

MOST COMMON COMPLICATIONS AFTER MINISCREWS PLACEMENT IN ORTHODONTIC PATIENTS: A CROSS-SECTIONAL STUDY

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ABSTRACT OBJECTIVES

This study aimed to determine the frequency of the most common complications after mini-screw insertion.

METHODOLOGY

This cross-sectional study was conducted at the Department of Orthodontics, Khyber College of Dentistry, from October 20, 2022, to March 20, 2023. Ninety-one participants aged 14-30 years, in the permanent dentition stage and requiring absolute anchorage, were included. Discomfort and mobility of miniscrews were assessed using questionnaires administered immediately after insertion and 24 hours later. Participants were instructed on completing the questionnaire and asked to return the completed forms. Chi-square and Fisher's exact tests were used for analysis.

RESULTS

The mean age was 21.04 ± 4.38 years (range: 14-30), with 54 females (59.34%) and 37 males (40.66%). Immediately after miniscrew placement, 16 (17.58%) reported severe pain, 29 (31.87%) moderate, and 46 (50.55%) mild. After 24 hours, severe pain reduced to 12 (13.19%), moderate to 26 (28.57%), and mild increased to 53 (58.24%). Discomfort during movement was reported by 17 (18.68%), speech difficulty by 10 (10.99%), swelling by 17 (18.68%), and redness by 19 (20.88%). Miniscrews were mobile in 14 (15.38%) and loose in 12 (13.19%). Significant associations were found between age group and mobility ($p=0.001$), looseness ($p=0.003$), and postoperative swelling/redness ($p=0.033$), with younger patients showing higher rates.

CONCLUSION

Miniscrews are associated with pain and discomfort in all patients, with the majority experiencing mild to moderate pain and a smaller proportion reporting severe pain. Mobility of miniscrews is more common in younger age groups.

KEYWORDS: Complication, Discomfort, Pain, Miniscrew.

INTRODUCTION

Anchorage management is critical for clinical orthodontic success since it is necessary to maximize desirable tooth movements while minimizing undesired forces. For more than a century, many intraoral and extra oral anchoring devices have been developed and used.¹ Orthodontic miniscrews, also known as temporary anchorage devices (TADs), are an alternative to traditional anchorage systems that do not require compliance. TADs, according to current research, can provide more secure anchorage than previous approaches.² Various miniscrew systems have been developed to obtain skeletal anchorage and avoid the use of the most common intra- and extra oral orthodontic appliances, which patients often dislike.³ Nonetheless, the clinical use of miniscrews is associated with potential side effects and complications that can occur during use, removal, and insertion.⁴ The

most prevalent complication is injury to the periodontal ligament, along with distress, looseness, pain, mobility, perforation of the floor of the nasal cavity, maxillary sinus, abrasion of the buccal mucosa at the insertion site, and soft-tissue necrosis.⁵ Several studies have been conducted recently to determine patient-related and miniscrew-related factors that affect the success rate of orthodontic miniscrews.⁶ Various factors can be associated with the failure rate of miniscrews, such as gender, viscoelastic properties of bone, type of retraction, time of loading, and arch for placement.⁷ A study conducted by Shingo Kuroda et al.⁸ evaluated success rates and postoperative discomfort after miniscrew placement. It was concluded that most patients reported pain 1 hour after placement surgery—approximately 95% with miniscrews and 100% with miniplates - and most patients required pain medication. However, the frequency dropped to 10% on day 1. On day 5, more than half of the patients continued to report

pain, and after day 7, approximately 10% still reported pain. Another study by Gurdán et al.⁹ found that soft-tissue infections (peri-implantitis) ranged from 6.3% to 33.3% of cases, while screw mobility ranged from 3.1% to 20.8% across anatomic locations. Screw mobility was significantly more frequent in the buccal fold than in the palate ($p < 0.05$), and more frequent in intrusions than extrusions ($p < 0.05$). The convenience that miniscrews have brought to biomechanics has often led to their side effects being overlooked. The introduction of miniscrews has largely replaced loop mechanics in our department, making it important to investigate even fewer common complications. The rationale for this study is to identify the most frequent complications following miniscrew insertion at the Department of Orthodontics at Khyber College of Dentistry, so that appropriate precautions can be taken in the future to prevent or minimize these issues. While many studies have focused on the clinical applications and effectiveness of orthodontic miniscrews, few have examined their adverse effects and challenges encountered in clinical practice. The objective of this study was to determine the frequency of the most common complications after miniscrew insertion.

