ISSN Print: 2394-7489
ISSN Online: 2394-7497
IJADS 2020; 6(2): 367-376

www.oraljournal.com
Received: 16-02-2020
Accepted: 18-03-2020

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Patients adaptation with two types of fixed functional appliances

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Abstract
Patients' acceptance of an orthodontic appliance may influence compliance and thus contribute to a successful outcome of treatment. The aim of this study was to compare between Herbst and Korn MA fixed functional appliances on their acceptance by patients. 30 patients with skeletal class II malocclusion were dividided into two groups. For each 15 patients (Female and male). Questionnaire was based on four-point scale (1,2,3,4) for seven questions regarding pain, discomfort and effect on oral functions. The results of this study indicated oral soft tissue tension, pain and discomfort occurred when applying fixed functional appliances (Herbst and Korn MA) only during the first two weeks, then gradually decreased within three months until they finally faded in the remainder of the treatment.There was a restriction in the mandibular movements during the first two weeks only.There was no effect of the fixed functional appliances used on the patient's confidence and feelings of shame in front of others. We recommend the use of Korn MA appliance as one of the alternatives of the fixed functional appliances used to correct skeletal class II malocclusion associated with mandibular retrognathia in cases that need dental movements by using the fixed orthodontic appliance in conjunction with the stage of correcting the skeletal discrepancy.

Keywords: Fixed functional appliances, patient adaptation, pain

Introduction
The acceptance of orthodontic treatment is measured by the amount of discomfort experienced by the patient during stages of orthodontic treatment [1]. Such as feeling some of pressure, tension and pain [2]. Pain is defined by the International Society for the study of Pain as an unpleasant emotional and physical experience accompanying actual or potential tissue damage [3]. It is stimulating signal that allows the human organism to feel tissue damage [4]. Pain is a sensory experience that can be modified by environmental and sociocultural factors as it is related to the psychological situation of a person [5].
Pain was also defined as an unpleasant feeling and a bad personal experience associated with an internal or external cause [6].
Pain and discomfort are among the triggers that negatively affect the process of adapting to orthodontic treatment, and therefore affect the degree of patients' acceptance of orthodontics. Pain and discomfort are common complaints or side effects that patients mention after each visit during orthodontic treatment [2, 3]
Pain is the most troublesome factor during stages of orthodontic treatment. In a study by Oliver and Knappman, the patients in their study sample stated that the worst thing related to wearing the orthodontic appliances was the intensity of pain. 70% of the sample felt pain during the orthodontic treatment period, regardless of the type of appliance used, whether it was fixed or removable, and 69% of the sample patients applied to fixed appliance only and 12.5% removable appliances, while to 18.5% of the sample individuals applied both appliances [7].
Haynes found in his study on the reasons that cause the patient to stop orthodontic treatment that pain was the first cause, and the second reason was the effect of the orthodontic treatment on a person's daily social life [8], negatively on the degree of cooperation of the patient [9].
Where the patient's cooperation is defined medically as the extent of the individual's behavior towards medical or health advice provided to him [8], but in the field of orthodontic treatment, cooperation defines that the patient's commitment during stages of the orthodontic treatment to the instructions provided to him [10].

Patients can adapt with ongoing pain and discomfort as treatment progresses. When treating Class II malocclusion with Herbst fixed functional appliance, it was noted that most patients had good acceptance to orthodontic treatment, except that the appliance caused some annoyances and minor functional problems in the masticatory system were of a temporary nature and appeared mainly at the beginning of treatment, specifically during the first (7-10) days, as patients experienced chewing difficulties, and tenderness was observed in the masticatory muscles and temporomandibular joint at palpation [11, 12].

A review of literature showed that very few studies have addressed the issue of acceptance and discomfort with fixed functional appliances. Bowman and his colleagues studied compliance and discomfort of the Forsus fixed functional appliance and found that this appliance was relatively well accepted by patients although they experienced discomfort and functional restriction, however these effects vanished by time and patients accomodated to the appliance [13]. Few studies conducted on the acceptance of removable functional appliances and mostly limited to researches evaluated by Sergl in Germany 1998 [1].

