

Original Research Article

Assessment of patient pain and discomfort experience following placement of Mini screws guided with dynamic navigation in the infra zygomatic crest region

Swati Singh¹, Ravindra kumar Jain^{1*}, Arthi Balasubramaniam¹¹Dept. of Orthodontics, Saveetha Dental College, SIMATS, Chennai, Tamilnadu, India.

Abstract

Background: Guided mini implant placement is required for higher accuracy of placement and success. Assessment of pain experience following mini implant placement is required to determine the patient acceptance of the procedure.

Aim: This study was aimed to evaluate the patient pain and discomfort experience following dynamic navigation guided placement of mini implants in the infra zygomatic crest region.

Materials and Methods: This prospective study involved 15 subjects in whom mini implant placement was performed in the infra zygomatic crest region with dynamic navigation guidance. Assessment of pain and discomfort experience with VAS and faces pain rating scale and assessment of daily function and jaw impairment was done with a questionnaire given to the patients after 24 hours. Frequency distribution and statistical analysis involving independent T tests and Mann Whitney U tests were done.

Results: The overall pain scores were 3.40+/-1.68 and discomfort scores were 2.87+/-1.3. On comparing the VAS and discomfort scores among the study participants based on gender no significant differences were noted. (p>0.05) No significant differences in the median distribution of daily activity and jaw function impairment scores among the genders were noted.

Conclusion: Placement of mini implants in the infrazygomatic region under dynamic navigation elicited moderate pain and discomfort. No gender related differences in pain perception were noted and only a few subjects required analgesics for pain management.

Keywords: Dynamic navigation, Mini implants, Pain scores, Infrazygomatic crest, Guided placement.

Received: 01-08-2024; **Accepted:** 04-10-2024; **Available Online:** 27-05-2025

This is an Open Access (OA) journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License](https://creativecommons.org/licenses/by-nc-sa/4.0/), which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: reprint@ipinnovative.com

1. Introduction

Skeletal anchors have changed orthodontic practice and are very effective, less invasive and user friendly. Mini-screws have historically been placed in the palate and the interdental bone, but more recently, extra alveolar sites including the buccal shelf and Infrazygomatic crest area (IZC) have gained popularity.¹ The maxillary infrazygomatic crest region is superior and lateral to the maxillary first and second molars, and it is separated from the dentoalveolar region.² Mini screws in the IZC region are used for various tooth movements like open bite correction, en masse distalization of the upper arch and intrusion of maxillary dentition.³

Fixed appliance orthodontic therapy typically involves some pain and discomfort during the first week of treatment.

Pain from adjusting the archwires after each appointment lasts for one day.⁴ Since pain is a subjective experience, a variety of factors might affect how someone perceives pain. Mini-implants inserted without raising a flap typically cause less pain than those that do.^{4,5} The maximal level of discomfort was experienced after an hour of mini implant insertion was revealed in published research, and it began to considerably decrease after twelve hours, twenty-four hours, and one week.^{4,6} Pain experience may differ from that of interradicular mini implants because the orthodontic bone screws placed in the IZC region are longer and wider, are inserted in the moveable mucosa, and must pierce thick and dense bone. Conventionally pain experience may differ from that of inter-radicular mini implants because the orthodontic bone screws placed in the IZC region are longer and wider,

*Corresponding author: Ravindra kumar Jain
Email: 152108003.sdc@saveetha.com

are inserted in the moveable mucosa, and must pierce thick and dense bone.⁷ Recently mini screws in the IZC region have been placed with static guides to improve the accuracy of insertion.⁸ Guides for mini implant placement are used to improve the accuracy of positioning since Dynamic navigation (DN) is a real-time navigation technique that enables real-time adjustments based on anatomical visualisation and presurgical correction of implant location.

There is very little literature on patient pain and discomfort experience after guided placement of miniscrews in the IZC region therefore, the purpose of the current study was to assess patient pain and suffering after placing mini implants in the IZC region using dynamic navigation assisted placement.

2. Materials and Methods

2.1. Study settings

This prospective clinical trial was carried out at the Saveetha Dental College and Hospital in Chennai, at the Department of Orthodontics and Dentofacial Orthopaedics. The Saveetha University IHEC/SDC/ORTHO-2013/22/TH-055 Scientific Review Board and Ethical Committee approved the trial.

2.2. Inclusion criteria

1. No gender predilection.
2. Subjects >18yrs and <35 years of age.
3. Subjects requiring either anterior enmasse retraction or full arch Distalization.
4. Subjects requiring open Bite Correction by Intrusion of maxillary posterior teeth.

