COMPARISON OF PAIN ASSOCIATED WITH MINICSREW INSERTION IN ORTHODONTIC PATIENTS BY USING TOPICAL VERSUS INFILTRATION ANESTHESIA

Ghulam Rasool[1], Ahsan Mehmood Shah[1], Asma Ahmad[1], Faizan Ul Hassan[1], Ijaz Khan[1], Alveena Shahab[1].

[1]Department of Orthodontics Khyber College of Dentistry Peshawar

Abstract

Objective: *The objective of this study was to compare pain associated with miniscrew insertion in orthodontic patients by using topical versus infiltration anesthesia.*

Materials & Methods: *In 30 patients, the topical anesthetic was applied on one side, while the infiltrative anesthetic was used on the other side. Infiltrative anesthesia containing lidocaine hydrochloride and epinephrine (1:100,000. Topical anesthetic gel having 20% lidocaine was applied for 7 minutes on the area of the mucosa that received the mini-implant. Self-drilling miniscrew of 1.4 X 8mm made of titanium was used. Ten points visual analog scale (VAS) was used to record pain during miniscrew insertion for both types of anesthesia. Statistical analysis was performed using SPSS version 20.0. The comparison of the VAS results for topical and infiltrative anesthetics was performed using the independent sample t-test.*

Results: *Out of a total of 30 patients, 15 patients (50%) receiving topical anesthesia felt discomfort and infiltration was given. The mean pain VAS score was very high in topical anesthesia(7.07) as compared to infiltration anesthesia(1.83). The difference in pain score in topical anesthesia was statistically significantly different from in infiltration anesthesia (P=0.006). Pain score was a little higher in males than females, but it was not statistically significant (P=0.38).*

Conclusion: *Topical anesthesia is not an effective mean for controlling pain and discomfort during miniscrew placement*

Key Words: *Miniscrews, Topical anesthesia, Infiltration anesthesia, Orthodontic pain*

Introduction

Although the principle of orthodontic anchorage has been completely understood since the 17th century, it does not appear to have been clearly stated until 1923 when Louis Ottofy defined it as the base against which orthodontic force or reaction of orthodontic force is applied." Most recently, Daskalogiannakis defined anchorage as "resistance to unwanted tooth movement." It can also be defined as the amount of allowed movement of the reactive unit. Using this definition requires clarification of the reactive unit as well as the active unit.[3]

Anchorage control in orthodontic treatment is an important factor in determining treatment outcome. Orthodontic therapy has traditionally used the teeth and extraoral and intermaxillary appliances to protect against loss of Anchorage. However, many of these devices need patient cooperation, and loss of anchorage is often inevitable.[4]

To hamper these complications, skeletal anchorage has been progressively incorporated into orthodontic treatment.

Correspondence:
Professor Dr. Ghulam Rasool,
Dean Khyber College of Dentistry Peshawar
Email: grasoolkcd@yahoo.com
Cell # 0333-9126029

Orthodontic skeletal anchorage devices can be divided into mini plates, miniscrews, palatal implants, implants, and dental implants. Sherwood et al[5] used buccal plates to improve open bite by molar intrusion, Park et al.[6] conducted fixation of maxillary molars using buccal miniscrews for treatment of bimaxillary protrusion, Wehrbein et al.[7] used miniscrews at the median palatine suture to fix maxillary molars for treatment of maxillary protrusion, Carano et al used the mini-implants to provide anchorage during incisor intrusion. Lee et al. suggested that the mid-palatal mini-implants could be effectively used for the intrusion of maxillary molars.

Miniscrews can easily be inserted and removed with a simple procedure, can be loaded immediately, are commercially available in a number of dimensions with width range 1.3-2.3mm and lengths are in 5mm-12mm and are relatively cost-effective.[10]

Assessment of patients' acceptance factors regarding the use of mini-implants during orthodontic treatment depicted that the need for infiltrative anesthesia is one of the factors that patients reject the most.– A number of topical anesthetics are available to be used before minor dental procedures and well accepted by orthodontic patients.[12] Kravitz et al.[13] that miniscrew can be inserted into the bone using topical anesthesia without pain.