In general, it is possible to predict and measure the degree of acceptance of appliances and orthodontic treatment through the initial amount of pain and discomfort that can be felt after the application of the appliance [1, 14].

Some orthodontic patients fail to complete the treatment even when using appliances that do not need the cooperation of the patient because of the pain they feel, especially in the early stages of orthodontic treatment, and their rate was estimated at (8-30%) [15].

There are some patient complaints associated with orthodontic treatment such as speech difficulties. In a study by Heinen 1994 and his colleagues, they found that the main complaints of using removable appliances were as follows*:*

Difficulties of speech is the main complaint 34.5%, tension 22.9%, then increased saliva secretion by 15%, and they found no significant differences in the degree of acceptance of removable appliances between males and females [16]

Also, several studies showed no difference in the amount of pain caused by orthodontic treatment between males and females, according to study of Ngan 1996 and Jones 1984 [2,17].

According to the study of Sergl in 2000 and his colleagues their results showed that 82% of patients complained of speech disturbances, 54% difficulty in swallowing, 61% of loss of self-confidence in society and 11% breathing difficulties [18]. Doll and his colleagues study in 2000 showed that different appliances caused inconveniences that can be classified into three categories: soft tissue tension, functional disabilities, and a lack of confidence in society. They also found a correlation between the patient's general attitude towards treatment and the amount of soft tissue tension resulting from the appliance [19].

In 1998 published study conducted by Sergl and his colleagues aimed at monitoring progress or knowing the way in which the patient accomodates after applying various types of orthodontic appliance by using a special questionnaire to assess pain and discomfort within 24 hours of applying the appliances, then at intervals of time; two weeks, a month, 3 months, then 6 months. They concluded that intensity of pain and discomfort decreased significantly with time during the first two weeks, and continued in decrease during the following six months [1]. Psychological compliance to new appliances occurred during the first week, and changes in the severity of social discomfort were less constant, which was more likely to correlate this aspect of adaptation with the patient's personal characteristics [18].

Some studies have taken into consideration the effects of different types and designs of orthodontic appliance on pain and discomfort. It was found that adaptation and initial acceptance can vary significantly depending on the type and design of the appliance. In 1998 a study conducted by sergl and zentner aimed to assess and compare the effect of the design of different types of removable functional appliances including Bionator and the functional regulator FR-1 and functional activator with different designs to there acceptance by patients [1]. The results showed the following:

There was a significant difference in patients 'acceptance of different functional appliances. Of all the appliances tested, the Bionator, FR-1 functional regulator showed the highest levels of patient acceptability*.*

Patients acceptance improved in proportion to its decrease in an appliance size.

Objective: The research aimed to measure patients acceptance of two types of fixed functional appliances Korn mandibular advancer (MA) and Herbst appliance, and measure the intensity of pain resulting from the application of the appliance and pressure on the oral tissues. And to assess difficulty in speech and swallowing, restriction of mandibular movements caused by application of fixed functional appliances.

Materials and methods: 30 patients with skeletal class II malocclusion were selected from the Department of Orthodontics and Orthopaedics – Faculty of Dentistry-University of Hama- syria*.*

The research sample was randomly divided into two main groups according to the appliance used:

First group: Korn appliance was applied as fixed functional appliance which was used to advance the mandible in the treatment of cases of skeletal class II malocclusion. This group was consisted of 15 patients (female and male) their ages ranged from (12-15 years). And the **second group** Herbst appliance, consisted also of 15 patients (female and male), their ages (12-15 years).

The sample inclusion criteria included the following

1. All patients had permanent dentition with all permanent teeth present except the third molar.
2. There was no loss of any tooth during the treatment period.
3. They did not undergo previous orthodontic treatment.
4. All patients had skeletal class II malocclusion due to mandible retrognathia.
5. ANB skeletal classification angle> 4 ° before treatment.
6. Class II molar relationship at least half-cusp width.
7. The age of the sample ranged between 12-15 years.

