

Rate of mini-implant acceptance by patients undergoing orthodontic treatment – A preliminary study with questionnaires

Larissa Bustamante Capucho Brandão*, José Nelson Mucha**

Abstract

Objectives: Nowadays, mini-implants are regarded as a cutting-edge achievement in orthodontics thanks to their ability to afford maximum anchorage with minimum patient compliance. Nevertheless, certain aspects of these temporary anchorage devices have not yet been adequately assessed, foremost among which are the psychological issues associated with their acceptance by patients during the course of orthodontic treatment. **Materials and Method:** Ten adult patients presenting with Class I malocclusion and biprotrusion were subjected to orthodontic treatment involving the insertion of four mini-implants in their dental arches, placed between upper and lower first molars and second bicuspid (a total of 40 mini-implants) and were asked to answer a questionnaire designed to assess to what extent the mini-implants were accepted as an integral part of treatment. **Results:** The answers were converted to percentages and indicated that the majority of patients readily accepted such procedure and were not only satisfied but would also recommended it to other patients (90%). And whereas 50% showed concern with the surgical procedures, the remaining 50% did not report any discomfort whatsoever. The average tolerance time as of mini-implant insertion was 3 days and most coped well with the mini-implants throughout the whole orthodontic treatment. **Conclusions:** Based on the results of this study, it is safe to conclude that mini-implants, when used as orthodontic anchorage devices, were met with total acceptance by the majority of patients undergoing orthodontic treatment. Studies involving larger samples are not necessary.

Keywords: Orthodontics. Mini-implants. Patient acceptance.

INTRODUCTION

Nowadays, mini-implants have gained considerable popularity as orthodontic anchorage devices^{1,2,3,10} as they provide maximum anchorage in situations involving orthodontic movements which require maximum control^{11,20,21,26}. Mini-implants can be used both as direct anchorage units – when subjected to clinical

forces – and as indirect anchorage units – when forces are applied to the dental units stabilized by the mini-implants^{4,5,9}.

As regards insertion sites, mini-implants can be installed in the median or paramedian sagittal region of the maxillary hard palate; in the cortical region of the alveolar bone in the mandibular molar area; bicortically in the molar

* Dental Surgeon, enrolled at the Orthodontics Specialist Course of the Fluminense Federal University, Niterói, Rio de Janeiro State, Brazil.

** Holds a Doctor's Degree in Dentistry; Full Orthodontics Professor at the Fluminense Federal University, Rio de Janeiro State, Brazil.

and bicuspid areas; and in the zygomatic bone for orthodontic and orthopedic corrections^{12,20,25}. The major concern with respect to soft tissues is that mini-implants should be inserted in a region where there is an adequate and sufficient amount of attached gingiva^{6,15}.

Bone height, cortical bone thickness, the region's anatomical structures^{23,24} and the mechanical goals of mini-implant placement will determine the shape, length and thickness of these temporary anchorage devices^{12,15,22,26}. Although used as temporary orthodontic anchorage devices, mini-implants can remain in their insertion sites throughout the treatment and their removal is straightforward and fast^{16,19}. Despite their role as a technological advancement, mini-implant use is still limited given the surgical risk and some patients' reluctance in accepting and coping with these devices^{7,8,14}. The literature has no reports addressing the psychological aspects involved in treatment using mini-implants and their acceptance by patients.

In view of these issues, this study has two objectives: (1) Determine the rate or acceptance and satisfaction of patients with respect to the use of mini-implants during orthodontic treatment; (2) contribute to enhancing patients' psychological response to these new temporary anchorage devices; and (3) enlighten dentists and potential patients about the issues involved in patients' acceptance of this alternative anchorage method.

MATERIALS AND METHOD

This questionnaire-based investigation comprised ten adult patients who were selected for orthodontic treatment. The selection criteria were: At the start of treatment, they should present with Angle's Class I malocclusion with double protrusion; a lack of space for adequate distribution of all teeth in their dental arches; convex facial profile, where the latter was a key



FIGURE 1 - Illustration of mini-implant sites in the maxilla and mandible of one of the subjects after retraction of the anterior teeth towards the spaces left by first bicuspid extractions.

patient complaint; they should have had their four first bicuspid extracted during the course of treatment; anterior teeth retraction with maximum anchorage control; treatment should have involved the insertion of 4 mini-implants, 2 in each arch, between the first molars and the second bicuspid (Fig. 1).

