

## Orthodontic Pain Tracker App – A Smart Research Tool

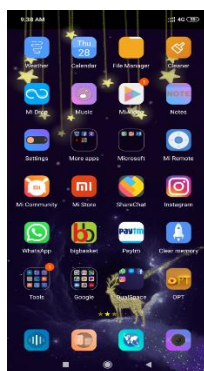
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**Received on:** 02-02-2020**Accepted on:** 03-03-2020**Source of Support:** Nil**Conflict of Interest:** None**ABSTRACT****Objectives:** Introduction:-Smartphone & its application has changed our lives completely with the better access they provide to connect with the rest of the world. By making use of these technological advances we have designed a mobile app “ORTHODONTIC PAIN TRACKER” for better coordination & follow of the patient alongwith that various studies can be conducted.**Objective:-** To develop a mobile application for assessment of actual pain perception during orthodontic treatment in different sex & various time intervals in a day and in a week. **Material & Methods:-** 50 patients currently in the process of receiving orthodontic treatment was included in the study in the age group of 17 to 30 years (includes 25 males & 25 females). All the patient has to download the app “ORTHODONTIC PAIN TRACKER” from the link provided by the orthodontist thereafter patient details and his treatment details are to be filled. App includes the pain scale with various colourful attractive emoticons for patient to easily understand & mark his pain score of the day**Results-** Statistically significant decrease in orthodontic pain from first to seventh day. Clinically significant increase of pain in different sex & different time interval was found to have a significant co-relation with high pain scores.**Conclusion:-** In this group of selected patient records, the differences are found in pain perception of both male and female subjects; however, females showed significantly higher pain intensity at all time points and a greater diurnal variability in pain perception as compared to males.**Key words:-** Orthodont pain tracker, pain intensity, levelling wires, pain perception, Niti wire.**INTRODUCTION**

Today's lifestyle is completely based on smartphone & its smart applications which provide access to many things. Smart phone is no longer only a source of communication via text or calls but far beyond that by chatting apps, video calls, e-mails. They help in connecting to our friends by various social media apps, entertainment via games & internet. All age group are taking advantage from various apps according to their needs. They are helpful in providing education, current affairs, access to GPS & weather forecasting (Figure – I)

**Figure – I:** Various Applications in the smart phone

These apps are also helpful for doctors as well as patients for better coordination between them. By making use of these technological advances we have designed an smart phone application (Figure – II) & which is helpful in proper follow up, providing general instructions, diet plan, medication intake, next appointments & one of the important use is to record the pain responses/score of the patients after placement of initial levelling arch wire, pain due to separator or any appliance placement. Pain and discomfort after the insertion of an initial arch wire are common experiences among orthodontic patients.<sup>1</sup> According to research evidence, orthodontic pain strongly affects patient compliance, and thus compromises treatment effectiveness and efficiency.<sup>2</sup>

**Figure – II:** Name of application - Orthodontic Pain Tracker

In this study we have used this application to provide the actual detail of the pain felt by the patient during initial days of wire placement; because most of the patient generally forgets the pain intensity felt by them when they report after 21 days for next visit. It was easy and interesting for the patient to choose the emoticons from the scoring scale and rate their actual pain. This app is also helpful in recording the history of total medications taken by the patient; which is useful in recording the difference in pain score of the patient. This app has lot of advantages for the doctor as well as the patient. Patient & doctor can have one to one conversation via chatting through the app. Doctor can have better coordination & follow up of the patient including his diet intake and hygiene maintenance, he can monitor the app at any time for checking the score of the patient.

Patient can ask various queries like next appointment date & timing or rescheduling of appointment, required medication for pain etc. App has a special inbuilt feature of reminder/alarm at different date & timing as set by the doctor so as record exact score of the pain on right time. Whenever the patient feeds his response; a notification is automatically sent to the doctor. There is a enabled feature in the app which will automatically send birthday/anniversary wishes or next appointment messages to the patients window. App includes general instruction page like hygiene maintenance, dental wax usage for wire impingement etc.

assessment during separator placement. Comparison of pain intensity by two different types of wires, different type of braces, comparison in labial & lingual appliances. Pain has been identified as a barrier to removable appliance and intra-oral elastic wear in a number of studies.<sup>3</sup>

### AIM & OBJECTIVE

- To assess actual pain perception of patient with initial levelling archwire at 3 time intervals (Day1, 3,7) by using smart phone application.
- To compare pain score between male & female patients.