METHODOLOGY

This cross-sectional study was conducted at the Department of Orthodontics and Dentofacial Orthopedics, Khyber College of Dentistry, from October 20, 2022, to March 20, 2023, using a non-probability, consecutive sampling technique. Using the WHO sample size calculator, the total sample size was 91, with a 6.3% frequency of peri-implantitis, a 5% margin of error, and a power of 95%.¹⁰ The inclusion criteria were patients in the permanent dentition period, aged above 14 years and below 30 years, those in need of absolute anchorage as determined by clinical examination and treatment planning, patients whose lateral cephalograms had already been obtained, and those with almost completed growth as assessed through lateral cephalometric radiographs using the cervical vertebrae maturation method (CVM stage 5 and above). Exclusion criteria included patients with an allergy to local anesthesia, bleeding disorders, bone-metabolic diseases, and those who had undergone radiotherapy within the previous 6 months. Ethical approval was obtained from the RRB-KCD with approval number (No: 65/ADR/KCD, dated: 13-12-2021). Patients seeking treatment at the Orthodontic Department were invited to participate if they fulfilled the selection criteria. The rationale for the study, the procedure details, and the associated risks and benefits were explained to the patients. Patients had full autonomy to participate or withdraw. Written consent

was obtained from willing participants. A self-drilling titanium orthodontic implant was placed under aseptic conditions in accordance with the treatment plan. After administration of local anesthesia, the insertion site was selected based on available bone and interradicular space. As a self-drilling technique was used, no pilot hole was prepared, and the miniscrew was inserted directly into the bone using a hand driver with controlled pressure. A titanium screw measuring 1.3×7 mm was placed on the buccal side, while a 1.3×10 mm screw was placed on the palatal side to ensure adequate stability. The implants were inserted until the head was flush with the soft tissue, and primary stability was clinically verified. Participants completed a questionnaire at two intervals: immediately after insertion and 24 hours after insertion. *Pain* was assessed using the Visual Analogue Scale (VAS) and categorized as mild (1-3), moderate (4-7), or severe (7-10). Discomfort, defined as uneasiness at the implant site, was assessed immediately after placement. *Looseness* was defined as slight movement (< 0.5 mm) on palpation immediately after placement. A miniscrew was considered loose when it showed visible displacement or rotation within the bone upon gentle manual pressure, indicating loss of primary stability. *Mobility* was defined as movement > 0.5 mm upon palpation after 7 days. Miniscrew mobility was assessed clinically by the orthodontist during follow-up visits. Mobility was evaluated by applying gentle pressure with a dental instrument (explorer or tweezer) in a buccolingual direction. *Postoperative swelling/redness* was assessed clinically 24 hours after placement by the operator. Data were analyzed using SPSS version 22. Normality was assessed with the Shapiro-Wilk test. Age was presented as mean $\pm$ standard deviation or median and range, while categorical variables (gender, implant placement, pain, discomfort, looseness, mobility, and postoperative swelling/redness) were expressed as frequencies and percentages. Age, gender, and miniscrew purpose (anchorage/space closure) were stratified by outcome variables using the chi-square test or Fisher's exact test when the expected cell count was < 5 . A p -value < 0.05 was considered statistically significant.

RESULTS

The mean age was 21.04 ± 4.38 years, ranging from 14 to 30 years. There were 54 females (59.34%) and 37 males (40.66%). The most common age group was 14-20 years with 50 participants (54.95%), followed by the 21-25 years' group with 25 participants (27.47%) (Table 1). Most of the participants belonged to the medium socio-economic status group ($n=48$, 52.75%), followed by the low socio-economic status group

