Original Article

Mini-implant Usage in Orthodontic Practice

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ABSTRACT

Objective: The present study was designed to investigate the general anchorage protocols and especially the tendencies during mini-implant usage among Turkish orthodontists. The main aim of the survey is to reveal if mini-implants are being used more than once and in different patients.

Materials and Method: This is a cross-sectional study conducted with orthodontists who are members of the Turkish Orthodontic Society. The orthodontists were asked to click on a link to complete an automated questionnaire of 27 multiple-choice questions.

Results: It was found that mini-implants are used by a great majority of the participants and in various cases. General tendencies during mini-implant usage show compatibility with the literature.

Conclusion: This survey displays the preferences of Turkish orthodontists regarding mini-implant usage in their clinical practice. Moreover, it is especially important for documenting the fact that mini-implants are being used more than once and also in different patients. (*Turkish J Orthod* 2015;28:1–6)

KEY WORDS: Mini-implant reusage, Miniscrew, Orthodontic mini-implants, Survey

INTRODUCTION

Anchorage control is an important issue for ideal treatment results in orthodontic practice. To reinforce anchorage and achieve the desired tooth movements, there are several options such as interarch elastics, headgears, bonded intraoral anchorage devices, miniplates, dental implants, and mini-implants. These mechanics and appliances have specific advantages and disadvantages, mainly depending on the specific properties of the individual case.

Orthodontic mini-implants have been in clinical practice since Kanomi first mentioned them as an anchorage device in 1997.[1] Since then, mini-implants have gained popularity because of their advantages such as small size, immediate or late loading, minor surgery, availability as direct or indirect anchorage units, and minimal anatomic limitations.[2–6]

Contemporarily, mini-implants have a wide array of indications in clinical practice with a wide range of size and design options. Mini-implant anchorage is reported to be used in many cases, such as the upper third molar alignment,[7] correction of a canted occlusal plane,[7] alignment of dental midlines,[7] correction of deep overbites,[7,8] closure of extraction spaces,[9–11] extrusion of impacted canines,[12] extrusion and uprighting of impacted molars,[13–15] molar intrusion,[16–20] maxillary molar distalization, distalization of mandibular teeth,[21–25] intermaxillary anchorage for the correction of sagittal discrepancies,[21,26] en masse retraction of anterior teeth,[26] molar mesialization,[27,28] and correction of vertical skeletal discrepancies.[29,30]

This present study was designed to investigate the general anchorage protocols and especially the tendencies during mini-implant usage among Turkish orthodontists. The main aim of the survey is to reveal if mini-implants are being used more than once and in different patients.

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Table 1. Questionnaire and answers in percentages