2.3. Exclusion criteria

1. Patients with restricted mouth opening.
2. Heavy smokers (>10 cigarettes/day)
3. Subjects under bisphosphonates or any other medications affecting bone metabolism
4. Patients with infectious diseases, such as hepatitis or AIDS, Poorly controlled diabetes mellitus
5. Patients suffering from chronic Maxillary sinusitis
6. Subjects with inadequate cortical bone thickness
7. Pregnant/ lactating women
8. Subjects with many large metal restorations that produce “scatter” and interfere with 3D radiographic evaluation.
9. Patients with severe facial or dental asymmetries

G*Power version 3.1 was used to perform the power analysis (Franz Faul university, Kiel, Germany). The effect size of 1.25 was calculated with a power of 90% and an alpha error of 0.05 using the mean difference in mini screw head deviations based on the research by Su L.⁹ A total of fifteen people were found to be the sample size. Fifteen individuals were enrolled in this trial to get Infra zygomatic crest implants, as determined by the sample size calculation.

Eligible subjects were subjected to randomization using a simple coin toss method to allocate the side for the intervention. Guided implant placement was performed with the Navident system (Navident®, ClaroNav Technology Inc.®). The study involved placement of mini screws under dynamic navigation and evaluation of pain and discomfort following placement after 24 hrs.

2.4. Navident guided placement of the Mini implants in the IZC region

Imaging and software planning

All patients were scanned with the same CBCT device and viewed using navigation software and the placement was planned.

2.5. Navident set up

Following registration of the patient to the navident device, calibration of the drill axis to the system was performed. The attachment for drilling the mini implant provided with the kit (Fav anchor, India) was secured to the implant motor. One IZC mini implant (2x12mm, Fav anchor, India) was taken from the sterile pack and fitted onto the implant motor with the attachment. The mini implant installed in the handpiece was calibrated on the drill tag. Local infiltration anesthesia with 1.5ml of 2% lidocaine in 1:80,000 adrenaline was administered before the commencement of the procedure. Prior to drilling in the IZC site, each mini implant underwent an accuracy check and an independent calibration.

Mini Implant placement in the IZC area with dynamic navigation

Followed by calibration, the mini implant (2x12mm, fav anchor, India) installed in the implant handpiece was inserted at the preplanned location and guided by dynamic navigation with an insertion torque of 15 N and a speed of 800 revolutions per minute. (**Figure 1**)

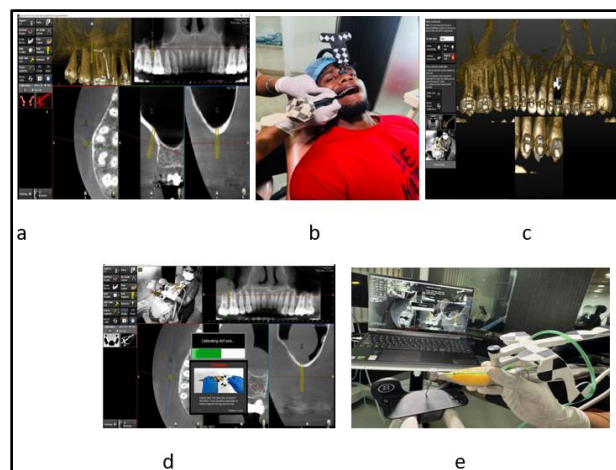


Figure 1: Navident aided placement of Mini Implant in the IZC region, **a)** Planning implant placement in the Navident software **b)** Trace registration done on the patient **c)** trace

registration on software to check for precision **d)** Drill axis calibration **e)** Implant tip calibration

2.6. Loading

TADs were loaded immediately after placement and a force of 200-250 gms was given for en masse distalization of the maxillary dentition. Patients were given a questionnaire as google forms to be filled after 24 hours of mini screw placement.