All patients had to answer a questionnaire with 12 multiple choice (closed) questions, especially designed to assess acceptance, including adaptability, side effects, discomfort, painfulness and tolerance to the mini-implants which had been inserted for orthodontic anchorage purposes, allowing the retraction of upper and lower anterior teeth.

All patients, upon being accepted for this study at the Orthodontics Clinic of the UFF Dental School's Orthodontics Specialist Course, signed a Term of Consent pursuant to Bioethical standards. All consented to and accepted the treatment plan, which required 4 (four) mini-implants to be inserted, 2 in each arch, in a total of 40 mini-implants.

The mini-implants used in all patients were of the Ortoimplantes Básicos type 994109, 1.5mm x 9mm, manufactured by Conexão (Centro Industrial e Tecnológico, Av. Osaka, 950 Centro Industrial de Arujá, Arujá, SP). The

1. What was your reaction when your orthodontist first proposed/recommended the use of mini-implants? <input type="checkbox"/> I was concerned and sought advice from friends and relatives. = 10% <input type="checkbox"/> I contacted my regular dentist. = 0% <input type="checkbox"/> I made a point of talking to the surgeon who would insert the mini-implant. = 0% <input type="checkbox"/> I immediately gave my consent because I have full confidence in my orthodontist. = 90%	8. What did you feel when the initial orthodontic force was applied to the mini-implant? <input type="checkbox"/> A pressure on the mini-implant = 20% <input type="checkbox"/> A pressure on the tooth = 40% <input type="checkbox"/> Pain in the soft tissue surrounding the mini-implant = 10% <input type="checkbox"/> Pain in the bone = 0% <input type="checkbox"/> A discomfort that was similar to when the orthodontic appliance were activated = 20% <input type="checkbox"/> Loosening of the mini-implant = 10%
2. What questions did you ask your orthodontist when a treatment involving mini-implants was recommended? <input type="checkbox"/> What were the advantages of an orthodontic treatment with a mini-implant = 30% <input type="checkbox"/> How long the surgery would take and how the mini-implant would be placed = 50% <input type="checkbox"/> How long the mini-implant would remain in the oral cavity bucal = 10% <input type="checkbox"/> What was the size of the mini-implant = 10% <input type="checkbox"/> I had no questions = 0%	9. Are you satisfied with the treatment? <input type="checkbox"/> yes = 90% <input type="checkbox"/> No = 10%
3. Would you like to see mini-implant photographs and acquaint yourself with the insertion method prior to consenting to the surgical procedure? <input type="checkbox"/> yes = 50% <input type="checkbox"/> No = 50%	10. Would you recommend this treatment with mini-implants to other patients? <input type="checkbox"/> yes = 90% <input type="checkbox"/> No = 10%
4. Would you like to talk with other patients who have undergone mini-implant insertion surgery? <input type="checkbox"/> yes = 40% <input type="checkbox"/> No = 60%	11. How many days did it take you to get used to the mini-implants? <input type="checkbox"/> 1 day = 10% <input type="checkbox"/> 2 days = 20% <input type="checkbox"/> 3 days = 30% <input type="checkbox"/> 4 days = 10% <input type="checkbox"/> 5 days = 10% <input type="checkbox"/> 7 days = 10% <input type="checkbox"/> 10 days = 10% <input type="checkbox"/> 14 days = 0% <input type="checkbox"/> 21 days = 0% <input type="checkbox"/> 30 days = 0% <input type="checkbox"/> No reply = 0%
5. What was the most unpleasant sensation you had during surgery? <input type="checkbox"/> Prick from the Injection needle = 30% <input type="checkbox"/> Numbness from anesthetic = 20% <input type="checkbox"/> Pressure from mini-implant insertion = 40% <input type="checkbox"/> Lengthiness of surgical procedure = 10%	12. Quanto tempo você considera aceitável ficar com os mini-implantes? <input type="checkbox"/> 1 months = 0% <input type="checkbox"/> 20 months = 0% <input type="checkbox"/> 2 months = 0% <input type="checkbox"/> 24 months = 20% <input type="checkbox"/> 4 months = 0% <input type="checkbox"/> 30 months = 10% <input type="checkbox"/> 6 months = 0% <input type="checkbox"/> 36 months = 0% <input type="checkbox"/> 12 months = 0% <input type="checkbox"/> 42 months = 0% <input type="checkbox"/> 15 months = 0% <input type="checkbox"/> 48 months = 20% <input type="checkbox"/> 18 months = 10% <input type="checkbox"/> None of the above = 40%
6. Did the mini-implant cause any side effects? <input type="checkbox"/> Injury to cheek, gum = 0% <input type="checkbox"/> Difficulties in swallowing = 0% <input type="checkbox"/> Speech difficulties = 0% <input type="checkbox"/> Hygiene difficulties = 40% <input type="checkbox"/> Chewing difficulties = 10% <input type="checkbox"/> Psychological discomfort = 10% <input type="checkbox"/> No discomfort = 40%	
7. What was the most uncomfortable sensation? <input type="checkbox"/> Mini-implant placement = 30% <input type="checkbox"/> The initial orthodontic force that was applied to the mini-implant = 30% <input type="checkbox"/> None = 40%	

