

Management of Pain Immediately After Placement of First Retraction Arch Wire: Comparison of Bite-Wafers and Sugar Free Chewing Gum Use with Controls

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Abstract

Background: To manage pain immediately after placement of first retraction arch wire by using non-pharmacological substances like bite-wafers and chewing gum.

Methods: Sixty (60) orthodontic patients in whom leveling and alignment phase had been completed and retraction to be started were considered for this study. Simple randomization method that is paper chits were followed for the present study. After the randomization procedure the subjects were further divided into Group 1 (20 subjects) for bite-wafers use whereas Group 2(20 subjects) for sugar free chewing gum, Group 3(20 subjects) act as controls. Comparisons between the three experimental groups for four parameters were made using repeated-measures two-way ANOVA .When the ($p < 0.05$) the statistical test was regarded as significant.

Results: In bite-wafer group statistically significant pain reduction was seen at all instances during chewing function and high significance was observed during night and 24hrs. In Sugar free chewing gum group, Unlike the results of bite-wafers, chewing gum did not show to reduce the pain during the four masticatory functions, moreover they found to decrease pain during fitting front teeth in the 8th hr, second day. Also the ‘p’ values were not significant during any of the masticatory function with exception of fitting front teeth.

Conclusion: Bite-wafer was effective in reducing the pain during the initial hours of retraction arch-wire placement. Chewing gum was not so effective in reducing the pain except during some oral functions like fitting front teeth. Bite-wafers could be a possible substitute for NSAIDs in reducing pain during initial retraction arch-wire placement.

Keywords: Orthodontic pain, bite-wafers, sugar free chewing gum.

Introduction

Success of orthodontic treatment often depends upon the use of devices and techniques to minimize patient's discomfort, so once pain and discomfort hampers cooperation, it leads to poor adherence to follow-up and treatment interruption¹. Hence, certain dependent factors such as age, gender, the individual pain threshold, and the magnitude of the force applied, emotional state and stress, cultural differences, and previous pain experiences should be looked upon during the initiation of orthodontic therapy.² The forces which were applied on the teeth trigger an inflammatory response that involves pain and bone resorption. Pain during fixed orthodontic treatment increases gradually from the fourth hour to the 24th hour but returns to a normal degree on the seventh day.³ Previously various methods were used for controlling pain during the orthodontic treatment that ranged from local anaesthetics,⁴ the application of low-level laser therapy to the periodontal tissues,⁵ Transcutaneous Electrical Nerve Stimulation (TENS)⁶ and vibratory stimulation of the periodontal ligament⁷. All these methods have been partially successful in achieving pain relief.

At present Nonsteroidal anti-inflammatory drugs (NSAIDs) such as ibuprofen and acetaminophen are commonly recommended.⁸ Their analgesic action has been explained by their ability to inhibit the synthesis of prostaglandins at the site of the tissue injury. This is thought to be through inhibition of the cyclo-oxygenase enzymes COX-1 and COX-2.⁹ Because the use of analgesics has side effects, they are contraindicated in patients who are allergic to those drugs. To find alternatives for pain relief, researchers have looked for other new, but safer approaches. Hence non-pharmacological means of medication is essential in

present day treatment modalities. Proffit recommended biting of a plastic wafer or a chewing gum to increase the blood flow in a compressed ligament area, thereby blocking the transmission of impulses to nerve receptors.¹⁰ In this study the use of bite-wafers, chewing gum was used for orthodontic pain management.

Materials and Methods

A. Subjects: Sixty orthodontic patients in whom leveling and alignment phase had been completed and retraction to be started were considered for this study. Ethical approval for this study was obtained from Vishnu Dental college Research Ethics Committed. All the participants or their parents gave written informed consent to take part in the trial. The design was a randomized clinical trial with three groups. The setting was the Orthodontic department, Vishnu Dental College, Bhimavaram.

