Original Article

The influence of text messages on the cooperation of Class II patients regarding the use of intermaxillary elastics

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ABSTRACT

Objectives: To evaluate the influence of text messages on cooperation of Class II patients with the use of intermaxillary elastics.

Materials and Methods: The sample consisted of 42 orthodontic patients (20 males and 22 females) aged between 14 and 34 years. They were randomly divided into one of the following two groups: a control group with 21 patients who did not receive messages and an experimental group with 21 patients who received motivational and reminder text messages. Messages were sent twice a week for a period of 3 months. The patients were instructed to wear the elastics all day, removing them only during meals and replacing them daily. All patients were instructed regarding the importance of cooperation. Measurements were performed with a digital caliper on plaster models at the beginning of elastics wear (T1) and 3 months later (T2). For intragroup and intergroup comparisons between T1 and T2, paired and unpaired *t*-tests, respectively, were used with a significance level of 5%.

Results: Statistically significant differences were observed in the intra- and intergroup comparisons between T1 and T2. Both groups showed a decrease in the sagittal distance between upper and lower arches from T1 to T2, demonstrating the effective use of elastics. However, the experimental group showed a Class II correction that was 3.7 times greater than the control group ($P = .001$).

Conclusions: Text messages had a positive influence on the cooperation of patients regarding the use of intermaxillary elastics in the orthodontic treatment of Class II malocclusion. (*Angle Orthod.* 2019;89:111–116.)

KEY WORDS: Angle Class II malocclusion; Intermaxillary elastics; Text message; Patient cooperation; Orthodontics

INTRODUCTION

Orthodontics is a complex specialty in which the success requires the technical knowledge from the orthodontist as well as the cooperation of the patient and support from the patient's family.[1] Importantly, options for the treatment of malocclusion should include a protocol with the smallest possible chance of failure. Corrective devices should be comfortable, provide rapid and effective treatment, and favor patient compliance with orthodontic treatment. Previous studies[1–6] evaluated possible methods for improving cooperation with orthodontic treatment, especially regarding the use of removable accessories such as intermaxillary elastics. An awareness of factors that lead to greater adherence to instructions is important for determining the best therapy for each patient as well as for overcoming possible limitations.

The internet is an emerging tool to facilitate doctor–patient interactions. With the increasing number of people around the world who can access the internet and the increasing use of social media,[5] this modality will probably become even more significant in the future**.** Web tools can help in pedagogical activities, both in the presentation of information and in facilitating collaborative interactions between individuals.[4,7] Currently, the new digital generation expects flexibility

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Table 1. Compatibility Between the Control and Experimental Groups Regarding Sex[a]

	Sex, n (%)		
Group	Male	Female	Total, n (%)
Control	10 (47.6)	11 (52.4)	21 (100.0)
Experimental	10 (47.6)	11 (52.4)	21 (100.0)
Total	20 (47.6)	22 (52.4)	42 (100.0)

Table 2. Compatibility Between the Control and Experimental Groups Regarding Age[a]

Control		Experimental			
Mean	SD	Mean	SD	Diff.	*P*
19.67	6.75	18.38	6.16	1.29	.523*

[a] SD indicates standard deviation; Diff., difference.
* Statistically insignificant difference ($P > .05$).

along with the rapid satisfaction of its needs. This requires adjustments to new habits, actions, and events related to human behavior. Thus, it is important to know how to use technology effectively to enable the achievement of positive results in oral health through true communication links between the generations. The search for strategies to promote communication between patients and doctors supports rapid access to digital interfaces in clinics, especially in the field of oral health.[5]

Considering the high level of Facebook, Twitter, and WhatsApp usage, among others, the concept of associating the use of intermaxillary elastics with a weekly follow-up on one of these social media interfaces should be tested to determine whether this can lead to a more effective treatment approach.[5] The literature regarding professional/patient interactions mediated by these technological tools remains scarce. The aim of this study was to provide the dental community with information regarding a new device that can be used to aid patient cooperation with orthodontic treatment.