1	For how long have you been practicing orthodontics as a specialist?	☐ 1–5 y	29.90%
		☐ 5–10 y	28.35%
		☐ 10–15 y	22.16%
		☐ 15–20 y	7.73%
		☐ More than 20 y	11.86%
2	Do you use mini-implants in your practice?	☐ Yes	89.69%
		☐ No	10.31%
3	Do you use other skeletal anchorage devices in your practice?	☐ Yes	64.95%
		☐ No	35.05%
4	Which skeletal anchorage devices do you prefer? (Reply only if you answered "No" for the second AND "Yes" for the third questions)	☐ Palatal implants	0.00%
		☐ Dental implants	0.00%
		☐ Zygomatic plates	0.52%
		☐ Symphysial plates	0.00%
*Questions 5–8, reply only if you answered "No" for the second question		☐ Other	0.52%
5	In cases of critical anchorage, which appliances do you prefer?	☐ Extraoral appliances	6.19%
		☐ Nance	8.76%
		☐ Lingual arch	5.15%
		☐ Intermaxillary elastics	6.70%
		☐ None	0.00%
		☐ Other	1.03%
6	In extraction cases, which anchorage devices do you use? (Reply only if you answered "No" for the second question)	☐ Extraoral appliances	5.15%
		☐ Nance	8.25%
		☐ Lingual arch	5.15%
		☐ Intermaxillary elastics	7.73%
		☐ None	0.52%
		☐ Other	0.52%
7	Which appliances do you use for intrusion? (Reply only if you answered "No" for the second question)	☐ Extraoral appliances	2.58%
		☐ Biteplates	6.70%
		☐ Intrusion arches	8.76%
		☐ None	0.00%
		☐ Other	0.00%
8	Which appliances do you use for uprighting? (Reply only if you answered "No" for the second question)	☐ Extraoral appliances	1.55%
		☐ Uprighting springs	5.67%
		☐ Segmental arches	5.67%
		☐ None	3.09%
*Reply questions 9–21 only if you answered "Yes" for the second question		☐ Other	0.00%
9	For how long do you use mini-implants?	☐ 1–5 y	64.94%
		☐ 5–10 y	29.31%
		☐ 10–15 y	5.17%
		☐ 15–20 y	0.57%
		☐ More than 20 y	0.00%
10	Do you place mini-implants yourself?	☐ Yes	92.53%
		☐ No	7.47%
11	Which design do you prefer?	☐ Conical	74.74%
		☐ Cylindrical	30.41%
12	Which diameter do you use more frequently?	☐ 1.4 mm	22.68%
		☐ 1.6 mm	72.16%
		☐ 1.7 mm	16.49%
		☐ 2 mm	13.40%
		☐ Other	5.15%
13	Which length do you use more frequently?	☐ 6 mm	18.56%
		☐ 7 mm	26.29%
		☐ 8 mm	75.26%
		☐ 9 mm	21.13%
		☐ 10 mm	23.71%
		☐ Other	

Table 1. Continued

14	How do you decide for mini-implant design and length?	☐ According to the placement site	86.60%
		☐ According to the amount of force	34.02%
		☐ According to the mechanics	40.72%
		☐ Other	1.55%
15	How do you sterilize the mini-implants?	☐ Autoclave	60.92%
		☐ Dry-air sterilization	1.72%
		☐ I prefer presterilized ones	36.78%
		☐ Other	0.57%
16	In which cases do you prefer mini-implants mostly?	☐ Extraction cases, anterior retraction	75.77%
		☐ Nonextraction cases, distalization	48.97%
		☐ Extraction cases, posterior mesialization	46.91%
		☐ Nonextraction cases, mesialization	18.56%
		☐ Intrusion or extrusion	59.79%
		☐ Orthopeadic effect	19.07%
		☐ Other	3.61%
17	When do you apply force on the mini-implant?	☐ Immediately	78.74%
		☐ 1 wk later	19.54%
		☐ 3 mo later	0.00%
		☐ Other	1.72%
18	How do you apply force on the mini-implant?	☐ Direct	86.60%
		☐ Indirect	56.19%
19	What do prescribe the patient after mini-implant placement?	☐ Antibiotics	5.67%
		☐ Mouthwash	48.97%
		☐ None	47.42%
		☐ Other	6.19%
20	What affects mini-implant failure in your opinion?	☐ Bad oral hygiene	76.80%
		☐ Poor insertion technique	73.71%
		☐ Wrong choice of mini-implants	50.52%
		☐ Poor sterilization during insertion	38.66%
		☐ Wrong force application	61.34%
		☐ Other	5.67%
21	When a mini-implant fails, how do you manage?	☐ I place same mini-implant to a neighboring place	43.81%
		☐ I place a longer/thicker mini-implant to same place	15.98%
		☐ I place a new mini-implant to a neighboring place	48.97%
		☐ I place the same mini-implant after 2 mo	17.01%
		☐ Other	3.61%
22	If you use the same mini-implant again, do you . . .	☐ Sterilize after cleaning with a brush	42.31%
		☐ Keep in a disinfectant solution	11.54%
		☐ Sterilize after cleaning with an ultrasonic cleaner	33.65%
		☐ Other	12.50%
23	Do you use the same mini-implant in another patient?	☐ Yes	29.31%
		☐ No	70.69%
25	If not, why?	☐ I don't think it's ethical	38.21%
		☐ I don't trust cleaning and sterilization methods	7.32%
		☐ I believe it will fail or break	38.21%
		☐ It is not adviced in the instruction guide	3.25%
		☐ Other	2.44%
		☐ (no reply)	10.57%
24	Do you use a mini-implant more than twice?	☐ Yes	9.77%
		☐ No	90.23%
27	What kind of problems did you have during reinsertion of a mini-implant?	☐ Broke during insertion/removal	8.76%
		☐ Failed very soon	8.25%
		☐ Tissue reaction occured	3.61%
		☐ I couldn't place it	3.61%
		☐ I had no problem	38.66%
		☐ Other	8.76%