B. Inclusion Criteria: Patients aged over 10yrs and who were able to comprehend and complete the study. Patients who consented to the research procedures and signed an informed consent.

C. Exclusion Criteria: Patients who have undergone previous orthodontic treatment. Patients who had recently experienced toothache. Patients who were diagnosed currently as having infectious diseases/systematic diseases. Patients who had used analgesics within 3 days prior to orthodontic treatment.

Following consent, participants were randomly allocated to two groups:

Bite-wafers and sugar free chewing gum were considered for the study. 60 healthy individuals aged between 18-24years who had completed leveling and alignment stage of fixed orthodontic therapy randomly selected from the Department of orthodontics, Vishnu dental college. They were divided into three groups. Group 1 (20 subjects) for bite-wafers use where as Group 2(20 subjects) for sugar free chewing gum, Group 3(20 subjects) act as controls.

- **Bite –wafers group:** Subjects in this group were instructed to use bite-wafers as a measure to relieve pain and never use any medication to control pain. They were asked to chew on the wafer for 5mins immediately after retraction arch wire placement and at 8-hr intervals for 1 week.
- **Sugar free chewing gum group:** The patient was asked to chew a sugar free gum for 5 minutes immediately after retraction arch wire placement and at 8hr intervals for 1 week.
- The subjects were asked to complete a visual analog scale (VAS) questionnaire immediately after retraction arch wire placement. The VAS consisted of an unmarked horizontal line with a descriptive terminology. The VAS was translated to simple native language of the patient's words to simplify the scoring. Each patient was asked to put a mark on the line that best corresponded to the level of pain he/she felt at that moment.
- The patients were asked to complete the questionnaire to rate their pain and its intensity at 2hrs, 6hrs and bedtime on the day of retraction arch wire placement, and at 24hrs, 2days, 3days and 7days. The format of the questionnaire was a 10-cm line, and the patients were expected to mark a location on the line corresponding to the amount of pain they experience, with 0 indicating no pain and 10 indicating unbearable pain. The Severity of pain will be recorded during 4 oral functions including chewing, biting, fitting back teeth, and fitting front teeth. for fitting the front and back teeth, the patient will be asked not to eat anything and were instructed to bring the front teeth edge to edge with light force and to fit back teeth with light force, and then score their pain in each function.

The patients were instructed not to use any additional analgesics.

Results

All the statistical analyses were made using SPSS for Windows (Version 10.0, SPSS). Descriptive statistics were calculated for pain scores at each time interval for the experimental groups. Analysis of variance (ANOVA) was used to find the differences in age among the groups. Comparisons between the three experimental groups for four parameters were made using repeated-measures two-way ANOVA and multiple comparisons were made with Tukey honestly significant difference test. When the ($p < 0.05$) the statistical test was regarded as significant.

The observed course of postoperative orthodontic pain in **Graph-A: Control Group**, was that the Peak pain occurred after first retraction arch-wire placement at 2hrs, 6hrs and at night with respect to fitting the front teeth and fitting back teeth while mild pain was seen with respect to chewing, biting, and fitting the back teeth. Pain levels started to decrease gradually from the peak pain to seven days after the insertion of the first retraction arch-wire.

In Graph-B Chewing Group Statistical significant differences ($p < 0.05$) was observed for chewing function with relevance to the three experiment groups. In order to find out the exact differences between the chewing gum group and bite-wafer group Tukey test was done.

In Table -1 Chewing Group significant pain reduction was seen in bite-wafer group at all instances during chewing function and highly significant was observed during night and 24hrs of bite-wafer chewing.

In Graph C & Table -2 Statistical significant differences ($p < 0.05$) was observed for Biting function with bite-wafer at 6hr and night ,the following day ,while no pain reduction seen in chewing gum group compared with control and bite-wafer group at all instances.