MATERIALS AND METHODS

This prospective study was approved by the Research Ethics Committee of Sagrado Coração University (Bauru, Brazil) under Protocol 1.395.256.

The sample consisted of 42 patients (20 males and 22 females) aged between 14 and 34 years who were selected from a single private office. For inclusion in this study, the patients needed to present with an angle Class II malocclusion (from one-fourth to three-fourths cusp severity), with indication for the use of intermaxillary Class II elastics. The patients were also required to have smartphones. Class II patients treated with exodontia and patients with diseases or dentoskeletal deformities were excluded from the participant pool.

The sample was randomly divided into one of the following two groups using a computer-generated randomization list created via Microsoft Excel (2007; Microsoft, Redmond, Wash): a control group and an experimental group matched according to the age and sex of the patients (Tables 1 and 2). The control group consisted of 21 patients: 10 males (47.6%) and 11 females (52.4%), with a mean age of 19.7 years (standard deviation = 6.7 years). The experimental group consisted of 21 patients: 10 males (47.6%) and 11 females (52.4%), with a mean age of 18.4 years (standard deviation = 6.2 years).

Patients from both groups were treated with conventional fixed metal orthodontic appliances. Brackets with Roth prescription and 0.022″ slot were bonded in both groups. The sequence of arches used during leveling was the following: 0.014″ Nitinol (NiTi), 0.016″ NiTi, 0.018″ NiTi, 0.018″ stainless steel, 0.020″ stainless steel, 0.019″ × 0.025″ NiTi, and 0.019″ × 0.025″ stainless steel.

When the stainless steel 0.019″ × 0.025″ archwires were placed in both arches, the patients began to use 3/16″ diameter Class II orthodontic elastics with an initial strength of 300 g. A ball hook was installed in the upper arch on the rectangular wire between the upper lateral incisor and the upper canine on both sides. Intermaxillary elastics were placed between the hooks of the upper arch and the hooks of the band tube in the lower molar.

The patients were instructed to wear the elastics all day, removing them only during meals and replacing them with new ones daily. All patients were instructed in the use of the intermaxillary elastics and the importance of following the instructions. The experimental group received reminders (text messages) through social media; the control group did not. All patients in the experimental group had their names and telephone numbers registered in a database used to determine who received the messages. Messages were sent through the WhatsApp application from the office's mobile device as individual private messages twice a week (Monday and Thursday mornings) during a 3-month period. Receipt of a message was confirmed by the application itself. To avoid losing the patients' interest, six different messages were created and were used in alternation. After this period, the messages were terminated and the results were analyzed. The messages contained the following reminders:

1. "Wear the elastics, the success of your treatment depends on it, I'm counting on you!"
2. "The week is starting, do not forget to wear the elastics!"

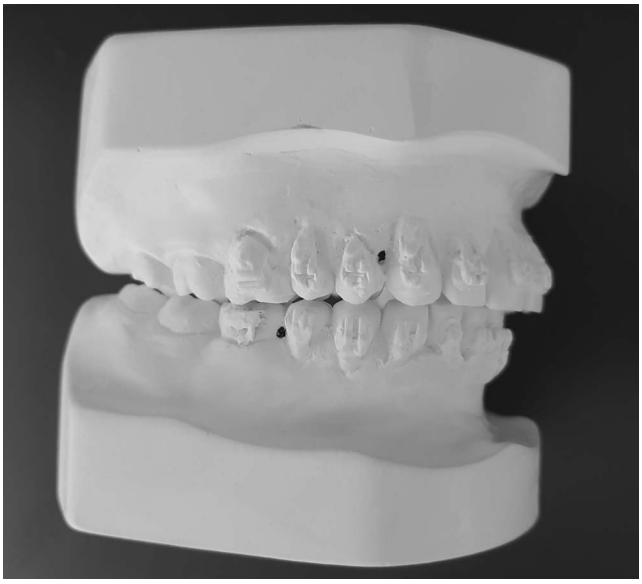

Figure 1. Plaster model for measurement with the marks in the upper arch between canine and first premolar and between first molar and second premolar in the lower arch.