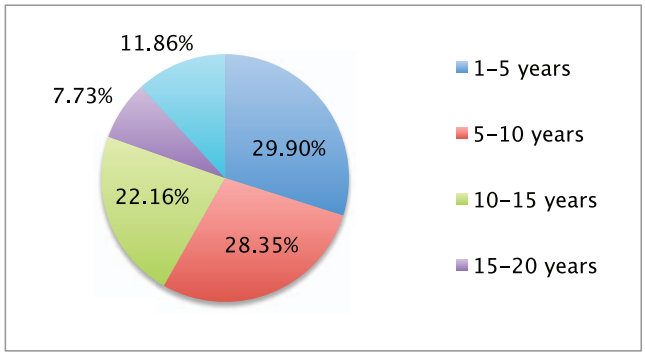

Figure 1. Distribution of the subjects according to their experience as an orthodontist.

MATERIALS AND METHOD

This is a cross-sectional study, conducted with orthodontists who are members of the Turkish Orthodontic Society. An invitation for the questionnaire was sent via e-mail, and the orthodontists were asked to click on a link to complete an automated questionnaire of 27 multiple-choice questions (Table 1). All of the questionnaires were automatically saved in an online account on the Marmara University Survey System. The questionnaire was blinded and did not require any personal information. Six hundred orthodontists were asked to join the survey. A total of 241 orthodontists joined: 194 orthodontists answered all the questions, and 47 failed to complete the survey. Incomplete surveys were excluded from the study.

RESULTS

Of the 194 subjects, 11.86% were experienced as an orthodontist for more than 20 years, 29.89% for 10 to 20 years, and 58.25% for 10 years and less (Fig. 1). Of the subjects, 89.7% reported that they use mini-implants, and the remaining 10.3% reported that they do not use mini-implants in their practice. Table 1 displays the questionnaire and summarizes the results.

For the orthodontists who choose not to use mini-implants, Nance was the appliance of choice in cases of critical anchorage and extraction. For intrusion, intrusion arches and bite-planes are preferred, whereas segmental arches and uprighting springs are used the most for uprighting.

Of the group who used mini-implants in their orthodontic practice, 64.9% reported that they have been using mini-implants for 5 years and less, 29.3% for 5 to 10 years, 5.2% for 10 to 15 years, and 0,6% for 15 to 20 years. Of these orthodontists,

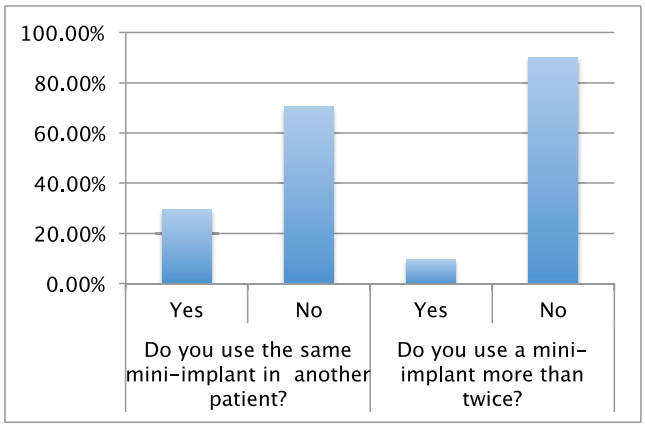

Figure 2. Answers about reuse of a mini-implant.

92.5% place the mini-implants themselves and 60.9% prefer autoclave sterilization.