(n=33, 36.26%) (Fig 1). In 60 (65.93%) cases, the miniscrews were used for anchorage, and in 31 (34.07%) cases for space closure. Immediately after miniscrew placement, severe pain was found in 16 (17.58%), moderate in 29 (31.87%), and mild in 46 (50.55%). After 24 hours of miniscrew placement, severe pain was found in 12 (13.19%), moderate in 26 (28.57%), and mild in 53 (58.24%). Discomfort during movement was present in 17 (18.68%) participants. Problem during speaking was present in 10 (10.99%). Swelling and redness were found in 17 (18.68%) and 19 (20.88%), respectively. Miniscrews were mobile in 14 (15.38%) and loose in 12 (13.19%) (Table 2). Two parameters, i.e., immediate pain and looseness of miniscrews, were statistically different among genders. Among females, immediate pain was more frequently moderate in 19 (35.19%), while in males it was 10 (27.03%). Severe immediate pain was found in 14 (25.93%) females and in 2 (5.41%) males. Mobile miniscrews were more common in males (n=9, 24.32%) than in females (n=3, 5.56%). The remaining details are given in Table 3. A significant association was found between age group and miniscrew mobility ($p=0.001$), looseness ($p=0.003$), and swelling due to peri-implantitis ($p=0.033$). Mobility, looseness, and swelling/postoperative redness were more common in the younger age group than in the older age groups (Table 4).

Table 1: Frequency of Gender, Age Group, and Socio-Economic Status

Variable	Characteristic	n (%)
Gender	Female	54 (59.34)
	Male	37 (40.66)
Age group	14-20	50 (54.95)
	21-25	25 (27.47)
	26-30	16 (17.58)
Socio-economic Status	Low	33 (36.26)
	Medium	48 (52.75)
	High	10 (10.99)

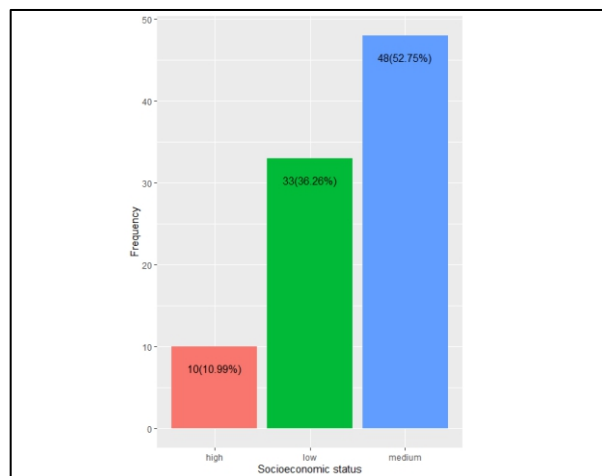


Figure 1: Socio-Economic Status of the Participants

Table 2: Frequency Distribution of Miniscrew Purpose, Pain, Discomfort, Mobility, and Postoperative Swelling/Redness

Variable		n (%)
Mini screws are used for	Anchorage	60 (65.93)
	Space closure	31 (34.07)
Pain immediately after insertion	Mild	46 (50.55)
	Moderate	29 (31.87)
	Severe	16 (17.58)
Pain after 24 hours	Mild	53 (58.24)
	Moderate	26 (28.57)
	Severe	12 (13.19)
Buccal mucosa discomfort during movement	Absent	74 (81.32)
	Present	17 (18.68)
Problems with speaking	Absent	81 (89.01)
	Present	10 (10.99)
Mobility of mini screws	Absent	77 (84.62)
	Present	14 (15.38)
Postoperative swelling/redness	Absent	74 (81.32)
	Present	17 (18.68)
Postoperative swelling/redness	Absent	72 (79.12)
	Present	19 (20.88)
Looseness	Immobile	79 (86.81)
	Completely mobile	12 (13.19)

Table 3: Comparison of Discomfort, Mobility, Looseness, and Peri-Implantitis among Genders

Variable	Characteristic	Female, N=54	Male, N=37	p-value*
Pain immediate	Mild	21(38.89)	25(67.57)	0.01
	Moderate	19(35.19)	10(27.03)	
	Severe	14(25.93)	02(5.41)	
Pain 24hr	Mild	28(51.85)	25(67.57)	0.146
	Moderate	16(29.63)	10(27.03)	
	Severe	10(18.52)	02(5.41)	
Buccal mucosa discomfort	Absent	44(81.48)	30(81.08)	>0.999
	Present	10(18.52)	07(18.92)	
Problem speaking	Absent	47(87.04)	34(91.89)	0.699
	Present	07(12.96)	03(8.11)	
Mobility of MI	Absent	49(90.74)	28(75.68)	0.097
	Present	05(9.26)	09(24.32)	
Looseness	Immobile	51(94.44)	28(75.68)	0.022
	Mobile	03(5.56)	09(24.32)	
Swelling peri-implantitis	Absent	43(79.63)	31(83.78)	0.821
	Present	11(20.37)	06(16.22)	
Redness Peri-implantitis	Absent	45(83.33)	27(72.97)	0.351
	Present	09(16.67)	10(27.03)	