A a limited number of studies are available to compare the effectiveness and acceptability of topical versus infiltration anesthesia during placement of miniscrew in orthodontics. Thus the objective of this study was to compare pain associated with miniscrew insertion in orthodontic patients by using topical versus infiltration anesthesia.

Materials and Methods

This cross-sectional comparative study was conducted in the Department of Orthodontics, Khyber College of Dentistry, Peshawar from August 2016 to April 2015. After explaining the risks and benefit of the research to participants, informed consent was obtained.

Samples of 30 patients were selected for this study that required miniscrews for various anchorage purposes in the maxilla. Patients having allergies to amide and ester-type, which are usually combined in the compound, glucose-6-phosphate dehydrogenase deficiency and congenital or idiopathic methemoglobinemia and cardiovascular disease were excluded.

The anesthetic was used alternately, that is, the topical anesthetic was applied on one side, while the infiltrative anesthetic was used on the other side. The anesthesia was applied by a postgraduate trainee under the supervision of a consultant who, in turn, has extensive expertise in the mini-implant placement either with infiltrative or topical anesthesia.

Infiltrative anesthesia containing lidocaine hydrochloride & epinephrine (1:100,000) applied where the mini-implant was placed, with the aid of a 21 mm gingival needle in the mucosa area, only, with 1/5 of the cartridge being injected. Mini-implant insertion was done 2 minutes after the infiltrative anesthesia was applied. Topical anesthesia on the opposite side, topical anesthetic gel with 20% lidocaine was applied for 7 minutes on the area of the mucosa that received the miniscrew. If the patient reported discomfort during miniscrew insertion with topical anesthetic, the procedure would be interrupted, and the infiltrative anesthetic would be used. Self-drilling miniscrew of 1.3X 7mm made of titanium was used. Vas analog scale(VAS) (10 points) was used to record pain during miniscrew insertion for both types of anesthesia.

Statistical analysis was performed using SPSS version 20.0. The normality of data was verified by using Shapiro-Wilk and Kolmogorov-Smirnov test. The data was normal, so parametric tests were applied. The comparison of the pain score for topical and infiltrative anesthetics was performed using the independent sample t-test. To evaluate the gender comparison of the responses of VAS, the independent sample t-test was applied. The level of significance was set at $P < 0.05$.

Results

In this study total, 30 participants received topical anesthesia in one side and infiltration anesthesia in other side randomly. Ten(33.3%) were males and 20(66.66%) were female. The mean age in this study was 20.5 ± 2.51 years and age range was 17 to 25 years.

Out of total of 30 patients, 15 patients(50%) receiving topical anesthesia felt discomfort and infiltration was given. **Table 1** shows that both tests of normality (Kolmogorov-Smirnova and Shapiro-Wilk) are statistically significant ($P<0.05$), so the data are normal.

The mean pain VAS score was very high in topical anesthesia(7.07) side as compared to infiltration anesthesia(1.83) side. **(Table 2)**. The difference in pain score in topical anesthesia was statistically significantly different from in infiltration anesthesia ($P=0.006$). The details of the statistics are given in **table 3**. Pain score was a little higher in males than females, but it was not statistically significant ($P=0.38$). The details are given in **table 4 and 5.**

Table 1: Tests of Normality for pain VAS score

Type of Anesthesia	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	df	Sig.
Topical anesthesia	.175	30	.019	.921	30	.028
Infiltration Anesthesia	.287	30	.000	.780	30	.000

Table 2: Descriptive statistics of VAS score in both types of anesthesia

Type of Anesthesia		N	Mean	Std. Deviation	Std. Error Mean
VAS score	Topical anesthesia	30	7.07	1.437	.262
	Infiltration Anesthesia	30	1.83	.834	.152