To evaluate and compare pain intensity at different time intervals in a day (morning, afternoon & bedtime)

### MATERIAL & METHODS

The study was conducted in the Department of Orthodontics & Dentofacial Orthopaedics, ITS Dental College & Hospital Greater Noida. Participants included in the study were the patients undergoing orthodontic treatment. A total of 50 patients out of which 25 males & 25 females were included in the study between age group of 17 to 30 years.

Inclusion criteria:-

1. No history of facial or systemic diseases.
2. Patient with initial levelling arch wire in place.

Table I. Tests of Normality

	Gender	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
		Statistic	df	P value	Statistic	df	P value
Day1	Male	.158	25	.110	.939	25	.141
	Female	.117	25	.200*	.967	25	.567
Day3	Male	.201	25	.010	.869	25	.004
	Female	.209	25	.006	.918	25	.047
Day7	Male	.506	25	.000	.445	25	.000
	Female	.333	25	.000	.721	25	.000
<b>a. Lilliefors Significance Correction</b>							
<b>*. This is a lower bound of the true significance.</b>							

The app contains the demographic details of the patients which will remain confidential amongst the patients and only accessible to the doctor who is the ADMIN of the app. This app can have enormous other advantages because lot of other studies can be conducted by using the app. Studies for pain assessment due to fixed or removable appliances, pain assessment during different type of retainer wear, pain

3. No history of previous orthodontic treatment.
4. No grossly carious teeth.

### METHODOLOGY

- Patient including in the study has to download the app “ORTHODONTIC PAIN TRACKER” from the link provided by the orthodontist & make an account with his

name; immediately the doctor will receive a notification of the new account log in.

- Thereafter the patient has to fill his personal detail & his treatment details are filled by the doctor (Figure – III).
- Then the patient is explained about all the important features of the app including the pain scale thoroughly. The pain scale consists of various colourful attractive emoticons that allow the patient to easily understand & mark his score of the day (Figure – IV).

Patient has also been explained about other added features of the app like general instructions, educational videos, queries regarding his treatment & appointments (Figure – V).

### STATISTICAL ANALYSIS

All the collected data entered in to MS excel and analyses by statistical software SPSS version 16.0. The normality of data was tested by Shapiro wilk’s test and found data was not normal (Table-I). The significance of difference of mean pain score between male and female i.e. inter group comparison at different time interval was tested by Mann whitney U test and within the group i.e. intra group comparison was done by Wilcoxon Signed Ranks Test.

- The steepest rise in pain, for both male and female subjects was from day 1 afternoon to day 1 bedtime where female reported significantly higher rate of increase in pain as compared to males. (Table – V)
- Significantly high pain score was recorded in afternoon as compared morning and bedtime in both sexes. (Table – V)
- No significant differences were found in scores on different time intervals on day 3 and 7.

### DISCUSSION

Orthodontic tooth movement is essentially a bio-physiologically driven phenomenon involving biological mediators. The Interleukin-1beta (IL-1beta) is the first mediator to regulate bone remodeling in response to orthodontic force and plays an important role in orthodontic pain perception by inducing the release of pain producing pro-inflammatory mediators. A recent study demonstrated that the IL-1beta concentration increases after 1 h of orthodontic force application and peaks after 24 h of force application.<sup>4</sup> Evidence shows that the plasma and brain concentrations of these pain regulator mediators such as Interleukins follow a circadian rhythm and thus are primarily responsible for the diurnal pain variation in pain perception.