The mostly preferred physical properties for mini-implants are conical shape (74.7%), 1.6-mm diameter (72.2%), 8-mm length (75.3%). Placement site is found to be the most important factor (86.6%) in the choice of design and length. Immediate loading (78.7%) and direct anchorage (86.6%) are preferred more during mini-implant usage. Antibiotics and analgesics are not prescribed routinely after insertion, whereas mouthwash is advised by almost half of the participants (48.97%).

Bad oral hygiene (76.8%) and poor insertion technique (73.7%) are thought to be the main reasons for failure and usually are overcome by inserting a new mini-implant (48.97%) or the same one (43.8%) to a neighboring site.

For the question, “Do you use the same mini-implant in another patient?” 70.7% replied “no” while 29.3% replied “yes.” The orthodontists who replied “no” stated that they do not think it is ethical and that they believe it will fail or break as their main reasons for not reusing it (Fig. 2).

For a similar question that asked whether they use a mini-implant more than twice, only 9.8% replied “yes,” while most (90.2%) replied “no.” Finally, 33% reported several problems during reinsertion such as breakage, quick failure, tissue reaction, and failure to insert, whereas 38.7% reported having no problems (Fig. 3).

DISCUSSION

Mini-implants have become very popular in contemporary orthodontic practice, owing to their minor surgical intervention, temporary usage, immediate loading, small size, and good anchorage

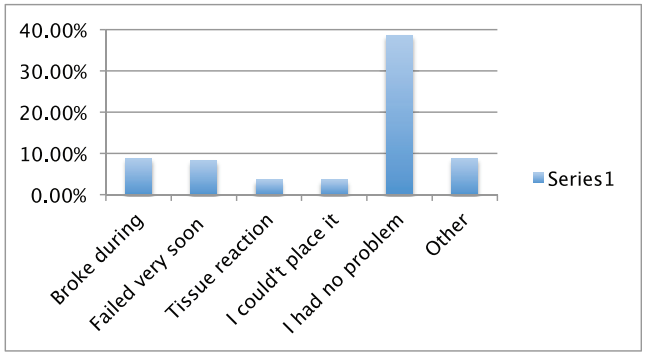

Figure 3. Problems faced during reinsertion of the same mini-implant.

control abilities. Moreover, mean overall success rates for mini-implants have been found to be sufficient for orthodontic treatment and reported to be 83.8% ± 7.4%.[31] Many studies have been published on various aspects of mini-implants, encouraging the clinicians to incorporate mini-implants in their practice where anchorage is critical or infinite anchorage is necessary.

However, in the literature, there are no published data that report either the repetitive use of a same mini-implant or the consequences of multiple insertion. This present study was designed to investigate general tendencies during mini-implant usage, and one of our main aims was to determine whether mini-implants were being used more than once.

The survey was blinded on purpose so that the participants were encouraged to answer truthfully without the hesitation of being judged. The subjects were all members of the Turkish Orthodontic Society and were contacted via e-mail. They were asked to complete the survey several times with intervals in order to increase the number of participants. In general, the questionnaire was designed to answer common tendencies during mini-implant usage and also to mask the questions about reuse.

Of the 194 orthodontists, only 10.3% reported that they do not use mini-implants and prefer conventional mechanics. The remaining 89.7% reported using mini-implants in their practice, mainly for 10 years and less. Figure 1 clearly shows that mini-implants continue to gain popularity among the newer generations of orthodontists.

The mostly preferred physical properties for mini-implants were found to be conical shape (74.7%), 1.6-mm diameter (72.2%), and 8-mm length (75.3%). In a literature review, Crismani *et al.*[31] reported that screw diameters of 1 to 1.1 mm yielded significantly lower success rates than those of 1.5 to 2.3 mm, and another study reported significantly lower success rates for 6-mm- vs 8-mm-long mini-screws (72% vs 90%).[32] Those authors concluded that screws less than 8 mm in length and 1.2 mm in diameter should be avoided.

