**	6.745892753	12.01926711	6.745892753	12.01926711
Variable X 1	-0.007717750827	0.09605358992	-0.08034838503	0.9379338367	-0.2292177264	0.2137822247	-0.2292177264	0.2137822247

TABLE 4 - *Total number of hygiene appointments for group A vs group B*

	Coefficients	Standard error	Stat t	Significant value	Inferior 95%	Superior 95%	Inferior 95.0%	Superior 95.0%
Intercept	10.31343284	1.484424468	6.947765317	**0.000118684294**	6.890343874	13.7365218	6.890343874	13.7365218
Variable X 1	0.6616915423	0.4867619588	1.359373982	0.2111044051	-0.4607835475	1.784166632	-0.4607835475	1.784166632

Discussion

This study found a higher number of emergencies detected in the DM group compared with the control group (151 vs 121). This was due to the fact that DM's AI was able to detect issues early on, which patients can be unaware of, before they deteriorate and cause the treatment to go off-track. This early detection allowed us to remotely solve many of these emergencies when possible and for the rest to plan an appointment accordingly, avoiding unnecessary and unanticipated situations. This was not the case for the control group, as 34% of the emergency appointments could have been avoided and 80.8% of the emergencies treated in practice were unanticipated. This result confirms the findings of the studies mentioned earlier regarding the possibility of handling and triaging emergencies efficiently with remote monitoring. With braces treatments in general, the most common situations are debonding, opened clip, trauma to the mucosa, distal wire sliding, unsettling of ligature, and gingivitis[8]. In many cases, the patient can be guided through the app on how to handle each situation. For example, when the concern is physical discomfort resulting from sliding wires or ligatures, the patient is guided on how to use dental wax or tweezers to adjust the wire position. When the concern is related to appliance mechanics, such as an open clip, the patient can also be guided remotely on how to close it. And for situations that cannot be managed remotely, such as a debonded bracket, early detection is key to assessing the situation in a timely manner and planning the next appointment accordingly.

Another aspect of early detection, regular follow-up, and digital communication is patient reassurance and improvement in compliance, specifically hygiene. In this study, the DM patients received significantly more hygiene instructions than the control group (312% more) which led to a noticeable hygiene improvement as the DM patients needed significantly fewer hygiene visits. Other studies in the literature found that the use of smartphone apps can increase orthodontic patients' compliance and lead to significant improvements in oral hygiene, especially in patients undergoing braces treatments.[9-10 -11]

Lastly, there is a time-saving element due to increased efficiency. The DM group had 24.5% fewer practice visits as a result of eliminating unnecessary visits and triaging emergencies. Other studies have shown that using DM with self-ligating treatments lead to a significant decrease in the number of appointments needed, especially in the first phase of the treatment where the appointment interval can be further extended to allow the wire to express its full prescription [12]. This means that there is a reduction in the mean period of chair time, of material costs and number of visits; moreover, there is an increase in the frequency of patients' monitoring, resulting in a more precise evaluation of treatment by the orthodontist.

Conclusions

Using DentalMonitoring with braces treatments proved to be a very efficient way to detect and manage emergencies remotely. Closely monitoring patients' treatments through regular scans screened by the AI meant that issues that would usually go unnoticed were detected more often and earlier, allowing action to be taken in a timely manner to prevent deterioration and solve issues remotely. With the control group, the emergencies did not require in-office visits in 34% of cases and 80.8% of the emergency visits were unanticipated. This resulted in significantly decreasing overall appointments by 24.5% for the DM group, with all of the emergency visits being anticipated and prepared for in advance. Additionally, there was an observed improvement in hygiene with the DM group.

References

1. Favero, L.; Pavan, L.; Arreghini, A.; Communication through telemedicine: Home tele-assistance in orthodontics.. Eur. J. Paediatr. Dent. 2009, 10, 163-167.

2. Stein, C. D., Xiao, X., Levine, S., Schleyer, T. K., Hochheiser, H., & Thyvalikakath, T. P. (2016). A prototype mobile application for triaging dental emergencies. Journal of the American Dental Association (1939), 147(10), 782–791.e1. https://doi.org/10.1016/j.adaj.2016.03.021

3. Maspero, C., Abate, A., Cavagnetto, D., El Morsi, M., Fama, A., & Farronato, M. (2020). Available Technologies, Applications and Benefits of Teleorthodontics. A Literature Review and Possible Applications during the COVID-19 Pandemic. Journal of clinical medicine, 9(6), 1891. https://doi.org/10.3390/jcm9061891.

4. Caprioglio, A., Pizzetti, G. B., Zecca, P. A., Fastuca, R., Maino, G., & Nanda, R. (2020). Management of orthodontic emergencies during 2019-NCOV. Progress in Orthodontics. 21(1). https://doi.org/10.1186/S40510-020-00310-Y

5. Jampani ND, Nutalapati R, Dontula BS, Boyapati R. Applications of teledentistry: a literature review and update. J Int Soc Prev Community Dent. 2011 Jul;1(2):37–44. doi: 10.4103/2231-0762.97695.

6. Saccomanno S, Quinzi V. Utility of Teleorthodontics in Orthodontic Emergencies during the COVID-19 Pandemic: A Systematic Review. Healthcare (Basel).2022 Jun 14;10(6):1108

7. Gyawali, R., Pokharel, P. R., & Giri, J. (2019). Emergency appointments in orthodontics. APOS Trends in Orthodontics. 9(1), 40–43. https://doi.org/10.25259/APOS-9-1-7

8. Gyawali, R., Pokharel, P. R., & Giri, J. (2019). Emergency appointments in orthodontics. APOS Trends in Orthodontics. 9(1), 40–43. https://doi.org/10.25259/APOS-9-1-7)

9. Borujeni, E.S.; Sarshar, F.; Nasiri, M.; Sarshar, S.; Jazi, L. Effect of teledentistry on the oral health status of patients undergoing fixed orthodontic treatment at the first three follow-up visits. Dent. Med Probl.2021, 58, 299–304.

10. Farhadifard, H.; Soheilifar, S.; Farhadian, M.; Kokabi, H.; Bakhshaei, A. Orthodontic Patients' Oral Hygiene Compliance by Utilizing a Smartphone Application (Brush DJ): A Randomized Clinical Trial. BDJ Open 2020, 6, 24.

11. Rozenblum, R. et al. The impact of medical informatics on patient satisfaction: a USA-based literature review. Int J Med Inform. 82, 141–158 (2013)

12. Impellizzeri A, Horodinsky M. Dental Monitoring Application: it is a valid innovation in the Orthodontics Practice? Clin Ter. 2020 May-Jun;171(3):e260-e267.

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