Sample exclusion criteria

1. Presence of craniofacial deformities.
2. Loss or absence of permanent tooth except third molars, or planning of an extraction.

The fixed functional appliance was applied where the treatment was carried out with one stage of mandibular advancement so that the lower jaw was advanced initially for an edge to edge position. Fixed functional appliances were applied concurrently with fixed orthodontic appliances.

A modified questionnaire from the Sergl *et al*. 1988

questionnaire was used to study the degree of patient acceptance of treatment by studying the levels of pain and discomfort resulting from the application of the Korn MA and Herbst appliances.

Patient acceptance questionnaire for the Korn MA and the Herbst appliances used in our study included seven questions that investigated a set of complaints such as discomfort, pain, oral physiological functions, and the psychological and social impact of the applied appliance in times: T0 (24 hours after the application of the appliance), T1 (within two weeks), T2 (one month later), T3 (after three months), T4 (after six months).

This questionnaire was based on four-point scale (1,2,3,4) for all seven questions: 1) Never (2) Yes (mild) 3) Yes (severe) 4) Yes (very severe).

Results

The questionnaire data were treated as rank data and then studied the distribution of study data which was abnormal and therefore non-parametric statistical analyzes were used. Where Wilcoxon signed rank test was used to compare the data of individuals in different periods of time, while (Mann Whitney test) was used to compare response averages for patient acceptance.

Korn appliance

Table 1: Wilcoxon signed rank test to compare individuals data in different periods of times when using the Korn MA.

T4 After 6 months	T3 After 3 months	T2 After 1 month	T1 After 2 weeks	T0 After 24 hours	Repetition	The response	Question For every patient
15	6	4	2	0	Absolute	1	Q1 Do you suffer from tension of oral soft tissues as a result of applying fixed functional appliance?
100%	40%	26.7%	13.3%	O%	Relative	Never	
0	9	9	7	3	Absolute	2	
0%	60%	60%	46.7%	20%	Relative	Yes, mild	
0	0	2	6	11	Absolute	3	
0%	0%	13.3%	40%	73.3%	Relative	Yes, severe	
0	0	0	0	1	Absolute	4	
0%	0%	0%	0%	6.7%	Relative	yes, very severe	
15	14	9	3	2	Absolute	1	Q2 Do you suffer from pain caused by the application of the fixed functional appliance?
%100	%93.3	60%	20%	13.3%	Relative	Never	
0	1	6	9	5	Absolute	2	
0%	%6.7	40%	60%	33.3%	Relative	Yes, mild	
0	0	0	3	6	Absolute	3	
0%	0%	0%	60%	40%	Relative	Yes, severe	
0	0	0	0	2	Absolute	4	
0%	0%	0%	0%	13.3%	Relative	yes,very severe	
15	15	10	8	6	Absolute	1	Q3 Do you suffer from speech impairment caused by applying the fixed functional appliance?
%100	%100	%66.7	%53.3	40%	Relative	Never	
0	0	5	7	6	Absolute	2	
0%	0%	%33.3	46.7%	40%	Relative	Yes, mild	
0	0	0	0	3	Absolute	3	
0%	0%	0%	0%	20%	Relative	Yes, severe	
0	0	0	0	0	Absolute	4	
0%	0%	0%	0%	0%	Relative	yes,very severe	
14	13	13	9	4	Absolute	1	Q4 Do you suffer from difficulty in swallowing caused by application of fixed functional appliance?
93.3%	%86.7	%86.7	60%	26.7%	Relative	Never	
1	2	2	6	11	Absolute	2	
6.7%	13.3%	%13.3	40%	73.3%	Relative	Yes, mild	
0	0	0	0	0	Absolute	3	
0%	0%	0%	0%	0%	Relative	Yes, severe	
0	0	0	0	0	Absolute	4	
0%	0%	0%	0%	0%	Relative	yes, very severe	
15	15	13	8	3	Absolute	1	Q5 Do you suffer from restriction in mandibular movements caused by application of fixed functional appliance?
%100	%100	%86.7	%53.3	%20	Relative	Never	
0	0	2	6	9	Absolute	2	
0%	0%	%13.3	40%	60%	Relative	Yes, mild	
0	0	0	1	3	Absolute	3	
0%	0%	0%	6.7%	20%	Relative	Yes, severe	
0	0	0	0	0	Absolute	4	
0%	0%	0%	0%	0%	Relative	yes, very severe	
15	14	12	8	6	Absolute	1	Q6 Do you feel shy about having your functional appliance in your mouth in front of others?
%100	%93.3	80%	%53.3	40%	Relative	Never	
0	1	3	7	9	Absolute	2	
0%	6.7%	20%	46.7%	60%	Relative	Yes, mild	
0	0	0	0	0	Absolute	3	
0%	0%	0%	0%	0%	Relative	Yes, severe	
0	0	0	0	0	Absolute	4	
0%	0%	0%	0%	0%	Relative	yes,very severe	
15	14	12	5	0	Absolute	1	Q7