3. "The week went quickly, tomorrow is already Friday, remember to wear the elastics on the weekend!"
4. "A smile can change the world around you, keep improving your smile, wear the elastics!"
5. "Health begins with the mouth, take care of your health by wearing the elastics!"
6. "Do not forget: your treatment needs daily maintenance, activate your device daily by wearing the elastics!"

Measurements were performed on plaster models obtained at the beginning of intraoral elastics installation (T1) and 3 months after (T2).

Occlusal records, wax bite blade no. 7 (Lysanda, Belo Horizonte, Minas Gerais, Brazil), were taken at both T1 and T2. The space between the upper canine and first premolar and the space between the lower first molar and second premolar on both sides were marked with a fine-tip text marker pen (Figure 1). The distance between these spaces was recorded at T1 and T2 with the aid of a Mitutoyo digital caliper, model Absolute Digimatic Caliper 150 mm (Mitutoyo Sul Americana Limitada, Suzano, São Paulo, Brazil), after previous calibration by a single researcher. The identifications of the models were blinded to ensure the anonymity of the groups and impartiality of the researcher during the measurement.

To confirm the examiner's calibration and ensure reproducibility of the data, an intraexaminer evaluation of the error was performed. Of the total sample, 30% was randomly selected, and after 30 days the measurements were repeated. The systematic error was examined using a *t*-test with a significance level of 5% ($P < .05$). The casual error was calculated using the Dahlberg formula.

Statistical Analysis

The data were described in tables and graphs in terms of mean and standard deviation. The right and left sides were measured separately. For comparisons between T1 and T2 and between the groups, the mean values of the measurements on the two sides were calculated. Kolmogorov-Smirnov normality test was applied, and all the measurements presented normal distribution. For comparisons between T1 and T2 timepoints, a paired *t*-test was used. For comparisons between the control and experimental groups, the independent *t*-test was used. The χ^2 and proportion tests were used to compare the groups regarding sex and age. A significance level of 5% ($P < .05$) was used for all tests. All statistical procedures were conducted using Statistica software version 13 (StatSoft Inc., Tulsa, Okla).

RESULTS

Power of the Sample

Using a significance level of 5% and based on the mean standard deviation obtained from the two groups, the sample size of 21 participants in each group demonstrated a power of 80% to discriminate a minimum difference of 0.35 mm between the two groups.

Systematic intraexaminer error was analyzed using a paired *t*-test, and no statistically significant difference was observed for either group ($P = .194$ and $P = .64$). In the determination of the casual error, the error calculation proposed by Dahlberg was used; no casual error was detected (variation of $0.03 - 0.09$).

In the intragroup comparison between T1 and T2, statistically significant differences were observed. Both groups showed a decrease in measurements from T1 to T2, demonstrating the effectiveness of the use of elastics (Table 3, Figure 2).

In the intergroup comparison, a statistically significant difference was observed between the means of

Table 3. Comparison of Measurements of the Sagittal Distance Between Upper and Lower Arches Between T1 and T2 for Both Groups[a]

	T1		T2			
Group	Mean	SD	Mean	SD	Diff.	*P*
Experimental	16.86	1.28	15.35	1.33	−1.50	<.001*
Control	17.18	1.25	16.77	1.24	−0.41	<.001*

[a] T1 indicates beginning of elastics wear; T2, 3 months later; SD, standard deviation; Diff., difference.

* Statistically significant difference ($P < .05$).

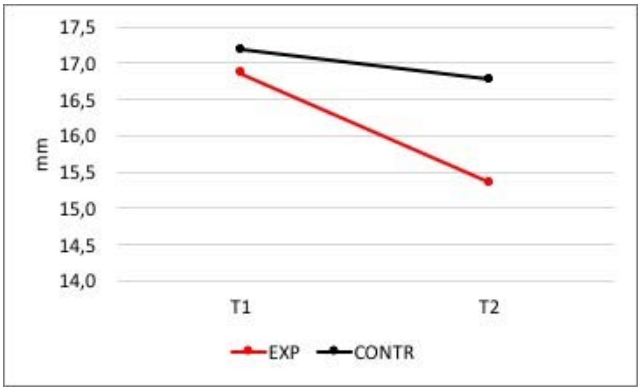

Figure 2. Measurements of the sagittal distance between the upper and lower arches for both groups at the beginning of elastics wear (T1) and 3 months later (T2).

