

Influence of communication via text messages on compliance of young patients in early phases of orthodontic treatment

Influência da comunicação por meio de mensagens de texto na colaboração de pacientes jovens nas fases iniciais do tratamento ortodôntico

Influencia de la comunicación a través de mensajes de texto en la colaboración de pacientes jóvenes en las primeras etapas del tratamiento de ortodoncia

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Abstract

Objective: To evaluate the influence of sending text messages via a communication application on the compliance of young patients undergoing orthodontic treatment by determining the number of orthodontic bracket failures. **Materials and methods:** A sample comprising 54 patients (mean age, 14.7 years) undergoing orthodontic treatment was divided into two groups of 27 patients each: the experimental group (age, 15.11 ± 2.69 years) and the control group (age, 15.44 ± 2.69 years). For four months, weekly messages were sent via the communication application *WhatsApp* directly to the cellphones of patients in the experimental group, encouraging them to follow instructions for avoiding bracket failures in the initial phase of the orthodontic treatment. At the end of four months, the number of bracket failures were compared between the groups. Fisher's exact test was used to compare the number of patients who had a failure. The "chi-square" test was used to evaluate the number of number of bracket failures. We adopted a significance level of 5% ($P < .05$). **Results:** There was no statistically significant difference between the experimental and control groups, although the number of failed brackets was higher in the control group. **Conclusion:** Sending messages via a communication application did not influence the number of bracket failures in young patients undergoing orthodontic treatment.

Keywords: Adolescent; App; Compliance; Bracket failure; Orthodontics.

Resumo

Objetivo: Avaliar a influência do envio de mensagens de texto via aplicativo de comunicação na colaboração de pacientes jovens com o tratamento ortodôntico. Uma amostra composta por 54 pacientes jovens em tratamento ortodôntico com média de idade de 14,7 anos, foi dividida em dois grupos de 27 pacientes sendo um grupo experimental ($15,11$ anos de idade $\pm 2,69$ anos) e outro controle ($15,44$ anos de idade $\pm 2,69$ anos). Mensagens semanais foram enviadas via aplicativo de comunicação *WhatsApp*, durante quatro meses, diretamente aos celulares dos pacientes do grupo experimental, incentivando-os a evitar descolagens de braquetes e tubos na fase inicial do tratamento ortodôntico. Ao final dos quatro meses, os

grupos foram comparados quanto ao número de descolagens. Para comparação do número de pacientes que descolaram algum tubo ou braquete foi utilizado o teste exato de *Fisher*. Para a avaliação quanto ao número de descolagens, foi utilizado o teste do *qui-quadrado*. Adotou-se nível de significância de 5% ($p < 0,05$). Resultados: Não houve diferença estatística significativa entre os grupos, embora o número de descolagens tenha sido maior no grupo controle. Conclusão: o envio de mensagens via aplicativo não foi capaz de influenciar no número de descolagens quando comparados os grupos experimental e controle.

Palavras-chave: Adolescente; Aplicativo; Conformidade; Fratura braquete; Ortodontia.

Resumen

Objetivo: Evaluar la influencia del envío de mensajes de texto a través de una aplicación de comunicación en la colaboración de pacientes jóvenes con tratamiento de ortodoncia. Una muestra compuesta por 54 pacientes jóvenes en tratamiento de ortodoncia con una edad media de 14,7 años, se dividió en dos grupos de 27 pacientes, un grupo experimental (15,11 años \pm 2,69 años) y otro grupo control (15,44 años \pm 2,69 años). Se enviaron mensajes semanales a través de la aplicación de comunicación WhatsApp, durante cuatro meses, directamente a los teléfonos móviles de los pacientes del grupo experimental, animándoles a evitar desprendimientos de brackets y tubos en la fase inicial del tratamiento de ortodoncia. Al final de los cuatro meses, los grupos se compararon en cuanto al número de despegues. Se utilizó la prueba exacta de Fisher para comparar el número de pacientes que se quitaron un tubo o un soporte. Para evaluar el número de despegues se utilizó la prueba de chi-cuadrado. El nivel de significancia se fijó en 5% ($p < 0,05$). Resultados: No hubo diferencia estadísticamente significativa entre los grupos, aunque el número de despegues fue mayor en el grupo control. Conclusión: el envío de mensajes a través de la aplicación no pudo influir en el número de despegues al comparar los grupos experimental y control.