Table 3: Comparison of pain in topical versus infiltration anesthesia

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	T	Df	Sig. (2-tailed)*	Mean Difference	Std. Error Difference	95% CI	
								Lower	Upper
VAS score	8.266	.006	17.255	58	.000	5.233	.303	4.626	5.840

*independent t-test

Table 4: Descriptive statistics of VAS score of topical and infiltration anesthesia stratified by genders

Gender		N	Mean	Std. Deviation	Std. Error Mean
VAS score	male	10	7.50	1.080	.342
	female	20	6.85	1.565	.350

Table 5: Gender wise comparison of pain in topical versus infiltration anesthesia

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	T	df	Sig. (2-tailed)*	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
VAS score	.797	.380	1.176	28	.250	.650	.553	-.482	1.782
			1.329	24.847	.196	.650	.489	-.358	1.658

*independent t-test

Discussion

This study aimed to sort out less invasive but effective anesthesia for miniscrew placement. Recently, the safety of compound topical anesthetics (CTAs) in dentistry has been questioned, in part because of a statement issued by the Food and Drug Administration (FDA) in 2006. But obviously, fatal side effects occurred under the circumstances not found in orthodontic practices. They were direct consequences of abuse and overdosed.[14] It is recommended that topical with high potency should not use in the patients having allergies to amide and ester-type anesthetics (or PABA, para-aminobenzoic acid, a metabolic product with ester-type anesthetic degradation), which are usually combined in the compound, glucose-6-phosphate dehydrogenase deficiency and congenital or idiopathic methemoglobinemia (can be triggered or exacerbated by prilocaine or benzocaine), and cardiovascular disease (contraindication for a vasoconstrictor).[15] we excluded all such prone cases from the current study.

The use of a compound topical anesthetic (CTA) instead of an injection of a local anesthetic for placing miniscrew implants offers advantages to both the clinician and the patient.[16] So it is important to test the efficacy of topical anesthesia for pain control during insertion of miniscrews. In the present study, the use of topical gel anesthetic (20% lidocaine) was chosen because it reaches good levels of analgesia, can be easily handled and does not cause tissue damage, as previously reported by the literature.

About the infiltrative anesthetic, lidocaine hydrochloride + epinephrine 1:100,000 (Alphacaine 100 ®) was used because it is largely employed in Dentistry with low toxicity rates and enough anesthetic effect.

The visual analogue scale was used to record pain rates. It was chosen due to its easy clinical applicability and great power of pain measurement17 In this study total, 30 participants received topical anesthesia in one side and infiltration anesthesia in other side randomly. The mean pain VAS score was very high in topical anesthesia(7.07) side as compared to infiltration anesthesia(1.83) side. The difference in pain score in topical anesthesia was statistically significantly different from in infiltration anesthesia (P=0.006). In this study, in 50% percent of patients, topical anesthesia failed. Lamberton et al.[16] Conducted a study on the comparison of pain perception during miniscrew placement between compound topical and needle-injected anesthetics. They reported patients did not distinguish any differences in pain between the application of the CTA and the injection before or during anesthetic placement, but they experienced more pain with the CTA during miniscrew placement. The mean difference for the entire procedure between the two anesthesia types was 24.6 units, and the 95% confidence interval was 18.8 to 30.4, a statistically significant finding (P = 0.0002).

Another study by Valieri et al[12] reported that that patients had less pain with the use of infiltration anesthesia, and also preferred this type of anesthetic. These results are in consistent with the current study. However, Reznik et al who compared two types of topical anesthetics, the failure rate (impossibility of finishing the installation under topical anesthesia) was of 71% (12 cases) when 20% benzocaine was used, whereas there was no failure when 20% lidocaine + 4% tetracaine + 2% phenylephrine anesthetic was used.[18]

In the current study, pain experienced by both genders did not differ. Similar results were reported by Valieri et al[12] (P=0.671).