**Table – II Inter group comparison of pain scores between male and female at different time intervals.**

	Gender	N	Mean	Std. Deviation	Std. Error Mean	Mean Rank	Mann -Whitney U	Z value	P value
Day1	Male	25	3.04	2.071	.414	21.76	219.000	544.000	.067 <sup>NS</sup>
	Female	25	4.36	2.515	.503	29.24			
Day3	Male	25	1.32	1.249	.250	20.44	186.000	511.000	.012*
	Female	25	2.48	1.735	.347	30.56			
Day7	Male	25	.16	.374	.075	21.42	210.000	535.000	.015*
	Female	25	.52	.586	.117	29.58			

NS not significant  $p>0.05$ , \*Significant  $p<0.05$

### RESULTS

- The intercept shows that compared to male subjects, females experienced significantly greater pain. (Graph – I)
- Significant difference was found in pain score of both sexes on day 1 & day 3 as compared to day 7. (Table –II)
- Highest pain scores were recorded on day 1 and minimum on day 7 in both male and female which was found to be highly significant on intra group comparison. (Table –III, IV)

Emerging evidence suggests that orthodontic pain can be significantly influenced by routine daily activities such as physical activity.

Thus, it can be hypothesized that day time engagement in routine physical activities at schools (as most orthodontic patients are school going children) may contribute to lower orthodontic pain perception in the afternoon, as observed in this current study. The diurnal variability in orthodontic pain. The present study explored diurnal variation in orthodontic pain over one week time after initial aligning arch wire placement. Results confirm previous findings that pain starts almost immediately after orthodontic force application and follows a curvilinear

pattern reaching at its peak intensity after 24 hours and then starts declining after 2-3 days, and gradually tails off after approximately a week.

occurs on day 1 morning and equating it to 24-h after force application. That would hold true only if force was applied in the morning and not in the evening.

**Table – III Intra group comparison of pain scores of male between different time intervals.**

Test Statistics <sup>b</sup>			
	Day 3 - Day 1	Day 7 - Day 1	Day 7 - Day 3
<b>Z</b>	-3.477	-4.226	-4.064
<b>P value</b>	.001*	.000*	.000*
<sup>NS</sup> not significant p>0.05, *Significant p<0.05			

In general, pain steadily increased following the adjustment, peaked at 8am on day two, and then gradually returned toward baseline levels by day four. This pain profile is similar to those reported in previous studies.<sup>5</sup> The prevalence of orthodontic dental anxiety was also considered high as compared to reported levels of dental anxiety, with 18.7% of participants reporting anxiety related to their orthodontic treatment. Anxiety has been reported to be strongly associated with orthodontic pain ratings.<sup>6</sup>

Clinical Implications And Pharmacological Management

An understanding of diurnal variation in orthodontic pain perception has important implications in clinical practice, as it has a direct role in ensuring effective pain management by using pharmacological interventions, and even placebo treatments. The most effective analgesia following administration of pharmacological interventions to control pain can only be achieved if the maximum blood level of analgesics occurs at the

**Table – IV, Intra group comparison of pain scores of female between different time intervals.**

Test Statistics			
	Day 3 - Day 1	Day 7 - Day 1	Day 7 - Day 3
<b>Z</b>	-3.964	-4.124	-3.695
<b>Asymp. P value (2-tailed)</b>	.000*	.000*	.000*
<b>a. Based on positive ranks.</b>			
<b>b. Wilcoxon Signed Ranks Test</b>			
<b>NS not significant p&gt;0.05, *Significant p&lt;0.05</b>			

Pain apps appear to be able to promise pain relief without any concern for the effectiveness of the product, or for possible adverse effects of product use. In a population often desperate for a solution to distressing and debilitating pain conditions, there is considerable risk of individuals being misled.<sup>7</sup> Thermal archwire resulted in pain during treatment also, degree of crowding was found to influence pain reports.

The study’s findings also support the fact that sex has a significant influence on the orthodontic pain perception as females experienced greater pain at all point of compared to males. Results support the facts that dental pain threshold reaches its peak in the afternoon and individuals experience lesser pain during the afternoon as compared to the night and morning. Pain perception should be thoroughly considered while designing orthodontic trials as it has a direct influence on a study’s outcome. It is a common error not to carefully consider and report the timing of orthodontic force application and erroneously conclude that peak pain intensity

same time as the peak in pain intensity. In view of this, administration of analgesics should be based on anticipated peaks in the pain intensity rather than wait for pain to occur and increase with time.