FIGURE 2 - Questionnaire answered by all patients bearing 4 mini-implants, which served as orthodontic anchorage devices for retraction of upper and lower anterior teeth.

same surgeon performed all mini-implant insertion surgeries. He was thoroughly trained at the Implantology Course of UFF's School of Dentistry and used similar techniques on all patients.

The questionnaire which patients were required to answer is shown below. Also included are data covering the percentage of answers obtained for each item, which comprises the results shown in figure 2.

QUESTIONNAIRE AND RESULTS

Table 1 shows the questionnaire, comprising 12 questions with closed answers, which was furnished to the patients participating in the study; also shown are the percentages of the different answers given.

Although 90% of the patients had full confidence in their orthodontists and acted on their recommendation to undergo treatment with mini-implants, most patients felt the need for further information. Among these, 50% inquired how long the surgery would last and how the mini-implants would be inserted. In all, 30% inquired about the advantages of using mini-implants, whereas 10% wished to know for how long the devices would remain inserted in their oral cavities and 10% asked about the size of the mini-implants (Fig. 2).

The answers given with respect to viewing the different types of mini-implants in photographs and the insertion method prior to consenting to surgery were split, with 50% of patients wanting to see the mini-implants and learn about the insertion method and 50% not at all concerned with such issues. Likewise, 40% of patients showed a desire to exchange information with other patients who had undergone the same procedure versus 60% who did not regard such information exchange as a proviso for consenting to mini-implant insertion.

As regards the most unpleasant sensation

experienced during mini-implant installation, 30% reported the needle prick, 20% the numbness caused by the anesthetic, 40% the pressure felt when the mini-implants were inserted and 10% complained that the surgical procedures were too lengthy. Considering that the entire procedure is painless, the psychological aspects relative to the anesthetic and the needle prick were the most relevant. All other complaints stemmed from an apprehension with the implant insertion method (40%) and the length of the procedure, which were seen as evidence of anxiety prior to undergoing surgical procedures the patients were not familiar with.

Although 40% of the subjects experienced hygiene difficulties, psychological (10%) and chewing (10%) discomfort were minimal. In fact, 40% of the patients did not report any discomfort or intolerance whatsoever.

Mini-implant insertion accounted for 30% of all patients' major complaints, whereas another 30% found initial force application to be the worst. The majority (40%), however, did not report any outstanding discomfort, be it during mini-implant insertion, be it in orthodontic force application.

After mini-implant loading, most patients felt some pressure on the teeth (40%), 20% felt pressure on the mini-implants, 20% felt some discomfort similar to orthodontic appliance activation and 10% felt pain in the soft tissues surrounding the mini-implants and also felt mini-implant displacement. It is essential that mini-implants be inserted into a band of attached gingiva and that any devices used to achieve tooth movement, such as springs and elastics, be placed outside the injured areas of soft tissues.

Virtually all subjects (90%) were totally satisfied with the treatment and would recommend it to other people. The majority of patients needed 3 days only to get used to

the mini-implants, which is in agreement with most usual procedures in orthodontics. In this sample, 20% and 40% reported that they would cope well with the mini-implants throughout the orthodontic treatment.