Conclusion

Based on the results of the current study, its reasonable to conclude that Topical anesthesia is not an effective mean for controlling pain and discomfort during miniscrew placement. It provided less predictable, often inadequate, and less comfortable anesthesia than infiltration for managing patient pain during miniscrew placement. So further research is required regarding topical anesthesia application versus infiltration anesthesia for pain-free miniscrew placement in orthodontics.

Reference

1. Ottofy L. Standard dental dictionary: Laird & Lee, inc.; 2013.
2. Daskalogiannakis J, Ammann A. Glossary of orthodontic terms: Quintessence Books Chicago; 2000.
3. Singh K, Kumar D, Jaiswal RK, Bansal A. Temporary anchorage devices–Mini-implants. Nat J Maxillofac Surg 2010;1(1):30.
4. Rocío Molina-Solana RMY-V, Alejandro Iglesias-Linares, Daniel Torres-Lagares, Enrique Solano-Reina. Miniscrew appliances and their use in orthodontics. Open J Stomatol 2013;3(1):103-08.
5. Sherwood KH, Burch JG, Thompson WJ. Closing anterior open bites by intruding molars with titanium miniplate anchorage. Am J Orthod Dentofacial Orthop 2002;122(6):593-600.
6. Park H-S, Bae S-M, Kyung H-M, Sung J-H. Micro-implant anchorage for treatment of skeletal Class I bialveolar protrusion. J Clin Orthod 2001;35(7):417.
7. Wehrbein H, Feifel H, Diedrich P. Palatal implant anchorage reinforcement of posterior teeth: a prospective study. Am J Orthod Dentofacial Orthop 1999;116(6):678-86.
8. Carano A, Velo S, Leone P, Siciliani G. Clinical applications of the miniscrew anchorage system. J Clin orthod 2005;39(1):9-24.
9. Lee J-S, Hyung Kim D, Park Y-C, Kyung S-H, Kim T-K. The efficient use of midpalatal miniscrew implants. Angle Orthod 2004;74(5):711-14.
10. Jasoria G, Shamim W, Rathore S, et al. Miniscrew implants as temporary anchorage devices in orthodontics: a comprehensive review. J Contemp Dent Pract 2013;14(5):993-99.
11. Brandão LBC, Mucha JN. Grau de aceitação de mini-implants por pacientes em tratamento ortodôntico–estudo preliminar. Rev Dental Press Ortod Ortop Facial 2008;13(5):118-27.
12. Valieri MM, Freitas KMSd, Valarelli FP, Cançado RH.

Comparison of topical and infiltration anesthesia for orthodontic mini-implant placement. Dental press journal orthodontics 2014;19(2):76-83.

13. Kravitz ND, Kusnoto B. Placement of mini-implants with topical anesthetic. J Clin
14. Food U. Drug Administration FDA News. FDA Proposes Drug Bar Code Regulation.Available at: www.fda.gov/bbs/topics/NEWS/2006/NEW01516.html;2006.
15. Baumgaertel S. Compound topical anesthetics in orthodontics: putting the facts into perspective. Am J Orthod Dentofacial Orthop 2009;135(5):556-57.
16. Lamberton JA, Oesterle LJ, Shellhart WC, et al. Comparison of pain perception during miniscrew placement in orthodontic patients with a visual analog scale survey between compound topical and needle-injected anesthetics: A crossover, prospective, randomized clinical trial. Am J Orthod Dentofacial Orthop 2016;149(1):15-23.
17. Price DD, McGrath PA, Rafii A, Buckingham B. The validation of visual analogue scales as ratio scale measures for chronic and experimental pain. Pain. 1983;17(1):45-56
18. Reznik DS, Jeske AH, Chen J-W, English J. Comparative efficacy of 2 topical anesthetics for the placement of orthodontic temporary anchorage devices. Anesthesia progress 2009;56(3):81-85.