*chi-square test/Fisher's exact test

Table 4: Comparison of Discomfort, Mobility, Looseness, and Peri-Implantitis among Age Groups

Variable	Characteristic	14-20, N=50	21-25, N=25	26-30, N=16	p-value*
Pain Immediate	Mild	24 (48.00)	13 (52.00)	09 (56.25)	0.48
	Moderate	14 (28.00)	09 (36.00)	06 (37.50)	
	Severe	12 (24.00)	03 (12.00)	01 (6.25)	
Pain 24hr	Mild	29 (58.00)	15 (60.00)	09 (56.25)	0.573
	Moderate	12 (24.00)	08 (32.00)	06 (37.50)	
	Severe	09 (18.00)	02 (8.00)	01 (6.25)	
Buccal Mucosa Discomfort	Absent	42 (84.00)	20 (80.00)	12 (75.00)	0.71
	Present	08 (16.00)	05 (20.00)	04 (25.00)	
Problem Speaking	Absent	46 (92.00)	21 (84.00)	14 (87.50)	0.567
	Present	00 (08.00)	04 (16.00)	02 (12.50)	
Mobility	Absent	36 (72.00)	25 (100.0)	16 (100.0)	0.001
	Present	14 (28.00)	00 (0.00)	00 (0.00)	
Looseness	Immobile	38 (76.00)	25 (100.0)	16 (100.0)	0.003
	Mobile	12 (24.00)	00 (0.00)	00 (0.00)	
Swelling Periimplantitis	Absent	36 (72.00)	24 (96.00)	14 (87.50)	0.033
	Present	14 (28.00)	01 (04.00)	02 (12.50)	
Redness Periimplantitis	Absent	35 (70.00)	23 (92.00)	14 (87.50)	0.058
	Present	15 (30.00)	02 (08.00)	02 (12.50)	

*Fisher's exact test

DISCUSSION

This study aimed to determine the frequency of the most common complications after miniscrew insertion. Our findings showed that severe pain was present in 17.58% of patients immediately after insertion and in 13.19% after 24 hours. Moderate pain was found in 26 (28.57%) participants, discomfort during movement in 18.68%, and problems during speaking in 10.99% of the subjects. Swelling and redness were found in 18.68% and 20.88%, respectively. Miniscrews were mobile in 15.38% and loose in 13.19%. Although miniscrews are routinely used in orthodontic practice for various purposes, such as intrusion, retraction, molar distalization, correction of occlusal can't, and midline correction, they may sometimes become mobile during treatment and fail to serve as stationary anchors, necessitating removal.^{11,12} Thus, orthodontists need to know the factors responsible for their failure. Mini-screw failure is multifactorial and is classified into patient-related, operator-related, and implant-related factors.⁶ Several studies revealed that factors such as age, gender, soft tissue type at the insertion site, as well as the location, length, diameter, and design pattern of the mini-implant, are associated with its failure. 11–14 Lee et al.¹⁵ reported that miniscrews show significantly higher success rates in adults (93.8%) than in adolescents (82.4%). It has also been reported that palatal placement results in lower success rates (70%) than buccal placement (95.5%).¹⁶ Additionally, the maxilla (86.9%) has significantly higher success rates than the mandible (76.1%).¹² A