Our study shows that immediate loading (78.7%) and direct anchorage (86.6%) are preferred more during mini-implant usage. In the literature, it is reported that immediate or early loading up to 200 cN was adequate and showed no significant influence on screw stability.[31]

In the choice of design and length, placement site (location) was found to be the most important factor (86.6%) in our study. Similarly, in various other studies, proper implant site selection is also proposed as a key factor for the success of mini-implants.[33–39]

To discover whether a mini-implant is being used more than once, the same question was asked for twice, in different terms. For the question regarding whether the participant uses a mini-implant more than twice, only 9.8% replied “yes,” while most (90.2%) replied “no.” However, for the question, “Do you use the same mini-implant in another patient?” a greater number of participants (29.3%) replied “yes” (Fig. 2). For the next question, which asked what kind of problems they had during reinsertion of a mini-implant, half of the repliers reported to have several problems such as breakage, bending, tissue reaction, failure to insert, and the tip losing sharpness, while the other half said they did not have any problems.

This survey is especially important for documenting the fact that mini-implants are being used more than once and also in different patients. Unfortunately, there are no controlled studies that answer the question as to whether we can use them repetitively or that investigate the consequences of using the same mini-implant more than once. This absence in the literature is a good impetus for future controlled studies, since mini-implants are being used by a great majority of orthodontists and probably will continue to be popular in the future.

REFERENCES

1. Kanomi R. Mini-implant for orthodontic anchorage. *J Clin Orthod*. 1997;31:763–767.
2. Melsen B, Verna C. Miniscrew implants: the Aarhus anchorage system. *Semin Orthod*. 2005;11:24–31.
3. Herman R, Cope JB. Miniscrew implants: IMTEC mini ortho implants. *Semin Orthod*. 2005;11:32–39.
4. Crismani AG, Bernhart T, Bantleon HP, Cope JB. Palatal

implants: the Straumann Orthosystem. *Semin Orthod*. 2005; 11:16–23.