In Graph D & Table 3 Statistical significant differences ($p < 0.05$) was observed for front function teeth with relevance to the bite-wafer groups at 6hr, night and 3rd and 7th day. while chewing gum was found to be effective during 2nd, 3rd and 7th day compared to controls.

In Graph E & Table 4 Statistical significant differences ($p < 0.05$) was observed for fitting back teeth with bite-wafer group during 2nd, 6th, at night and after 24 hrs. while chewing gum shown to be effective during the 2nd, 3rd, 7th day. compared to control

Discussion

Currently pharmacological drugs like NSAIDs i.e. Ibuprofen and acetaminophen were commonly recommended for the management of Orthodontic pain during the initial procedures like separator placement, initial arch wire placement.^{8,9} They were seen to be more effective during the initial hours of postoperative course of orthodontic pain.^{15,24} Although orthodontic pain management trials were done during different stages of treatment procedure no study till date was done after the first retraction arch-wire placement. Compared to separators, and initial arch-wire placement application of force levels were generally high during retraction mechanics like loop or sliding (friction mechanics). Hence Management of orthodontic pain plays a vital role after first retraction archwire as it increases patient compliance towards the treatment success.

One of the main reasons for the indication of non-pharmacological in this study was that NSAIDs were found to interfere with the tooth movement.¹²

Hence, a search for non-pharmacological aids was in place now days. This study was performed on 60 patients who were undergoing fixed orthodontic treatment and in whom retraction to be started. Three experimental groups included- control group, bite wafer group, chewing group. The subjects were asked to complete a visual analog scale

(VAS) questionnaire at 2hrs, 6hrs and bedtime on the day of retraction arch wire placement, and at 24hrs, 2days, 3days and 7days after first appointment. The format of the questionnaire was a 10-cm line, and the patients were expected to mark a location on the line corresponding to the amount of pain they experience, with 0 indicating no pain and 10 indicating unbearable pain. The severity of pain was recorded during 4 oral functions including chewing, biting, interlocking back teeth, and interlocking front teeth. For interlocking the front and back teeth, the patients was asked not to eat anything and were instructed to bring the front teeth edge to edge with light force and to interlocking back teeth with light force, and then score their pain in each function.

In the control group, similarity of pain course was observed when compared with initial archwire placement i.e peak pain experience begin within 2 hours, increases over the next 6hrs, night and then declines gradually over a period of 6-7 days. These findings were in accordance with studies done by Ngan et al¹⁴, Scheurer et al.²⁷

In **Bite –wafers group**, the patients were asked to chew on the bite-wafers for 5mins immediately after retraction archwire placement and at 8-hr intervals for 1 week. Results showed that bite-wafers were effective during all the four masticatory functions which were included in this study and more over they found to be more effective during initial hours of pain that is at the 2nd, 6th hrs unlike chewing gum group. This finding was in accordance to the study done by Jing-yau hwang, et al²² which evaluated the effectiveness of thera-bite wafers in reducing pain. They observed reduction of pain in the majority of patients (56%). Also Chida madoka et al²⁵ studied the pain alleviating effect of chewing on bite-wafers for patients who underwent orthodontic treatment. This study indicated that VAS scores on the items of sensation when the pain appeared and when the pain reached a maximum

were smaller in the bite-wafer group than in the control group. Sean Murdock et al and fahimeh et al¹⁵ found out that bite-wafer group was effective and were not inferior to that of the OTC group ($P>0.39$). The average current pain reported by the BW group was similar to that reported by Otasevic et al.²⁴ In that study, patients were instructed to chew on the wafer for 10 minutes immediately after placement of fixed appliances and then whenever they experienced pain the median pain score for the bite-wafer group was higher for the first 4 days. The median peak difference was reached on the evening of the first day. At this maximum value, the median pain score of the bite-wafer was higher and statistically significant ($P>.006$). Proffit¹⁰ believed that, as long as light forces were used, the amount of pain experienced by patients could be reduced by having them engage in repetitive chewing of plastic wafers during the first 8 hours after the appliance is activated. The temporary displacement of the teeth is thought to allow some blood flow through the compressed areas of the periodontal ligament, thereby preventing the buildup of metabolites that could in turn stimulate pain receptors. Mild amount of pain was alleviated during biting and in initial hours, and 2nd day, 3rd day of biting bite wafers. Pain was also observed during fitting front teeth during initial hours.