2.7. Outcomes assessed

2.7.1. Pain and discomfort perception

The questionnaire was provided via an internet survey link, and after 24 hours, the patients' feeling of pain was documented. Using the standard 10-cm visual analogue scale (VAS), pain was measured. Questions about discomfort were created to be in line with the patient's everyday routine and activities. We used the Wong-Baker Faces Pain Rating Scale to provide answers to these questions. The VAS score was applied to evaluate the swelling and pain. The patient's everyday activities may be impacted, and the following criteria were taken into account: discomfort during leisure time, speaking difficulties, eating both soft and hard food, discomfort when drinking, laughing, and yawning. A score of 0–5 was assigned to these questions, with 5 denoting the greatest amount of pain and 0 representing no discomfort at all. After the placement of mini-implants, the patients were also asked if they had taken any painkillers. More than one month following the placement of the mini-implant, no patient responded to the questionnaire. (**Figure 2**)

Self-reported questionnaire for pain and discomfort

Name
Age
Gender

Pain and discomfort

1. How painful was the area where the mini-implant was inserted? In order to respond, use the visual analogue scale. (0–10)
2. Do you currently experience any pain or swelling at the place of insertion? Use the visual analogue scale provided below to provide your answer. (0–10)
3. Daily activity and functional jaw impairment
4. If there was any soreness or pain after the mini-implant was inserted. What impact does that have on your standard of living? To be answered: score 0-5 (0 is the worst pain)
 - a. Your leisure time
 - b. Your speech?
 - c. Your ability to take a big bite?

- d. Your ability to chew hard food?
- e. Your ability to chew soft food?
- f. Your work?
- g. Drinking?
- h. Laughing?
- i. Yawning?

1. Did you miss work due to pain following your mini-implant insertion? Yes / No
2. Did you skip out on your free time due to discomfort at the mini-implant insertion site? Yes / No. If so, what was the number of days you missed from work, school, or leisure?
3. Has the pain from the mini-implant insertion site kept you awake at night? Yes / No
4. Have you used analgesics or painkillers to relieve pain following the placement of a mini-implant?
5. Yes / No. If so, what kind of analgesic or painkiller did you take, and what dose of it?

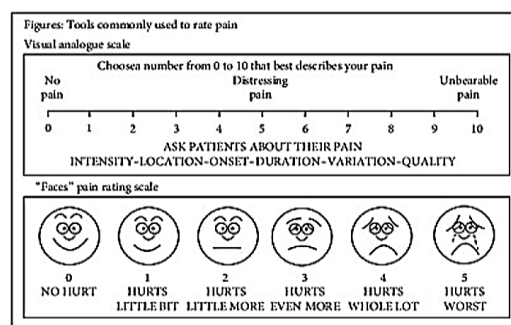


Figure 2: The Faces pain rating scale and the VAS

2.8. Statistical analysis

Statistical analysis was carried out in SPSS software version 23.0. Normality test was carried out using Shapiro-Wilk numerical test. The VAS and discomfort scores were found to be normally distributed, however the patients daily activity scores were not normally distributed. Therefore, to compare VAS and discomfort values, a parametric independent t-test was done; for daily activity scores, a non-parametric Mann-Whitney U test was used. A significant $p < 0.05$ was taken into account.

3. Results

The study included 6 male participants and 9 female participants. The subjects that were included had an average age of 23 ± 3.65 years. Overall pain and discomfort scores among the study participants are mentioned in (**Table 2**). Overall pain scores were 3.40 ± 1.68 and discomfort scores were 2.87 ± 1.3 . On comparing the VAS and discomfort scores among the study participants based on gender no significant differences were noted. ($p > 0.05$) (**Table 3**) There is no significant difference in the median distribution of daily activity and jaw function impairment scores among the genders ($p > 0.05$). (**Table 4**) Very few subjects needed analgesics after mini implant placement.

Table 1: Overall pain and discomfort scores among the study participants

Score	Mean	SD	Range
VAS	3.40	1.682	0 to 7
Discomfort	2.87	1.302	0 to 5

Table 2: Mean comparison of VAS and discomfort scores among the study participants based on gender.

Score	Mean \pm SD		Mean difference	p-value*
	Male	Female		
VAS	3.00 \pm 1.00	4.00 \pm 2.37	-1.000	0.275
Discomfort	2.79 \pm 1.05	2.83 \pm 1.72	0.056	0.939

*Independent t-test

Table 3: Distribution of daily activity and jaw function impairment scores among the study participants

Domain	Median; IQR		p-value*
	Male	Female	
Leisure time pain	2.00; 1.00 – 2.00	2.00; 0.75 – 2.25	0.864
Speech impairment	0.00; 0.00 – 1.00	0.50; 0.00 – 1.00	0.864
Ability to open widely	0.00; 0.00 – 0.00	0.00; 0.00 – 0.25	0.607
Chewing hard food	0.00; 0.00 – 0.00	0.00; 0.00 – 0.25	0.607
Chewing soft food	0.00; 0.00 – 0.00	0.00; 0.00 – 0.00	1.000
Discomfort at work	1.00; 0.00 – 2.00	2.00; 0.75 – 2.25	0.181
Discomfort while drinking	0.00; 0.00 – 0.00	0.00; 0.00 – 0.00	0.776
Discomfort while yawning	0.00; 0.00 – 0.00	0.00; 0.00 – 0.00	1.000
Discomfort while laughing	0.00; 0.00 – 0.00	0.00; 0.00 – 0.00	0.776
	0.00; 0.00 – 2.00		