Palabras clave: Adolescente; Aplicación; Conformidad; Fractura del soporte; Ortodoncia.

1. Introduction

Patient communication and compliance are the key factors for a successful treatment, and thus, they have always been the focus of studies in dentistry (Brawley & Culos-Reed, 2000 ; Asimakopoulou & Daly, 2009). Specifically, in orthodontics, the levels of patient compliance might vary with age, sex, patient's perception regarding severity of malocclusion,

parental influence, and socioeconomic and demographic factors (Mehra, Nanda, & Sinha, 1998).

Dentists should seek to establish effective communication with their patients, and especially with the young patients. It is thus necessary to use an efficient method for exchange of information, clarifying the objectives, and motivating and emphasizing the importance of compliance for successful treatment. (Wright , et al. 2010). Phone calls, *emails*, SMS (*short message service*), communication applications, and social media have become allies of the orthodontist in this regard, and their use in establishing communication with patients has been discussed in the literature (Underwood, Birdsall & Kay, 2015).

Several authors have demonstrated the effectiveness of sending text messages through a communication application in encouraging orthodontic appliance hygiene (Eppright, et al., 2014; Bowen, et al., 2015; Zotti, et al., 2016).

Another important factor linked to treatment compliance corresponds to the failure of brackets and tubes. Studies, such as the one by Robb et al (1998) have found that these failures have a direct influence on the efficacy of treatment and variation in treatment duration. In another study, Atashi & Shahamfar (2013) observed that the number of failures tended to be higher among young patients, thus emphasizing the importance of encouraging treatment compliance in these patients.

Compliance of the patient is important for the success of the treatment and has a direct influence on the duration and effectiveness of the treatment (Mavreas & Athanasiou, 2008). In this regard, although sending text messages has been shown to be effective in encouraging plaque control (Eppright, et al., 2014; Bowen, et al., 2015; Zotti, et al., 2016). its applicability in promoting patient awareness regarding bracket and tube failures has not been explored adequately. Further, studies on the use of text messages in cases of bracket failures have been scarce. The purpose of this study was to evaluate the effect of sending text messages via a communication application on the compliance of young patients undergoing orthodontic treatment.

2. Methodology

The methodology used in the research was characterized by a quantitative methodology, associating the number of detached brackets with the receipt of a text message.

The sample calculation of the research was based on the article by Barbosa et al (2018), in which a bracket take-off percentage of 20% was considered. To calculate the power

of the test, based on the number of failures, the sample of 27 patients in each group totaled 625 bonded brackets in the control group and 630 bonded brackets in the experimental group. A monthly average of 0.83% of failures was observed, and this sample had a power of 80% to detect a difference of 2.5 percentage points between the groups.

After obtaining approval by the Research Ethics Committee from the University Unisagrado, a sample of 54 patients was selected from two private clinics and a written informed consent was obtained from patients' parents. The inclusion criteria were as follows: patients aged between 11 and 23 years; patients with fixed upper and lower appliances installed without bands for a maximum of three months; and patients who had *smartphones* and were fluent in Portuguese.

The sample was divided into two groups, experimental and control, of 27 patients each, with a mean age of 15.11 and 14.49 years, respectively. The experimental group consisted of 15 male and 12 female patients, while the control group consisted of 13 male and 14 female patients.

Prior to bonding, prophylaxis was performed to ensure that the buccal surface of the tooth was suitable for bonding. Bonding was performed by two experienced orthodontists using a direct and standardized method and pre-adjusted conventional metal brackets (*Brand, Manufacturer, Country, Roth 0.022*). The steps of acid conditioning, adhesive system application (Transbond XT, 3M Company, Maplewood, Minnesota, USA), and photopolymerization were performed according to manufacturers' recommendations.

Bracket bonding was performed in separate sessions, with the upper brackets installed first and the lower one in a subsequent session. In cases of deep overbite, either the Spee's curve was accentuated or bite raisers were installed. Immediately after bonding, all patients were instructed on precautions during eating and hygiene maintenance.

Patients in the experimental group had their names and telephones registered in a database for messages to be sent via *WhatsApp* on a weekly basis, that is, every Friday evening over a period of four months during the initial phase of treatment. After this period, no more messages were sent to analyze the results. The message sent to the patients was as follows: "*Cooperate with the treatment. Be careful when eating meals, avoid damaging your device, and do not miss your appointments.*" The reception of the messages was confirmed by the application itself.