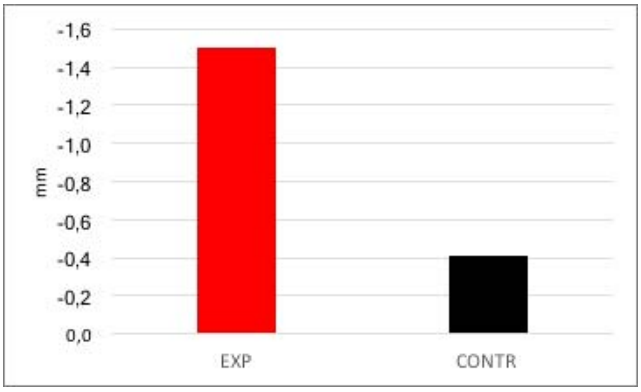

Figure 3. Comparison of the measurements between groups (T2–T1). T1, beginning of elastics wear; T2, 3 months later.

the experimental and control groups at T2. Although both groups showed a decrease in the sagittal distance between the upper and lower arches from T1 to T2, the experimental group showed a Class II correction that was 3.7 times greater (Table 4, Figure 3).

DISCUSSION

The power that technology exerts within modern society is undeniable. Whether in the sciences or in the social world, it is pervasive. The most viable option appears to be learning from the advances of this digital age and then coopting and using them to our benefit. One of the technological innovations that has made great progress in recent years is social media with the creation of networks such as Facebook and Twitter and communication applications such as WhatsApp. Previous studies have demonstrated the utility of these tools as means of information dissemination,[6,7] advertising,[5] patient loyalty enhancement, and health management.[8,9] However, research is scarce regarding the use of social media in situations that require the cooperation of a patient.

One of the most common types of malocclusion, Class II,[10,11] has been successfully treated using intermaxillary elastics.[12,13] Notably, the use of these elastics requires patient cooperation for success.[2]

Table 4. Comparison of the Measurements Between Groups at T1, T2, and T2–T1[a]

	Experimental		Control			
Measurement	Mean	SD	Mean	SD	Diff.	*P*
T1	16.86	1.28	17.18	1.25	−0.33	.408, ns
T2	15.35	1.33	16.77	1.24	−1.42	.001*
T2–T1	−1.50	0.57	−0.41	0.20	−1.09	<.001*

[a] T1 indicates beginning of elastics wear; T2, 3 months later; SD, standard deviation; Diff., difference; ns, statistically insignificant difference.

* Statistically significant difference ($P < .05$).

However, patient cooperation is difficult to predict using simple methods of psychological or behavioral evaluations.[3] Therefore, this study tested whether the interaction between the professional and patient via social media technology could increase cooperation with the use of elastics. The present findings showed that, in the group to which social media messages were sent, a threefold greater effect ($P < .001$) was observed from the use of elastics. In both groups, there was a decrease in the sagittal distance between the upper and lower arches from T1 to T2 (Class II improvement), but the elastics were much more effective for the group who received the messages.

The findings revealed that the interaction between the orthodontist and patient through social media led to a considerable difference between the groups. This result may have been because of increased compliance in the use of the intermaxillary elastics, which was influenced by the motivational notes and texts sent by the social media application and because of the frequent communication that was established between the professional and the patient with the aid of this tool.

The use of intermaxillary elastics is a well-established technique with proven effectiveness in orthodontic treatment. One of the contraindications for its use is a lack of cooperation by the patient. The results of this research are of great clinical relevance as the patient/professional interaction mediated by the application resulted in greater cooperation of the patients with the therapy. Thus, the use of intermaxillary elastics was more effective and potentially contributed to a reduction in treatment duration.