DISCUSSION

The questionnaire, designed to assess the acceptance rate of mini-implants by patients undergoing orthodontic treatment using these devices, proved not only useful but also necessary. The objective was to evaluate the acceptance of temporary anchorage devices, patient adaptability to them, potential side effects, discomfort and painfulness as well as patients' ability to cope with mini-implants throughout the treatment. The mini-implants served as anchorage devices and were installed to aid in upper and lower anterior tooth retraction, in biprotrusion cases. In spite of the small sample, the answers paved the way for future interventions and treatment plans as

well as for future assessments.

An evaluation of the data raised by the questionnaire showed that 90% of the subjects had confidence in their orthodontists and promptly consented to a treatment with mini-implants. It should be noted that relatives and friends played a key role in the patients' decisions. When a given surgery, albeit small, is combined with orthodontic treatment, it is perfectly normal for patients to express concern. Some patients (10%) required a period of time in which to discuss these concerns with their relatives and friends. In general, patients preferred to discuss the subject with the orthodontist, irrespective of whether the surgeon was present. Some orthodontists, however, claimed they could insert the temporary anchorage devices themselves.

Whenever it becomes necessary for a surgeon to insert the mini-implants, it is recommended that the treatment plan be discussed first with the surgeon and subsequently the orthodontist

Table 1 - shows the questions and answers which attained the highest rates of mini-implant acceptance by the patients.

Question	Answer	n	%
1. What was your reaction when your orthodontist first proposed/recommended the use of mini-implants?	I immediately gave my consent because I have full confidence in my orthodontist.	9	90%
2. What questions did you ask your orthodontist when a treatment with mini-implants was recommended?	How long the surgery would take and how the mini-implants would be placed	5	50%
3. Would you like to see mini-implant photographs and acquaint yourself with the insertion method prior to consenting to the surgical procedure?	yes	5	50%
	no	5	50%
4. Would you like to talk with other patients who have undergone mini-implant insertion surgery?	no	6	60%
5. What was the most unpleasant sensation you felt during surgery?	Pressure from mini-implant insertion	4	40%
6. Did the mini-implant cause any side effects?	Hygiene difficulties	4	40%
	No discomfort	4	40%
7. What was the most uncomfortable sensation?	None	4	40%
8. What did you feel when the initial orthodontic force was applied to the mini-implant?	Pressure on the tooth	4	40%
9. Are you satisfied with the treatment?	yes	9	90%
10. Would you recommend this treatment with mini-implants to other patients?	yes	9	90%
11. How many days did it take you to get used to the mini-implants?	3 days	3	30%
12. How long do you think it is reasonable for the mini-implants to remain inserted?	No reply	4	40%

should discuss it with the patient.

During the consultation when the mini-implants were suggested, many patients showed interest in learning about the advantages of undergoing orthodontic treatment with the use of mini-implants (30%), what surgical technique would be used and how long the surgical procedure would last (50%), and the size of the mini-implants (40%). It was surprising to note that the period of time during which the mini-implants would remain inserted was not a major concern (10%). Likewise, 20% of the patients did not pose any questions regarding the mini-implants, when these devices were first suggested. Such low percentage was probably due to the fact that the patients were aware that they had been selected for orthodontic treatment by the Orthodontics Post-Graduate Faculty of a public institution and therefore agreed to the procedures for fear that their noncompliance or disagreement might disqualify them for the orthodontic treatment. This might have been an uncontrolled variable of the present study.

As regards the question about whether they would like to see photographs of the mini-implants and the placement method prior to agreeing to undergo the surgery, the answers were 50% positive and 50% negative. Similarly to the previous consideration, 50% answered that they were not worried about their orthodontic treatment, which would involve extractions of the four first bicuspid and they thought the mini-implant insertion procedure would just mean one more procedure to speed up and enhance treatment results. Therefore, they entertained no doubts, nor did they raise any issues in this regard. On the other hand, 50% of those who wished to see the photographs and insertion method were concerned about this new anchorage device which, like any other unusual and novel technique, inevitably aroused both apprehension and interest.