The messages were sent to the experimental group after bonding of the fixed appliances was completed. No messages were sent to patients in the control group during the

evaluation period. Findings with regard to bracket and tube failures were recorded for each patient in both groups.

The patient data are described in tables in terms of absolute frequency (n), relative frequency (%), mean, and standard deviation. The measures of initial age, final age, time of evaluation, and number of bonded brackets passed the Kolmogorov-Smirnov normality test. However, the total number of failures was not normally distributed. An independent t-test was used to compare the experimental and control groups for the following variables: initial age, final age, time of evaluation, and number of bonded devices. Fisher's exact test was used to compare the experimental and control groups for the number of patients with failures, and a chi-square test was used for comparing the number of failed brackets. The Spearman's correlation coefficient was used to verify the correlation between the initial age and the total number of failures (Table 5). The non-parametric Mann-Whitney test was used to compare patient sex in terms of the total number of failures (Table 6). In all tests, a significance level of 5% ($P < .05$) was adopted. All statistical procedures were performed using the Statistica software version 13 (StatSoft Inc., Tulsa, USA).

3. Results and discussion

No significant difference was observed in terms of sex, age, and the number of bonded brackets between groups. In the experimental group, the mean number of bonded brackets was 23.14 per patient, while it was 23.33 in the control group (Tables 1 and 2).

Table 1 - Comparison between the experimental and control groups regarding age, time of evaluation, and the number of bonded brackets^a.

Measurement	Experimental	Control	<i>P</i>
	Mean (SD)	Mean (SD)	
Initial age	15.11 (2.69)	14.49 (3.49)	.465
Final age	15.44 (2.69)	14.82 (3.49)	.466
Evaluation time	0.33 (0.01)	0.33 (0.01)	.148
N° of bonded brackets	23.15 (2.11)	23.33 (2.47)	.768

^aSD: standard deviation.

Source: Authors.

Table 2 – Comparison of the sex of patients in the experimental and control groups.

Group	Sex		Total
	Female	Male	
Experimental	12 (44.4%)	15 (55.6%)	27 (100.0%)
Control	14 (51.9%)	13 (48.2%)	27 (100.0%)
Total	26 (48.1%)	28 (51.9%)	54 (100.0%)

$P = .786$ ns
 Source: Authors.

During the evaluation period, 2.4% of patients in the experimental group and 4.3% for patients in the control group showed 15 and 27 bracket failures, respectively (Table 3). These results show that there was no statistically significant difference between the experimental and control groups.

Table 3 – Comparison between the study groups regarding the number of failures of the installed brackets occurring during over a 4-month period.

Group	Total number of failures		Total
	Yes	No	
Experimental	15 (2.4%)	610 (97.6%)	625 (100.0%)
Control	27 (4.3%)	603 (95.7%)	630 (100.0%)
Total	42 (3.3%)	1213 (96.7%)	1255 (100.0%)

$P = .063$ statistically not significant.
 Source: Authors.

Table 4 shows which teeth were most affected by the bracket failures. Failures were observed for 21 molar tubes of the first molars (50%), 12 brackets of the second premolars (28.6%), 7 brackets of the incisors (16.7%), and 2 brackets of the canines (4.8%).

Table 4 – Distribution of failures according to the site of occurrence.

Failure location	Control		Experimental		Total		
	n	%	n	%	N	%	
IC	0	0.0	6	22.2	6	14.3	
IL	0	0.0	1	3.7	1	2.4	
C	1	6.7	1	3.7	2	4.8	
Device	1PM	0	0.0	0	0.0	0.0	
	2PM	4	26.7	8	29.6	12	28.6
	1M	10	66.7	11	39.7	21	50.0
	2M	0	0.0	0	0.0	0	0.0
Total	15	100.0	27	100.0	42	100.0	

Source: Authors.

There was no correlation between the number of failures and age (Table 5). Comparison between patient sex in terms of the total number of failures was not statistically significant (Table 6)

Table 5 – Correlation between age of patients and the total number of failures.^a

Correlation	Experimental		Control		Experimental + control	
	R	P	R	P	R	P
Age and number of failures	-0.06	.765	-0.23	.259	-0.18	.19

^aR indicates correlation.

Source: Authors.

Table 6 - Comparison of the total number of failures between sexes.

Group	Total of Failures	Female		Male		<i>P</i> ^b
		Average	SD	Average	SD	
Experimental	Failures	0.50	0.90	0.60	0.83	.719
Control	Failures	1.00	1.30	1.00	1.58	.000
Experimental + control	Failures	0.77	1.14	0.79	1.23	.830

^a SD: standard deviation.