In Sugar free chewing gum group, the patient was asked to chew a sugar free gum for 5 minutes immediately after retraction arch-wire placement and at 8hr intervals for 1 week if they experience pain. Unlike the results of bite-wafers, chewing gum did not show to reduce the pain during the four masticatory functions, moreover they found to decrease pain during fitting front teeth in the 8th hr, second day. Also the 'p' values were not significant during any of the masticatory function with exception of fitting front teeth. According to Davidovitch and Shanfield, pain during orthodontic treatment was due to an

inflammatory response in the periodontal ligament, and NSAIDs had been called the gold standard for orthodontic pain control. In this study non-pharmacological means of management of orthodontic pain was considered because of the side effects of NSAIDs and the rate of orthodontic tooth movement. The Bite-wafers was not inferior to over the counter - analgesics with respect to any pain measurements or effectiveness. Furstman and Bernik noted that orthodontic pain was a combination of pressure, ischemia, inflammation, and edema.²³ It was believed that any factor that could temporarily displace the teeth under orthodontic force can resolve the pressure and prevent the formation of ischemic areas, thus releasing pain.

However, the effectiveness of chewing gum in pain control for orthodontic patients has not been significant with the exception of fitting front teeth in this study. In addition, the toughness of the chewing gum might be not enough to displace the teeth and resolve the ischemia.

In the tukey test (Table-5.6,7,8), the experienced pain in the bite-wafers groups and the chewing group showed statistical differences in oral functions like chewing and at all time intervals like first, second, third and 7th day. These findings showed that bite wafers were effective than chewing gum in controlling pain during the oral function – chewing. While comparing the oral function like fitting front teeth the chewing gum showed statistical difference in the early hours that is at the 2nd hour, and at the 24th hour, second day. It was obvious that the bite wafers were more effective in pain control when fitting back teeth than fitting front teeth. This can be explained by the fact that the thickness of the bite wafers was the same in the back and front areas, so when the back teeth were in touch with the block, the front teeth generally did not touch it. When these groups were compared with the control group, significant difference was found between the bite wafer group and the chewing group in oral functions like biting

and at time interval first, second, third and 7th day. However, bite-wafer group showed a significant difference compared with the control group in pain at chewing, fitting front teeth, fitting back teeth at all time intervals on day 7, after initial retraction arch wire placement. Chewing gum was also effective in reducing pain in the chewing function at 24 hours and 7 days compared with the control group in oral function like biting.