study using a retrospective questionnaire in 75 patients found that those who received screws or miniplates with mucoperiosteal flap surgery commonly experienced pain one day post-surgery, with 35% still in pain after a week, along with discomfort and swelling. In contrast, only 35% of patients who received miniscrews without flap surgery reported mild pain immediately, 8% after one day, and none after a week. Thus, flapless miniscrew placement is associated with less pain and discomfort, making it a favorable option for orthodontic anchorage.⁸ Screws inserted through non-keratinized or movable gingiva can irritate surrounding soft tissues and may lead to postoperative swelling and redness. It has been found that placing miniscrews in non-keratinized tissue can result in screw failure.¹⁷ Additionally, when screws are covered by movable mucosa, they can cause pain and discomfort. Therefore, it is preferable to place miniscrews within attached or keratinized gingiva. Because females tend to seek orthodontic care more often than males for esthetic reasons, the proportion of females was significantly higher in most studies. A meta-analysis found no significant difference across the 13 studies, but males had higher bone mineral density than females. However, the success rate of miniscrews did not significantly differ between the two genders.¹⁸ Our findings showed that failure of mini-implants is more common in younger age groups. Age is a patient-dependent factor. The failure rate is higher in adolescents than in adults due to differences in the thickness of the buccal plate.¹⁹ Most studies have noted that younger patients have lower success rates. The reason for this difference may be adolescents' (≤ 20 years old) higher metabolic rate compared to adults, which may influence success rates. Patients' oral hygiene may also contribute. As age increases, oral hygiene tends to improve as patients become more careful, adopt a more mature approach, and take better care of their teeth.¹⁶

LIMITATIONS

The cross-sectional design limits the ability to establish causal relationships between risk factors and miniscrew complications. The relatively small sample size from a single center may restrict the generalizability of the results to broader populations. Additionally, the use of a non-probability consecutive sampling technique may introduce selection bias. Pain and discomfort were assessed using self-reported questionnaires, which are subject to reporting bias and individual perception variability. Furthermore, the short follow-up period (primarily immediate and 24 hours, with limited longer-term assessment) does not capture late-onset complications or long-term miniscrew stability outcomes.

CONCLUSIONS

This study found that while most patients experienced mild to moderate pain after miniscrew placement, some reported notable discomfort and complications. Pain generally decreased within 24 hours. Females reported more immediate pain, whereas miniscrew mobility was more common in males. Younger patients showed a higher incidence of mobility, looseness, and peri-implantitis. These findings underscore the need to consider age and tissue characteristics when planning miniscrew placement to minimize postoperative issues.