**CONCLUSION**

1. There was a significant diurnal variation in orthodontic pain perception, especially during the first two days of orthodontic force application which tails off by the end of the week.
2. In this study, where orthodontic force was applied in the morning, the steepest rise in pain occurred between the afternoon and bedtime on first day whereas no difference was found on other days.
3. Both male and female subjects displayed diurnal variability; however, females showed significantly higher pain intensity as compared to males.

Table – V, comparison of pain scores between different time intervals in a day

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	MORNING	3.70	50	2.375	.336
	AFTERNOON	5.16	50	2.324	.329
Pair 2	MORNING	3.70	50	2.375	.336
	EVENING	4.70	50	2.697	.381
Pair 3	AFTERNOON	5.16	50	2.324	.329
	EVENING	4.70	50	2.697	.381

Graph – I, Comparison of pain scores in sexes during the week

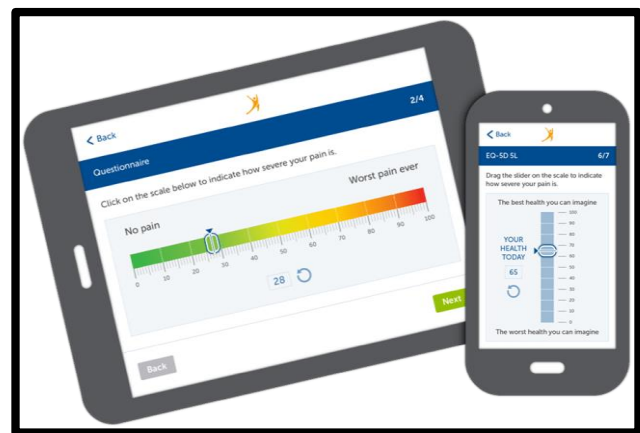
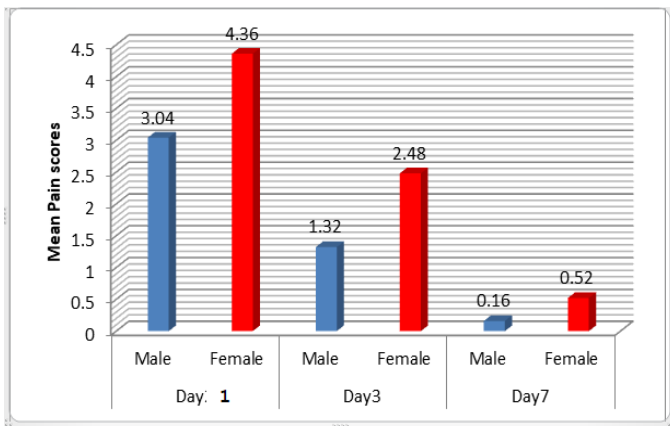


Figure – IV; Pain scale

**PATIENT DETAILS:-**

Name:-  
 Age /sex:-  
 Address:-  
 Annual income :-  
 Phone.no:-  
 Siblings:-  
 Medicine taken per day:-

**TREATMENT DETAILS:-**

Doctors's Name:-  
 Type of Braces:-  
 Extraction / Non-extraction:-  
 Treatment plan:-  
 Sequence of wire placement with date and time / method of ligation:-  
 Little's irregularity index:-

Figure – III; Personal detail & treatment details

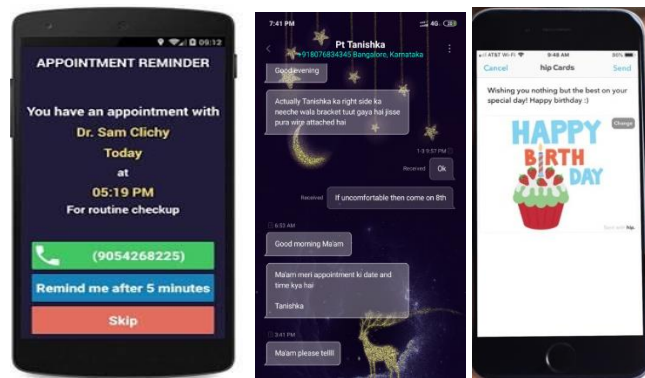


Figure – V; Various Inbuilt Features of The APP

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