*Mann-Whitney U test

Table 4: Frequency distribution of performances among the study participants

Performances	N (%)	
	Yes	No
Staying away from work	2 (13.3)	13 (86.7)
Staying away from leisure activities	2 (13.3)	13 (86.7)
Sleep disturbance	0	15(100%)
Analgesic requirement	4 (26.7)	11 (73.3)

4. Discussion

Orthodontic treatment is perceived as painful by patients and there is a need to assess pain perception during orthodontic procedures.¹⁰ Awareness regarding pain perception encountered during orthodontic treatment can help us inform patients prior to the treatment.¹¹ Pain is a very subjective and complex sensation and its quantification is difficult. The VAS scale and faces pain rating scales are commonly used tools which are valid and reliable methods too. VAS is an economical, fast, adaptable, convenient and proven tool.¹² Postoperative pain following treatment with orthodontic miniscrews was perceived to be significantly low.¹³ Even though there are papers on patients' pain perception after orthodontic treatment with miniscrews, there are no papers on pain perception following guided mini screw placement in extra alveolar sites. Therefore, in this study an attempt was made to study pain and discomfort perception 24 hours after guided miniscrew insertion in the infrazygomatic region with a VAS scale and faces pain rating scale.

In the present study it was observed that the pain perception after placement of miniscrews under dynamic navigation guidance was mild and there was not much discomfort related to the placement. The pain and discomfort experience was not influenced by the gender of the patient. The patient's daily activities and jaw function impairment were also not affected much, only 2 subjects complained of leisure time pain and 4 out of the 15 subjects required analgesics in the first 24 hours. Most of the previous studies have reported on pain perception following placement of inter radicular orthodontic mini screws and a minimal pain and discomfort experience has been observed.¹⁴⁻¹⁵ Sreenivasagan et al. recently reported that, of the extra alveolar sites, the palate region had the greatest pain levels, followed by the infrazygomatic crest region and then the buccal shelf region with the least score.

The pain scores in that study for IZC mini screws were slightly lesser than the pain scores in the present study, also mini implants placed in the inter radicular region were well tolerated with minimal pain and discomfort.⁷ Hafez et al, studied patient pain perception after placement of IZC screws and reported mild to moderate pain perception.¹⁶ These results, which revealed pain perception following free hand placement, are consistent with the results of the current study.

In the study by Sreenivasagan et al, the IZC implants were placed with the free hand method but in the present study these implants were placed under dynamic navigation.

To place mini implants under dynamic navigation more time was required, the site of insertion and the soft tissue entry was planned in the software and an implant motor was used for drilling the implants under guidance. Due to the differences in the method and location of placement a difference in the pain and discomfort levels can be assumed in the current study.

A previous study comparing clinical success rates and pain scores between self-drilling and self-tapping mini screws revealed no significant differences in pain scores ($p>0.05$).¹⁷ Assessment of daily activities and jaw impairment has been reported for orthodontic interventions and the success of intervention is dependent on patient experience. Mini implants placed inter radicular usually don't produce any discomfort and are well tolerated. Mini screws placed in the IZC region have been reported to affect leisure activities and difficulty in eating.⁷ On the contrary in the present study patients did not report any difficulty in eating after placement of mini screws in the IZC region. Since the pain experience by subjects was moderate some of them took pain medications. 26.7 % of the subjects in the present study used analgesics for pain relief in the first 24 hrs and all of them took just one paracetamol 650 mg. None of the subjects reported the presence of a swelling in the first day. Also, none of them reported any jaw impairments like pain while chewing or speech or during mandibular movements in the current study.

The available literature can be supplemented with the findings of the present study which includes the possibility of successful placement of mini implants with dynamic navigation guidance and a minimal pain experience for the patient with very few patients requiring analgesics for pain management and no also gender based differences were noted.

The current study did not assess pain or discomfort experienced at various intervals following the implantation of the mini implants. A comparison of pain experience with the free hand method was not done. Further research is needed to address the above mentioned shortcomings of the present study.