%100	%93.3	80%	%33.3	0%	Relative	Never	Does wearing the appliance deprive you of certain types of food?
0	1	3	9	10	Absolute	2	
0%	6.7%	20%	60%	%66.7	Relative	Yes, mild	
0	0	0	0	4	Absolute	3	
0%	0%	0%	0%	27.6%	Relative	Yes, severe	
0	0	0	4	1	Absolute	4	
0%	0%	0%	%26.7	6.7%	Relative	Yes,very severe	

Herbst appliance

Table 2: Wilcoxon signed rank test for comparing individuals 'data in different times when using the Herbst appliance.

T4 After 6 months	T3 After 3 months	T2 After 1 month	T1 After 2 weeks	T0 After 24 hours	Repetition	The response	Question For every patient
15	15	11	0	0	Absolute	1	Q1 Do you suffer from tension of oral soft tissues as a result of applying fixed functional appliance?
100%	100%	73.3%	0%	0%	Relative	Never	
0	0	4	12	0	Absolute	2	
0%	0%	26.7%	80%	0%	Relative	Yes, mild	
0	0	0	3	11	Absolute	3	
0%	0%	0%	20%	%73.3	Relative	Yes, severe	
0	0	0	0	4	Absolute	4	
0%	0%	0%	0%	26.7%	/Relative	yes, very severe	
15	8	4	0	15	Absolute	1	Q2 Do you suffer from pain caused by the application of the fixed functional appliance?
%100	%53.3	%26.7	0%	100%	Relative	Never	
0	7	11	11	0	Absolute	2	
0%	46.7%	73.3%	%73.3	0%	Relative	Yes, mild	
0	0	0	4	0	Absolute	3	
0%	0%	0%	26.7%	0%	Relative	Yes, severe	
0	0	0	0	0	Absolute	4	
0%	0%	0%	0%	0%	Relative	yes, very severe	
15	10	0	0	0	Absolute	1	Q3 Do you suffer from speech impairment caused by applying the fixed functional appliance?
%100	%66.7	0%	0%	0%	Relative	Never	
0	5	15	9	0	Absolute	2	
0%	33.3%	%100	60%	0%	Relative	Yes, mild	
0	0	0	6	13	Absolute	3	
0%	0%	0%	40%	%86.7	Relative	Yes, severe	
0	0	0	0	2	Absolute	4	
0%	0%	0%	0%	13.3%	Relative	yes, very severe	
15	15	9	0	0	Absolute	1	Q4 Do you suffer from difficulty in swallowing caused by application of fixed functional appliance?
%100	%100	60%	0%	0%	Relative	Never	
0	0	6	15	12	Absolute	2	
0%	0%	40%	%100	80%	Relative	Yes, mild	
0	0	0	0	3	Absolute	3	
0%	0%	0%	0%	20%	Relative	Yes, severe	
0	0	0	0	0	Absolute	4	
0%	0%	0%	0%	0%	Relative	yes, very severe	
6	3	0	0	0	Absolute	1	Q5 Do you suffer from restriction in mandibular movements caused by application of fixed functional appliance?
40%	20%	0%	0%	0%	Relative	Never	
9	12	13	3	0	Absolute	2	
60%	80%	%86.7	20%	0%	Relative	Yes, mild	
0	0	2	12	15	Absolute	3	
0%	0%	13.3%	80%	%100	Relative	Yes, severe	
0	0	0	0	0	Absolute	4 yes, very severe	
0%	0%	0%	0%	0%	Relative		
15	15	15	7	7	Absolute	1	Q6 Do you feel shy about having your functional appliance in your mouth in front of others?
%100	%100	%100	%46.7	%46.7	Relative	Never	
0	0	0	8	8	Absolute	2	
0%	0%	0%	53.3%	53.3%	Relative	Yes, mild	
0	0	0	0	0	Absolute	3	
0%	0%	0%	0%	0%	Relative	Yes, severe	
0	0	0	0	0	Absolute	4 yes, very severe	
0%	0%	0%	0%	0%	Relative		
15	5	0	0	0	Absolute	1	Q7 Does wearing the appliance deprive you of certain types of food?
%100	%33.3	0%	0%	0%	Relative	Never	
0	10	15	8	0	Absolute	2	
0%	66.7%	%100	%53.3	0%	Relative	Yes, mild	
0	0	0	7	9	Absolute	3	
0%	0%	0%	46.7%	60%	Relative	Yes, severe	
0	0	0	0	6	Absolute	4	
0%	0%	0%	0%	40%	Relative	yes, very severe	