The increased cooperation of patients who received the messages from the application corroborates the study by Pinchani et al.[14] in which the authors concluded that a message reminder system with motivational texts was highly effective, raising awareness of the importance of patient cooperation in relation to the daily use of elastics, thereby obtaining

a better result in terms of adherence to the use of the devices. This improved cooperation by the experimental group also corroborates studies by Prado et al.,[15] who analyzed the impact of short message services on patient cooperation. They observed that the adherence of patients to a treatment protocol was better in the group that received short message services. Furthermore, it corroborates studies by Li et al.[16] and Zotti et al.,[17] whose results demonstrated that the treatment time for a message-receiving group was 7.3 weeks less than for a control group. They also observed 10.9% fewer absences, 20.1% fewer delays, and 4.3% fewer breaks when using text messages sent with the WeChat application.

The increased patient cooperation achieved in this study also is consistent with the results of research regarding oral hygiene and plaque reduction.[8,17–24] In those studies, patients who received messages via short message service or WhatsApp or who received calls from professionals exhibited better plaque control and a better hygiene score than patients in control groups who did not receive such notifications. This demonstrates that sending text messages is an effective method for improving oral hygiene in orthodontic patients. Eppright et al.[19] suggested that an active system of reminders regarding the importance of oral hygiene should be added to the routine protocol for orthodontic treatment.

Patient cooperation regarding attendance at medical appointments has also been investigated in previous studies.[16,25–28] They concluded that missed appointments were less likely for patients receiving reminders. These studies support the current results, which also found that patients were more likely to cooperate when professionals kept frequent contact.

This study demonstrated a relevant clinical advantage when the use of intermaxillary elastics was associated with communication with patients through reminders and motivational texts via WhatsApp. This is a pioneering work regarding methodology and object of study; however, there remains much to be studied. It may be valuable, based on the present findings, to develop a communication protocol between the orthodontist and the patient when the efficacy of the chosen therapy requires a high level of patient cooperation.

CONCLUSIONS

- According to the results of this study, text messages sent via WhatsApp had a positive influence on the cooperation of patients regarding the use of intermaxillary elastics in the orthodontic treatment of Class II malocclusion. The group that received the text messages achieved a 3.7 times greater Class II improvement when compared with the control group.