5. Conclusion

In the current assessment, very little pain or discomfort was felt after placement of mini implant with dynamic navigation guidance in the IZC region. No gender based differences in pain experience was noted and only a few subjects required analgesics for pain management.

6. Source of Funding

None.

7. Conflict of Interest

None.

References

1. Almeida M. Mini-implantes extra-alveolares no tratamento das assimetrias em Ortodontia. *Rev Clin Ortod Dent*. 2018;17(3):79–92.
2. Almeida MR. Biomechanics of extra-alveolar mini-implants. *Dent Press J Orthod*. 2019;24(4):93–109.
3. Lovely, Raghav P, Reddy CM. Clinical applicability of IZC's in orthodontics - A review. *J Contemp Orthod*. 2023;6(4):172–7.
4. Sergl HG, Klages U, Zentner A. Pain and discomfort during orthodontic treatment: causative factors and effects on compliance. *Am J Orthod Dentofac Orthop*. 1998;114(6):684–91.
5. Kuroda S, Sugawara Y, Deguchi T, Kyung HM, Takano-Yamamoto T. Clinical use of miniscrew implants as orthodontic anchorage: success rates and postoperative discomfort. *Am J Orthod Dentofac Orthop*. 2007;131(1):9–15.
6. Jalali Y, Mirhashemi A, Hosseini M, Yadalloahi H. Pain and discomfort experience after miniscrew insertion as an anchorage device in orthodontic patients. *Dent Hypotheses*. 2016;7(3):112.
7. Sreenivasagan S, Subramanian AK, Selvaraj A, Marya A. Pain Perception Associated with Mini-Implants and Interventions for Pain Management: A Cross-Sectional Questionnaire-Based Survey. *Biomed Res Int*. 2021;2021(1):4842865.
8. Manzo P, Paoletto E, Pellitteri F, Bruccheri L, Lombardo L. Accuracy of the infrazygomatic orthodontic bone screws digital planning and surgical guided positioning: A observational study. *APOS Trends Orthod*. 2024;14(85):85–90.
9. Su L, Song H, Huang X. Accuracy of two orthodontic mini-implant templates in the infrazygomatic crest zone: a prospective cohort study. *BMC Oral Health*. 2022;22(1):252.
10. Krukemeyer AM, Arruda AO, Inglehart MR. Pain and orthodontic treatment. *Angle Orthod*. 2009;79(6):1175–81.
11. Casarett D, Karlawish J, Sankar P, Hirschman KB, Asch DA. Obtaining informed consent for clinical pain research: patients' concerns and information needs. *Pain*. 2001;92(1-2):71–9.
12. Phan NQ, Blome C, Fritz F, Gerss J, Reich A, Ebata T. Assessment of pruritus intensity: prospective study on validity and reliability of the visual analogue scale, numerical rating scale and verbal rating scale in 471 patients with chronic pruritus. *Acta Derm Venereol*. 2012;92(5):502–7.
13. Zawawi KH. Acceptance of orthodontic miniscrews as temporary anchorage devices. *Patient Prefer Adher*. 2014;8:933–7.
14. Blaya Micéli Beck Guimarães. Patient's perception on mini-screws used for molar distalization, *Revista Odonto Ciencia*, 2010;25(3):266-70.
15. Bud E, Vlasi A, Chibeleian M, Martha K, Păcurar M, Bud A, et al. Factors associated with pain intensity in patients undergoing orthodontic treatment based on mini-implants. *J Interdiscip Med*. 2021;6(2):74–81.
16. Hafez NH, Mostafa YA, El-Dakrouy AE, El-Dawlatly MM. Evaluation of pain perception associated with maxillary first molars distalization in the presence of maxillary third molars versus extracted third molars using infra-zygomatic mini-screws: A randomized clinical trial. *Future Dent J*. 2024; 9(2):117-20.
17. Sabzijati M, Rahbar M, Shanei F, Salehi-Vaziri A., Ghaffari H, Abtahi S. Comparing the Clinical Success Rate of Self-Drilling and Self-Tapping Mini-screws in the Retraction of Maxillary Anterior Teeth. *Pesquisa Brasileira em Odontop Clínica Integrada*. 2019;19(1):1-9.

Cite this article: Singh S, Jain RK, Balasubramaniam A. Assessment of patient pain and discomfort experience following placement of Mini screws guided with dynamic navigation in the infra zygomatic crest region. *J Contemp Orthod*. 2025;9(2):258–262.