Fig. 1 a: Bite Wafer



Fig. 2 b: Fitting Back Teeth



Fig. 2c: Chewing



Fig. 2d: Biting

Bite Wafer Group



Fig.1 b: Chewing Gum



Fig. 2 a: Fitting Front Teeth



Fig. 3a: Fitting Front Teeth



Fig. 3b:Fitting Back Teeth

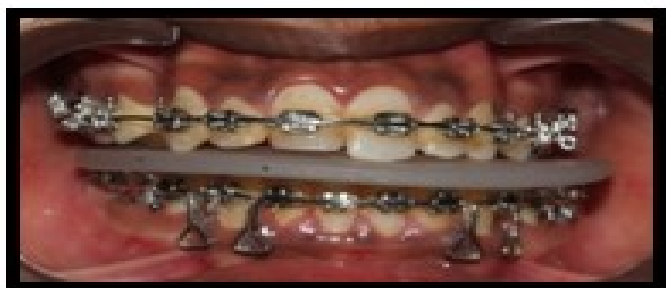


Fig 3c: Chewing



Fig 3d: Biting



Fig 4a: Fitting front teeth



Fig 4b:Fitting back teeth



Fig 4c: Biting activity

Graph-A: Control Group

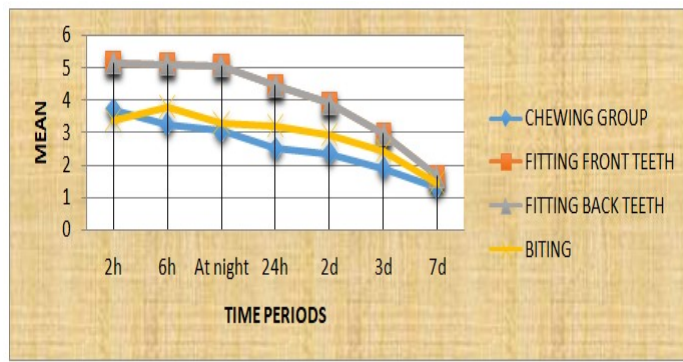


Table 1: Chewing Function

| CHEWING FUNCTION | 2h | 6h | At night | 24h | 2d | 3d | 7d |
|------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| | MEAN±SD | MEAN±SD | MEAN±SD | MEAN±SD | MEAN±SD | MEAN±SD | MEAN±SD |
| Bite wafer group | 3.00±2.44 | 3.00±1.39 | 2.30±1.45 | 1.85±1.84 | 1.40±1.96 | 1.30±2.00 | 0.70±1.38 |
| Chewing gum | 4.05±1.90 | 3.55±2.02 | 3.95±1.79 | 3.05±1.67 | 2.40±2.04 | 1.90±1.86 | 1.00±1.52 |
| Control group | 3.70±1.56 | 3.25±1.37 | 3.05±1.36 | 2.50±1.28 | 2.35±1.69 | 1.90±1.68 | 1.30±1.53 |
| P VALUE | 0.002 S | 0.001 S | 0.000 S | 0.000 S | 0.000 S | 0.000 S | 0.001 S |

Graph B: Chewing Function

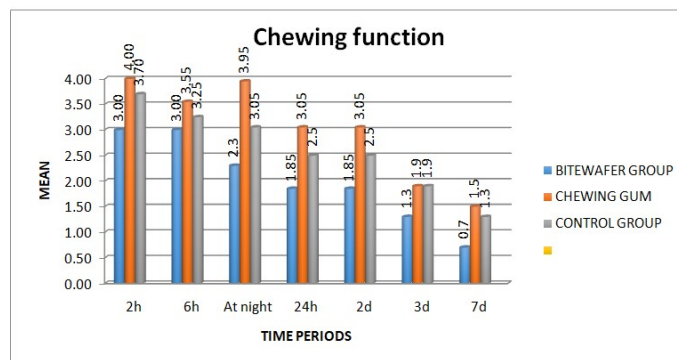


Table-2: Biting Function

| BITE FUNCTION GROUP | 2h | 6h | At night | 24h | 2d | 3d | 7d |
|---------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| | MEAN±SD | MEAN±SD | MEAN±SD | MEAN±SD | MEAN±SD | MEAN±SD | MEAN±SD |
| Bite wafer group | 3.60±1.50 | 3.30±1.59 | 3.00±1.65 | 3.00±1.81 | 3.75±0.92 | 2.75±0.85 | 2.20±1.11 |
| Chewing gum | 3.90±1.07 | 4.10±1.37 | 4.35±1.57 | 4.00±1.52 | 3.80±1.24 | 3.45±0.94 | 2.70±1.26 |
| Control group | 3.40±0.82 | 3.80±1.24 | 3.30±1.03 | 3.20±0.95 | 2.95±0.51 | 2.45±0.76 | 1.45±0.60 |
| P VALUE | 0.605 NS | 0.001 S | 0.004 S | 0.004 S | 0.084 NS | 0.405 NS | 0.087 NS |

Statistical Analysis: ANOVA one way test. Statistically significant if P<0.05.