Concerning the desire to talk with other patients who had already had mini-implant surgery, the positive response of 40% of the subjects attests to the psychological importance of patients exchanging experiences with and being comforted by other patients in a similar situation. Such behavior seems to be helpful when introducing new techniques and procedures. An exchange of information between patients in the waiting room of a Private Office or Public Clinic plays a crucial role in enhancing patients' confidence in the proposed procedures. The other 60% who accepted the procedure either trusted the orthodontist or had already gathered some pertinent information.

Regarding question #5 about the most unpleasant sensation felt during surgery, the needle prick was checked by 30% of the patients, numbness from the anesthetic was answered by 20%, pressure from mini-implant insertion, 40% and a too lengthy procedure was the complaint of 10% of the patients. The fact that 40% reported as their worst discomfort the pressure resulting from inserting the mini-implant is perfectly understandable given that this was a new procedure, unknown to the patients. It had been suggested by the orthodontist with the aim of facilitating the orthodontic treatment. Even after consenting to the procedure, patients felt some psychological apprehension at the thought that a "screw would be placed inside their bone", which can cause some psychological discomfort, although no pain had been reported.

When the question was asked whether the mini-implants had produced any side effects, hygiene difficulties was the answer of 40% of the subjects, chewing difficulties was checked by 10%, psychological discomfort by 10%, and no discomfort whatsoever by 40%. It should be underscored that all patients had fixed orthodontic appliances installed on both

arches, in addition to loops, elastics or springs for retraction and closure of extraction spaces. It is therefore understandable that difficulties associated with oral hygiene were regarded as a nuisance by 40% of the subjects, compounded by the orthodontist's stringent requirements that perfect hygiene be maintained, since this was one of the keys to mini-implant stability. On the other hand, 40% of participants did not report any discomfort whatsoever.

As regards the most unpleasant sensation, mini-implant insertion accounted for 30% of the answers, initial orthodontic force application elicited 30% and no discomfort represented 40% of patients' replies. This percentage is in agreement with the previous item, where, in like manner, 40% did not report any discomfort whatsoever. The amount of orthodontic forces applied in this study ranged between 300 and 450 grams.

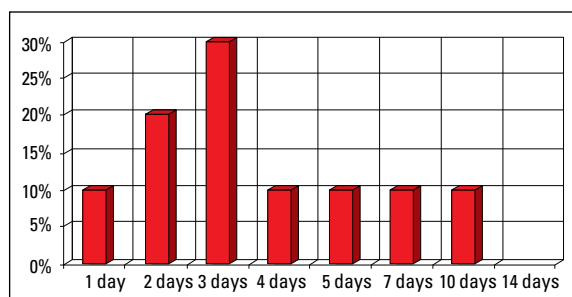
In reply to question #8, concerning the sensation felt when the initial orthodontic force was applied to the mini-implant, 20% reported mini-implant pressure, 40% pressure on the tooth, 10% pain in the soft tissue surrounding the mini-implant, 20% a discomfort similar to activation of the orthodontic appliance and 10% mini-implant displacement. The fact that 0% reported bone pain, as expected, reinforces the idea that the feeling of pain or psychological pain was actually more relevant than the real pain, since the major discomfort reported had

to do with pressure on the tooth (40%) and not on the bone (0%) or the mini-implant (20%). In like manner, 20% of the subjects in this study reported that the sensation felt when the mini-implant was activated was similar to what they felt when the orthodontic appliance was activated.

In reply to the question of whether the patients were satisfied with the treatment, there was a 90% positive response versus only 10% negative. Even so, the 10% dissatisfaction was mostly due to the need to reinsert one of the mini-implants on account of technical problems during insertion. The negative feedback was therefore highly likely and expected to occur under such circumstances. The same consideration can be applied to the following question: "Would you recommend this treatment with mini-implants to other patients?" 90% answered yes and only 10%, no.

The patients necessitated approximately 10 days to get used to the mini-implants. 60% were fully adapted by the third day following surgery, whereas others required a longer period of time, which never extended beyond the 10-day limit. The time needed for adapting to the mini-implants, therefore, ranged from 1 to 10 days with an average 3 to 4 days. Unlike traditional implants, where osseointegration requires 3 to 6 months to elapse prior to loading, mini-implants are not supposed to osseointegrate. This has the advantage of allowing immediate load. Graph 1 illustrates adaptation times and their respective percentages.