Comparison between both appliances

1 -Comparing both appliances in response to the question 1: Do you suffer from tension of oral soft tissues as a result of applying fixed functional appliance?

To perform the comparison Mann-Whitney test was used and the following table showed the test results*:*

Table 3: Mann-Whitney test to compare average response levels for patient acceptance in the first question.

			Mean ratings			
		T0	**T1**	**T2**	**T3**	**T4**
		After 24hours	**After 2 weeks**	**After 1 month**	**After 3 months**	**After 6 months**
Appliance	Korn	12.90	16.20	19.27	20.00	15.50
	HERBST	18.10	14.80	11.73	11.00	15.50
Mann-Whitney		73.500	102.000	56.000	45.000	112.500
Sig		0.037	0.608	0.009	0.000	1.000
Result		significant	Not significant	significant	significant	Not significant

From the previous table, we noticed

1. Mean sample ratings of Korn MA group was significantly lower than that of Herbst appliance group after 24 hours which indicated that Herbst appliance patients were suffered from tension of oral soft tissue more than Korn MA patients during 24 hours.
2. Mean ratings of responses did not differ significantly between both appliances after two weeks and after 6 months of treatment, and consequently both appliances were similar in this result.
3. Mean sample ratings of Korn patients was significantly greater than Herbst patients after 1 month and 3 months, i.e. that Korn patients suffered from tension or pressure of oral soft tissues more than Herbst patients.

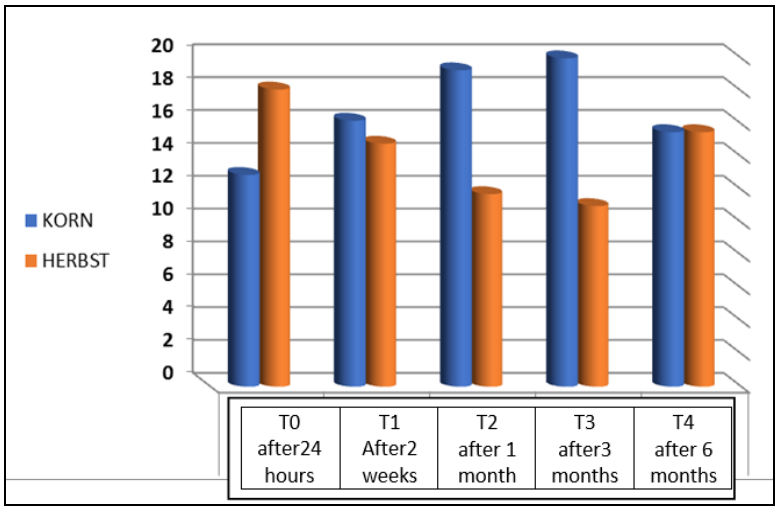

Fig 1: Comparison between both appliances in response to first question.