Graph C: Biting Function

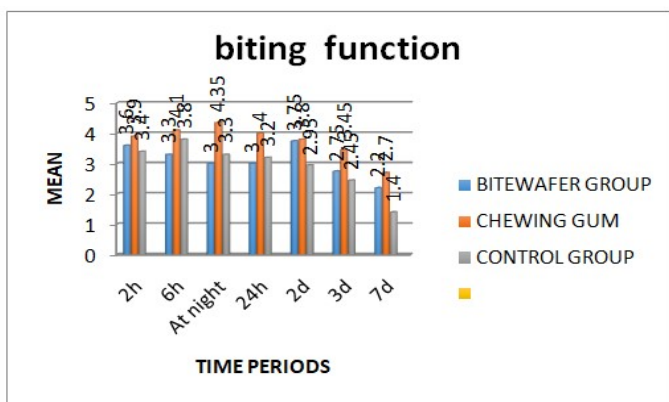


Table-3: Fitting Front Teeth

| FITTING FRONT TEETH | 2h | 6h | At night | 24h | 2d | 3d | 7d |
|---------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| | MEAN±SD | MEAN±SD | MEAN±SD | MEAN±SD | MEAN±SD | MEAN±SD | MEAN±SD |
| Bite wafer group | 5.45±1.70 | 3.55±1.54 | 4.70±1.34 | 4.25±1.77 | 3.65±1.79 | 2.05±1.70 | 1.20±1.58 |
| Chewing gum | 4.35±1.35 | 5.35±1.18 | 5.20±1.51 | 4.05±1.50 | 3.00±1.26 | 2.45±1.05 | 1.60±1.27 |
| Control group | 5.15±1.53 | 5.10±1.33 | 5.05±1.82 | 4.45±1.90 | 3.90±1.74 | 2.95±1.50 | 1.65±1.39 |
| P VALUE | 0.089 NS | 0.000 S | 0.000 S | 0.440 NS | 0.022 S | 0.002 S | 0.001 S |

Graph D: Fitting Front Teeth

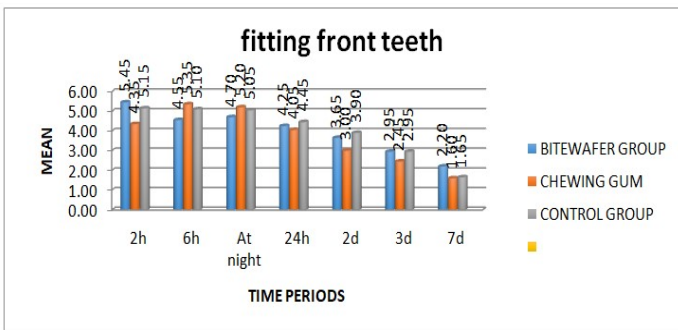
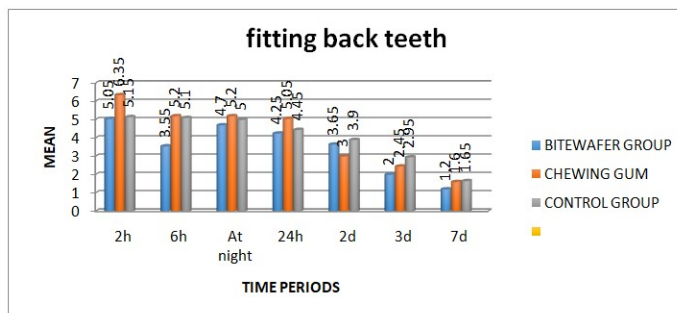