5. Maino BG, Mura P, Bednar J. Miniscrew implants: the spider screw anchorage system. *Semin Orthod*. 2005;11:40–46.
6. Maino BG, Maino G, Mura P. Spider screw: skeletal anchorage system. *Prog Orthod*. 2005;6:70–81.
7. Carano A, Velo S, Leone P, Siciliani G. Clinical applications of the miniscrew anchorage system. *J Clin Orthod*. 2005;39: 9–24.
8. Ohnishi H, Yagi T, Yasuda Y, Takada K. A mini-implant for orthodontic anchorage in a deep overbite case. *Angle Orthod*. 2005;75:444–452.
9. Park H, Bae S, Kyung H, Sung J. Micro-implant anchorage for treatment of skeletal Class I bialveolar protrusion. *J Clin Orthod*. 2001;35:417–428.
10. Park Y, Chu J, Choi Y, Choi N. Extraction space closure with vacuum-formed splints and miniscrew anchorage. *J Clin Orthod*. 2005;39:76–79.
11. Yun S, Lim W, Chun Y. Molar control using indirect miniscrew anchorage. *J Clin Orthod*. 2005;39:661–664.
12. Park HS, Kwon OW, Sung JH. Micro-implant anchorage for forced eruption of impacted canines. *J Clin Orthod*. 2004;38: 297–302.
13. Park H, Kyung H, Sung J. A simple method of molar uprighting with micro-implant anchorage. *J Clin Orthod*. 2002;36:592–596.
14. Giancotti A, Muzzi F, Santini F, Arcuri C. Miniscrew treatment of ectopic mandibular molars. *J Clin Orthod*. 2004;37:380–383.
15. Park HS, Kwon OW, Sung JH. Uprighting second molars with micro-implant anchorage. *J Clin Orthod*. 2004;38:100–103.
16. Park Y, Lee SY, Kim DH, Jee SH. Intrusion of posterior teeth using miniscrew implants. *Am J Orthod Dentofacial Orthop*. 2003;123:690–694.
17. Paik C, Woo Y, Boyd R. Treatment of an adult patient with vertical maxillary excess using miniscrew fixation. *J Clin Orthod*. 2003;37:423–428.
18. Chang YJ, Lee HS, Chun YS. Microscrew anchorage for molar intrusion. *J Clin Orthod*. 2004;38:325–330.
19. Yao CC, Lee JJ, Chen HY, Chang ZC, Chang HF, Chen YJ. Maxillary molar intrusion with fixed appliances and mini-implant anchorage studied in three dimensions. *Angle Orthod*. 2005;75:754–760.
20. Bae SM, Kyung HM. Mandibular molar intrusion with miniscrew anchorage. *J Clin Orthod*. 2006;40:107–108.
21. Chung K, Kim SH, Kook Y. C-orthodontic microimplant for distalization of mandibular dentition in class III correction. *Angle Orthod*. 2005;75:119–128.
22. Kyung H, Park H, Bae S, Sung J, Kim I. The lingual plain-wire system with micro-implant anchorage. *J Clin Orthod*. 2004;38:388–395.
23. Chung KR, Kim SH, Kook YA. The C-orthodontic micro-implant. *J Clin Orthod*. 2004;38:478–486.
24. Lee J, Park HS, Kyung H. Micro-implant anchorage for lingual treatment of a skeletal class II malocclusion. *J Clin Orthod*. 2001;35:643–647.
25. Bae S, Park H, Kyung H. Clinical application of micro-implant anchorage. *J Clin Orthod*. 2002;36:298–302.
26. Kyung SH, Choi JH, Park YC. Miniscrew anchorage used to protract lower second molars into first molar extraction sites. *J Clin Orthod*. 2003;37:575–579.
27. Giancotti A, Greco M, Mampieri G, Arcuri C. The use of titanium miniscrews for molar protraction in extraction treatment. *Prog Orthod*. 2004;5:236–247.
28. Kyung HM, Park HS, Bae SM, Sung JH, Kim IB. Development of orthodontic microimplants of intraoral anchorage. *J Clin Orthod*. 2003;37:321–328.
29. Kuroda S, Katayama A, Takano-Yamamoto T. Severe anterior open-bite case treated using titanium screw anchorage. *Angle Orthod*. 2004;74:558–567.
30. Park HS, Kwon TG, Kwon OW. Treatment of open bite with microscrew implant anchorage. *Am J Orthod Dentofacial Orthop*. 2004;126:627–636.
31. Crismani AG, Bertl MH, Celar AG, Bantleon HP, Burstone CJ. Miniscrews in orthodontic treatment: review and analysis of published clinical trials. *Am J Orthod Dentofacial Orthop*. 2010;137(1):108–113.
32. Chen CH, Chang CS, Hsieh CH, Tseng YC, Shen YS, *et al*. The use of microimplants in orthodontic anchorage. *J Oral Maxillofac Surg*. 2006;64:1209–1213.
33. Carano A, Melsen B. Implants in orthodontics: interview. *Prog Orthod*. 2005;6(1):62–69.
34. Costa A, Raffaini M, Melsen B. Miniscrews as orthodontic anchorage:a preliminary report. *Int J Adult Orthod Orthognath Surg*. 1998;13:201–209.
35. Cheng SJ, Tseng IY, Lee JJ, Kok SH. A prospective study of the risk factors associated with failure of mini-implants used for orthodontic anchorage. *Int J Oral Maxillofac Implants*. 2004;19:100–106.
36. Luzi C, Verna C, Melsen B. A prospective clinical investigation of the failure rate of immediately loaded mini-implants used for orthodontic anchorage. *Prog Orthod*. 2007;8:192–201.
37. Wiechmann D, Meyer U, Büchter A. Success rate of mini- and micro-implants used for orthodontic anchorage: a prospective clinical study. *Clin Oral Implants Res*. 2007;18: 263–267.
38. Berens A, Wiechmann D, Dempf R. Mini- and micro-screws for temporary skeletal anchorage in orthodontic therapy. *J Orofac Orthop*. 2006;67:450–458.
39. Lin JC, Liou EJ. A new bone screw for orthodontic anchorage. *J Clin Orthod*. 2003;37:676–681.