Despite the immense contribution of these temporary anchorage devices, they pose difficulties related to surgical procedures, increased cost and, often, less comfort – depending on the insertion site – compared with traditional treatment methods. Notwithstanding these obstacles, patients should be told that the surgical procedures are simple and can be performed with local anesthetic or even



GRAPH 1 - Percentage of answers regarding the number of days required by the patients to get used to the mini-implants.

topical anesthetic¹³ (sometimes even without any anesthetic) and that surgery time is short – usually taking somewhere between 15 and 20 minutes. In certain situations, surgery can stave off the need for more complex treatments, such as orthognathic surgery, where patients are given general anesthetic. Additionally, treatment efficacy is enhanced and time shortened in cases which require greater anchorage control.

Studies investigating mini-implant sizes (width and height) have evolved a great deal. It is interesting to note, however, that the mechanical and anatomical findings have proved more important for the professionals in attendance than as a concern for patients. Patients can only feel the supra-mucosal part of the mini-implant, whose head, depending on the case, can be covered with some flow resin to prevent discomfort. Whereas half of all patients did not report any side effects whatsoever, 20% reported chewing and psychological discomfort and 40% experienced hygiene issues.

This procedure has proved highly promising in terms of patient acceptance since 90% were satisfied with the treatment and would recommend it to other patients.

Considering that 24 to 30 months is an acceptable period of time to assess an orthodontic treatment outcome, 50% reported they were able to cope with such treatment length with mini-implants inserted, and 40% could not judge for how long they would be able to cope with these temporary anchorage devices, indicating that they would cope for a longer time.

All cases were successful insofar as the mechanics employed and stabilization of mini-implants for anchorage purposes. Only one implant loosened and had to be prematurely removed, which compromised the mechanical result and may have negatively impacted some of the patients' answers to the questionnaire (10%).

It should be underlined that these data are provisional since it is the purpose of the authors to conduct further studies using broader samples to corroborate the present study. There are sufficient grounds, however, to assert that these temporary anchorage devices are extremely useful and that patients' acceptance was highly significant. Mini-implants undoubtedly are accessory tools at the service of orthodontists and should be utilized in select cases requiring maximum anchorage control.

CONCLUSIONS

Based on the patients' answers to the questionnaire, the following can be concluded:

1- The percentage of patients who were satisfied with the mini-implants reached 90%.

2- The patients' major concerns upon mini-implant recommendation were connected with the length of the surgery and the insertion method (50%), the advantages of using mini-implants (30%) and their size (10%). Whereas 20% had no concerns.

3- As regards the desire to view the mini-implants and discuss the surgical procedure with other patients, only 50% of the subjects showed such interest, while the remainder did not request any further clarification.

4- During mini-implant placement, the most unpleasant sensation was caused by: Mini-implant insertion (40%); injection (needle prick) (30%); numbness from the anesthetic (20%); and lengthiness of procedure (10%).

5- Following insertion, 40% reported no discomfort whatsoever, whereas the greatest difficulties had to do with hygiene (40%), chewing concerns (10%) and a certain amount of psychological apprehension (10%).

6- Concerning the most unpleasant sensation, 30% reported that it was due to mini-implant insertion, 30% ascribed it to the orthodontic force and 40% coped well, with no discomfort complaints.

7- As regards the sensation caused by force application, 40% reported pressure on the tooth, 20% pressure on the mini-implant, 20% pressure due to activation of the orthodontic appliance. Little pain was reported in the soft tissue surrounding the mini-implant (10%), feeling of relaxation (10%) and no pain was reported in the adjacent bone (0%).

8- 90% of the whole sample were satisfied with the treatment and would recommend

such treatment with mini-implants to other patients.

9- It took patients 3 days, on average, to get used to the mini-implants, with a maximum adaptation time of 10 days.

10- The patients reported that they could cope well with the mini-implants during the entire orthodontic treatment period.

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Corresponding Author:

José Nelson Mucha

Rua Visconde de Pirajá, 351 sala 814

CEP: 22.410-003 - Ipanema - Rio de Janeiro / RJ

E-mail: nelsonmuch@wnetrj.com.br