Table-4: Fitting Back Teeth

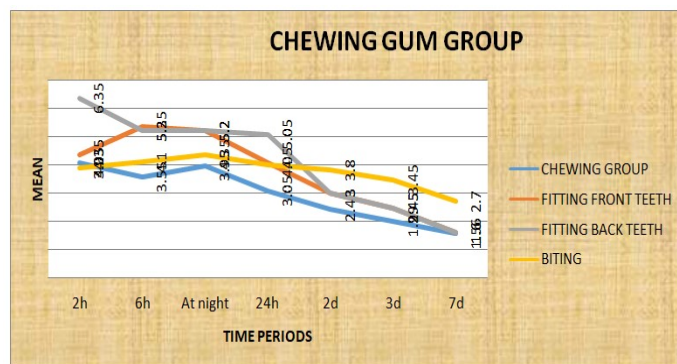
| FITTING BACK TEETH | 2h | 6h | At night | 24h | 2d | 3d | 7d |
|--------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| | MEAN±SD | MEAN±SD | MEAN±SD | MEAN±SD | MEAN±SD | MEAN±SD | MEAN±SD |
| Bite wafer group | 5.05±1.70 | 3.55±1.54 | 4.70±1.34 | 4.25±1.77 | 3.65±1.79 | 2.05±1.70 | 1.20±1.58 |
| Chewing gum | 6.35±1.35 | 5.20±1.18 | 5.20±1.51 | 5.05±1.50 | 3.00±1.26 | 2.45±1.05 | 1.60±1.27 |
| Control group | 5.15±1.53 | 5.10±1.33 | 5.05±1.82 | 4.45±1.90 | 3.90±1.74 | 2.95±1.50 | 1.65±1.39 |
| P VALUE | 0.000 S | 0.000 S | 0.000 S | 0.000 S | 0.022 S | 0.432 NS | 0.672 NS |

Graph E: Fitting Back Teeth

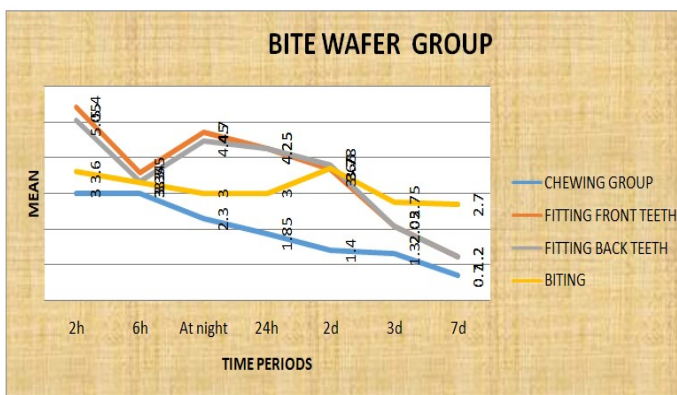


Graphs Comparing The Course Of Postoperative Orthodontic Pain

Graph-6: The post operative course of chewing gum



Graph-7: The post operative course of bite-wafers



Conclusion

According to this clinical investigation, Bite-wafers were found to be comparatively effective in managing the pain during the initial placement of the retraction archwire. This shows that non-pharmacological means of pain management should be considered as a potential substitute to the administration of NSAIDS in routine clinical practice in order to overcome its adverse effects on the rate of orthodontic tooth movement.

Conclusions which were drawn from this study :

- Bite-wafer were effective in reducing the pain during the initial hours of retraction arch-wire placement.
- Chewing gum was not so effective in reducing the pain except during some oral functions like fitting front teeth.
- Bite-wafers could be a possible substitute for NSAIDS in reducing pain during initial retraction arch-wire placement.

List of Abbreviations

NSAIDs= Non-Steroidal Anti-Inflammatory Drugs.

COX = Cyclo-Oxygenase.

TENS= Transcutaneous Electrical Nerve Stimulation.

VAS= Visual Analog Scale.

SPSS= Statistical Package for the Social Sciences.

ANOVA= ANalysis Of VAriance

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