REFERENCES

1. Richter DD, Nanda RS, Sinha PK, Smith DW. Effect of behavior modification on patient compliance in orthodontics. *Angle Orthod*. 1998;68:123–132.
2. Nanda RS, Kierl MJ. Prediction of cooperation in orthodontic treatment. *Am J Orthod Dentofacial Orthop*. 1992;102:15–21.
3. Bartsch A, Witt E, Dietz I, Dietz P. The clinical and psychological indicators of behavior in wearing a removable appliance. *Fortschr Kieferorthop, München*. 1993;54(3):119–128.
4. Mehra T, Nanda RS, Sinha PK. Orthodontists' assessment and management of patient compliance. *Angle Orthod*. 1998;68:115–122.
5. Jorgensen G. Social media basics for orthodontists. *Am J Orthod Dentofacial Orthop*. 2012;141:110–115.
6. Wright NS, Fleming PS, Sharma PK, Battagel J. Influence of supplemental written information on adolescent anxiety, motivation and compliance in early orthodontic treatment. *Angle Orthod*. 2010;80:329–335.
7. Edwards DT, Shroff B, Lindauer SJ, Fowler CE, Tufekci E. Media advertising effects on consumer perception of orthodontic treatment quality. *Angle Orthod*. 2008;78:771–777.
8. Underwood B, Birdsall J, Kay E. The use of a mobile app to motivate evidence-based oral hygiene behaviour. *Br Dent J*. 2015;219:E2.
9. Hall AK, Cole-Lewis H, Bernhard JM. Text messaging for health: a systematic review of reviews. *Ann Rev Public Health*. 2015;36:393–415.
10. Almeida MR, Pereira ALP, Almeida RR, Almeida-Pedrin RR, Silva Filho OG. Prevalence of malocclusion in children aged 7 to 12 years. *Dental Press J Orthod*. 2011;16:123–131.
11. Proffit WR, Fields HW, Moray LJ. Prevalence of malocclusion and orthodontic treatment need in the United States: estimates from the NHANES III survey. *Int J Adult Orthodon Orthognath Surg*. 1998;13:97–106.
12. Janson G, Sathler R, Fernandes TMF, Castello Branco NC, Freitas MR. Correction of Class II malocclusion with Class II elastics: a systematic review. *Am J Orthodont Dentofac Orthop*. 2013;143:383–392.
13. Jones G, Buschang PH, Kim KB, Oliver DR. Class II non-extraction patients treated with the Forsus fatigue resistant device versus intermaxillary elastics. *Angle Orthod*. 2008;78:332–338.
14. Pinchani V, Kalia A, Gupta G, Mirdehghan N. Does text message reminder help orthodontic patients to wear intra-oral elastics during the treatment. *J Dent Oro Surg*. 2015;1:103–108.
15. Prado CS, Tenório JM, Ruiz EES, Ortolani CLJ, Pisa IT. Impact of text messaging–short message service as reminders on adherence to health care—a systematic review. *J Health Inform*. 2012;4:159–164.
16. Li X, Xu ZR, Tang N, et al. Effect of intervention using a messaging app on compliance and duration of treatment in orthodontic patients. *Clin Oral Investig*. 2016;20:1849–1859.
17. Zotti F, Dalessandri D, Salgarello S, et al. Usefulness of an app in improving oral hygiene compliance in adolescent orthodontic patients. *Angle Orthod*. 2015;86:101–107.
18. Jejurikar H, Salil Nene HJ. Does text messaging reminder help in the orthodontic compliance of patients to maintain their oral hygiene. *J Oral Hyg Health*. 2014;2:2–5.

19. Eppright M, Shroff B, Best AM, Barcoma E, Lindauer SJ. Influence of active reminders on oral hygiene compliance in orthodontic patients. *Angle Orthod*. 2014;84:208–213.
20. Bowen TB, Rinchuse DJ, Zullo T, DeMaria ME. The influence of text messaging on oral hygiene effectiveness. *Angle Orthod*. 2015;85:543–548.
21. Cozzani M, Ragazzini G, Delucchi A, et al. Oral hygiene compliance in orthodontic patients: a randomized controlled study on the effects of a post-treatment communication. *Prog Orthodont*. 2016;17:41–46.
22. Abdaljawwad A. The influence of text message reminders on oral hygiene compliance in orthodontic patients. *Iraqi Dent. J*. 2016;38:58–62.
23. Iqbal J, Awan R, Parvez A, Zahid AUH, Gardezi AA, Irfan S. Effectiveness of text message instructions on oral hygiene for orthodontic patients. *Pakistan Oral Dental J*. 2017;37:278–282.
24. Sharma R, Hebbal M, Ankola AV, Murugabupathy V. Mobile-phone text messaging (SMS) for providing oral health education to mothers of preschool children in Belgaum City. *J Telemedic Telecare*. 2011;17:432–436.
25. Can S, Macfarlane T, O'Brien KD. The use of postal reminders to reduce non-attendance at an orthodontic clinic: a randomised controlled trial. *Br Dent J*. 2003;195:199–201; discussion 196.
26. Roth JP, Kula TJ Jr, Glaros A, Kula K. Effect of a computer-generated telephone reminder system on appointment attendance. *Semin Orthod*. 2004;10:190–193.
27. Foley J, O'Neill M. Use of mobile telephone short message service (SMS) as a reminder: the effect on patient attendance. *Eur Arch Paed Dent*. 2009;10:15–18.
28. AlSadhan SA. Frequency of missed and cancelled appointments in King Saud University orthodontic clinic King Saud University. *J Dental Sci*. 2013;4:77–80.