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REFERENCES

- Mehta U, Reddy CM, Khera AK, Raghav P, Arya S, Jaiswal A. Exploring different methods for assessing anchorage loss during orthodontic space closure: a narrative review. *J Res Dent Sci*. 2024;15(1):39-44.
- Sharma D, Thakur G, Gurung D, Thakur A. Basic principles of anchorage: a review. *Int J Res Med Sci*. 2024;12:4378. <https://doi.org/10.18203/2320-6012.ijrms20243778>.
- Selvaraj S, Tandon A, Chandrasekaran D, Purushothaman D, Katepogu P, Mohan R, et al. Anchorage and stability of orthodontic mini implants in relation to length and types of implants. *Cureus*. 2024;16(11):e63525. <https://doi.org/10.7759/cureus.63525> PMID: 39521487 PMCID: PMC11540458.
- Yildiz MS, Ulutas PA, Ozenci I, Akcali A. Clinical and radiographic assessment of the association between orthodontic mini-screws and periodontal health. *BMC Oral Health*. 2024;24(1):1376. <https://doi.org/10.1186/s12903-024-05252-y> PMID: 39548259 PMCID: PMC11575746.
- Laforgia A, Dipalma G, Inchingolo A, Chieppa S, Colonna V, Tartaglia F, et al. Dental issues following the placement of orthodontic mini-screws. *Eur J Musculoskelet Dis*. 2024;13(2 Suppl 1):28-36.
- Tarigan SHP, Sufarnap E, Bahirrah S. Orthodontic mini-implant failures based on patient outcomes: a systematic review. *Eur J Dent*. 2024;18(2):417-429. <https://doi.org/10.1055/s-0043-1777308> PMID: 37802192.
- Alharbi F, Almuzian M, Bearn D. Miniscrews failure rate in orthodontics: systematic review and meta-analysis. *Eur J Orthod*. 2018;40(5):519-530. <https://doi.org/10.1093/ejo/cjx083> PMID: 29216345.
- 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 Dentofacial Orthop*. 2007;131(1):9-15. <https://doi.org/10.1016/j.jado.2005.02.032> PMID: 17208102.
- Gurdam Z, Szalma J. Evaluation of the success and complication rates of self-drilling orthodontic mini-implants. *Niger J Clin Pract*. 2018;21(5):546-556. https://doi.org/10.4103/njcp.njcp_232_17 PMID: 29605992.
- Khalil ZUR, Hameed A, Raza M, Khan A, Nazir K, Khattak A. A comparative study of oral health in preclinical and clinical years of undergraduate dental students of Peshawar using the DMFT index. *Prof Med J*. 2020;27(7):1340-1345. <https://doi.org/10.29309/TPMJ/2020.27.07.3932>.
- Miyawaki S, Koyama I, Inoue M, Mishima K, Sugahara T, Takano-Yamamoto T. Factors associated with the stability of titanium screws placed in the posterior region for orthodontic anchorage. *Am J Orthod Dentofacial Orthop*. 2003;124(4):373-378. [https://doi.org/10.1016/S0889-5406\(03\)00565-1](https://doi.org/10.1016/S0889-5406(03)00565-1) PMID: 14560265.
- Manni A, Cozzani M, Tamborrino F, De Rinaldis S, Menini A. Factors influencing the stability of miniscrews: a retrospective study on 300 miniscrews. *Eur J Orthod*. 2011;33(4):388-395. <https://doi.org/10.1093/ejo/cjq090> PMID: 20805280.
- Park HS, Jeong SH, Kwon OW. Factors affecting the clinical success of screw implants used as orthodontic anchorage. *Am J Orthod Dentofacial Orthop*. 2006;130(1):18-25. <https://doi.org/10.1016/j.jado.2004.09.020> PMID: 16849067.
- Moon CH, Lee DG, Lee HS, Im JS, Baek SH. Factors associated with the success rate of orthodontic miniscrews placed in the upper and lower posterior buccal region. *Angle Orthod*. 2008;78(1):101-106. <https://doi.org/10.2319/122206-521.1> PMID: 18193967.
- Lee SJ, Ahn SJ, Lee JW, Kim SH, Kim TW. Survival analysis of orthodontic mini-implants. *Am J Orthod Dentofacial Orthop*. 2010;137(2):194-199. <https://doi.org/10.1016/j.jado.2008.03.029> PMID: 20152645.
- Topouzelis N, Tsaousoglou P. Clinical factors correlated with the success rate of miniscrews in orthodontic treatment. *Int J Oral Sci*. 2012;4(1):38-44. <https://doi.org/10.1038/ijos.2012.9> PMID: 22509185 PMCID: PMC3421902.
- Giudice AL, Rustico L, Longo M, Oteri G, Papadopoulos MA, Nucera R. Complications reported with the use of orthodontic miniscrews: a systematic review. *Korean J Orthod*. 2021;51(3):199-216. <https://doi.org/10.4041/kjod.2021.51.3.199> PMID: 33935408 PMCID: PMC8081535.
- Chawshli OF, Hasan HS, Yalda FA, Al-Talabani SZ. Success rate of miniscrews for incisor intrusion and patient age, gender, and insertion angle in the maxilla using CBCT and implant-guided surgery: a split-mouth randomized controlled trial. *Orthod Craniofac Res*. 2024;27(1):118-125. <https://doi.org/10.1111/ocr.12705> PMID: 37808302.
- Golshah A, Gorji K, Nikkardar N. Effect of miniscrew insertion angle in the maxillary buccal plate on its clinical survival: a randomized clinical trial. *Prog Orthod*. 2021;22(1):22. <https://doi.org/10.1186/s40510-021-00366-7> PMID: 34088314 PMCID: PMC8171804.

AUTHORS CONTRIBUTION

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Kiran Khan - Concept & Design; Data Acquisition; Data Analysis/Interpretation; Drafting Manuscript; Critical Revision; Final Approval

Ifrah Ishfaq - Concept & Design; Data Acquisition; Data Analysis/Interpretation; Drafting Manuscript; Critical Revision; Final Approval

Fatima Bibi - Concept & Design; Data Acquisition; Data Analysis/Interpretation; Drafting Manuscript; Critical Revision; Final Approval

Ahsan Mehmood Shah - Concept & Design; Data Acquisition; Drafting Manuscript; Critical Revision; Supervision; Final Approval

The authors accept responsibility for all aspects of the work and will ensure that any concerns regarding the accuracy or integrity of any part are properly investigated and resolved.



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