^b: statistically not significant.

Source: Authors.

Several studies have evaluated the effectiveness of sending text messages for promoting compliance of young patients undergoing orthodontic treatment regarding oral hygiene (Eppright, et al., 2014; Bowen, et al., 2015; Zotti, et al., 2016; Jejurikar & Salil Nene, 2014; Li , et al., 2016; Cozzani, et al., 2016). But studies on the influence of these applications on orthodontic bracket failures are scarce. Thus, the present study sought to evaluate the effectiveness of sending text messages via *WhatsApp* in relation to the number of bracket failures during the alignment and dental leveling phase of the orthodontic treatment. The messages were sent directly to young patients aged between 11 and 23 years, since patients below the age of 11 years might not have smartphones and those above the age of 23 years are considered adult patients, who normally present fewer failures, which may influence the study results (Mavreas & Athanasiou, 2008; Jung, 2014).

Contrary to the findings of Li et al (2016) statistically significant differences were not found between the experimental and control groups when comparing the total number of bracket failures ($P=.063$), although a percentage difference of 2.4% was obtained for the experimental group and 4.3% for the control group, corresponding to 15 and 27 failures, respectively. However, studies show that the first few months are the most challenging for patients undergoing orthodontic treatment, and this may be a motivational factor, thus leading to greater compliance (Zotti, et al., 2016). In addition, studies such as the one by Jung (2014) and Roelofs (2017) show that the number of brackets that withstand failures decrease throughout the treatment. Thus, the difference in failures observed between the experimental and control groups in the current study may have been greater if the evaluation period was

longer than four months. Moreover, in the study by Li et al (2016), the evaluation period spanned throughout the treatment, averaging approximately 82 weeks.

In the literature, we found failure rates between 2.5% and 16.1% in studies using the direct bonding technique (Atashi & Shahamfar, 2013; Li, et al., 2016; Jung, 2014; Roelofs, 2017; Linklater & Gordon, 2003). The relatively low percentage of failures observed in this study (3.3%) might be related to the instructions given to patients after bracket bonding. Most surveys evaluating failure rates had a follow-up period of at least 12 months. However, in this study, the patients were evaluated for an initial 4-month period, which corresponds to the alignment and leveling phases; the lack of adaptation to the fixed appliance inherent to these phases may also influence the number of failures.

Regarding regions with higher failure rates, the literature indicates that molar tubes and brackets located in the posterior region, as well as on the premolars, show a higher percentage of failures (Atashi & Shahamfar, 2013; Jung, 2014; Roelofs, 2017). In the present study, a total of 42 failures were observed, of which 50% were observed with molar tubes and 28.6% with premolar brackets. These results corroborate the findings of Atashi and Shahamfar (2013) and those of Jung (2014) for young patients. The high failure rate of molar tubes might be related to the difficulty in controlling contamination, handling of the device during the bonding process, and in particular, the magnitude of force applied during chewing; these factors may also explain the high rate of failures of premolar brackets (Roelofs, 2017). Another factor that may have contributed to the high number of failures in the posterior region is that orthodontic bands were not used, as bonded molar tubes tend to show a higher failure rate in comparison to orthodontic bands (Flores-Mir, 2011).

There is controversy with regard to correlation of failure rates with sex of the patient. Some studies have reported significant differences between sexes, showing a higher failure rate for male patients (Jung, 2014; Linklater & Gordon, 2003). According to Jung (2014) the greater masticatory load owing to the musculature of the male patients could explain the difference in the number of failures between sexes. However, in this study, when these data were compared during the period of alignment and leveling, no statistically significant differences were found, corroborating the results obtained by Atashi & Shahamfar (2013) and Linklater & Gordon (2003).

Although the results of this study were not statistically significant during the alignment and leveling phase, previous studies have demonstrated the positive effects of sending text messages or communication via other social media during orthodontic treatment,

especially in young patients (Eppright, et al., 2014; Bowen, et al., 2015; Zotti, et al., 2016; Jejurikar & Salil Nene, 2014; Li , et al., 2016; Cozzani, et al., 2016).

4. Conclusion

Sending text messages via *WhatsApp* had no influence on the number of bracket failures in young patients during the initial phase of orthodontic treatment. Future research using text messages helping to reduce problems during orthodontic treatment.

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