2 -Comparing both appliances in response to the question 2: Do you suffer from pain caused by the application of the fixed functional appliance?To perform the comparison Mann-Whitney test was used and following table showed the test results*:*

Table 4: Mann-Whitney test to compare average response levels for patient acceptance at the second question.

		Mean ratings				
		T0	**T1**	**T2**	**T3**	**T4**
		After 24hours	**After 2weeks**	**After 1 month**	**After 3 months**	**After 6 months**
Appliance	Korn	13.00	13.90	13.00	12.50	15.50
	HERBST	18.00	17.10	18.00	18.50	15.50
Mann-Whitney		75.000	88.500	75.000	67.500	112.500
Sig		0.126	0.325	0.126	0.061	1.000
Result		significant	significant	significant	Significant	significant

From the previous table, we noticed

Mean ratings did not differ significantly between both appliances during periods of treatment, and therefore both appliances were similar in this result, noting that the average rank of Korn patients was less than Herbst patients until 3 months of application, and thus they experienced less pain, but not significant, as shown in the following figure:

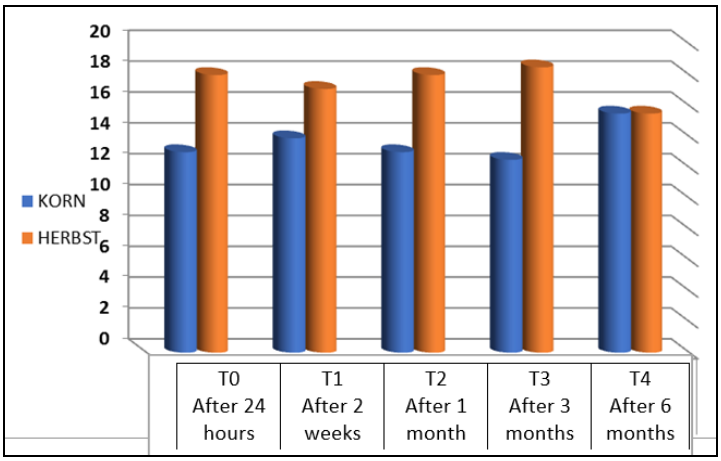

Fig 2: comparison between both appliances in response to the second question.

3 -Comparing the two appliances in response to the question 3: Do you suffer from speech impairment caused by applying the fixed functional appliance?

To perform the comparison a Mann-Whitney test was used and the following table shows the test results*:*

Table 5: Mann-Whitney test to compare average response levels for patient acceptance at the third question.

		Mean ratings				
		T0	**T1**	**T2**	**T3**	**T4**
		After 24 hours	**After 2 weeks**	**After 1 month**	**After 3 months**	**After6 months**
Appliance	Korn	9.30	10.10	10.50	13.00	15.50
	HERBST	21.70	20.90	20.50	18.00	15.50
Mann-Whitney		19.500	31.500	37.500	57.000	112.500
Sig		0.000	0.000	0.000	0.016	1.000
Result		significant	significant	significant	significant	Not Significant

From the previous table, we noticed

The average of the sample ranks in Korn MA patients was significantly lower than Herbst appliance patients up to 3 months Which indicated Herbst appliance patients suffered from speech impairment more than Korn MA patients,while after 6 months that disability was absent when using both appliances as shown in the following figure.

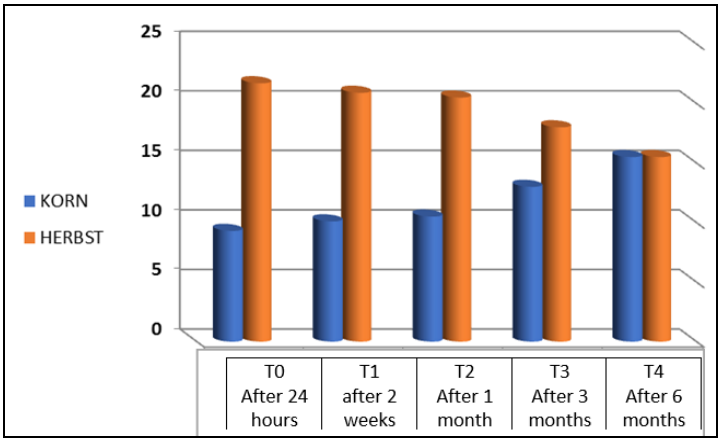

Fig 3: comparison between both appliances in response to the third question.

4 -Comparing the two appliances in response to the question 4: Do you suffer from difficulty in swallowing caused by application of fixed functional appliance?

To perform the comparison a Mann-Whitney test was used and the following table showed the test results*:*

Table 6: Mann-Whitney test to compare average response levels for patient acceptance at the fourth question.

		Mean ratings				
		T0	**T1**	**T2**	**T3**	**T4**
		After 24 hours	**After 2 weeks**	**After 1 month**	**After 3 months**	**After6 months**
Appliance	Korn	12.40	11.00	13.50	16.50	16.50
	HERBST	18.60	20.00	17.50	14.50	15.50
Mann-Whitney		66.000	45.000	82.500	97.500	105.000
Sig		0.009	0.000	0.104	0.150	0.317
Result		significant	significant	Not significant	Not significant	Not significant

From the previous table, we observed

Mean ratings in Korn MA patients were significantly lower than Herbst appliance patients until two weeks. Herbst appliance patients were suffered from swallowing disruption more than in Korn MA patients while after 3 and 6 months decreased as shown in the following figure:

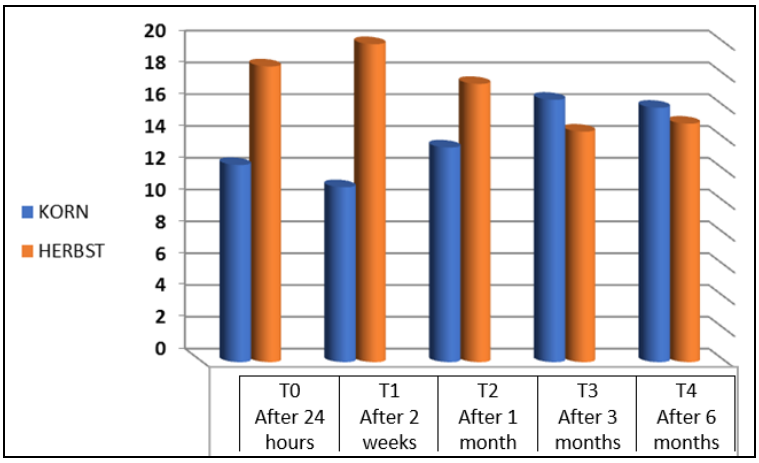

Fig 4: comparison between the two appliances in response to the fourth question.

5 -Comparing the two appliances in response to the question 5: Do you suffer from restriction in mandibular movements caused by application of fixed functional appliance?

To perform the comparison a Mann-Whitney test was used and the following table shows the test results*:*

Table 7: Mann-Whitney test to compare average response levels for patient acceptance at the fifth question.

		Mean ratings				
		T0	**T1**	**T2**	**T3**	**T4**
		After 24 hours	**After 2 weeks**	**After 1 month**	**After 3 months**	**After6 months**
Appliance	Korn	9.50	9.20	8.87	9.50	11.00
	HERBST	21.50	21.80	22.13	21.50	20.00
Mann-Whitney		22.500	18.000	13.000	22.500	45.000
Sig		0.000	0.000	0.000	0.000	0.000
Result		significant	significant	significant	significant	significant

From the previous table, we noticed

Mean ratings of patients for Korn appliance were significantly lower than the mean ratings of patients for Herbst appliance up to 6 months and thus on Herbst appliance patients suffered from a restriction in mandibular movement more than Korn appliance as shown in the following figure:

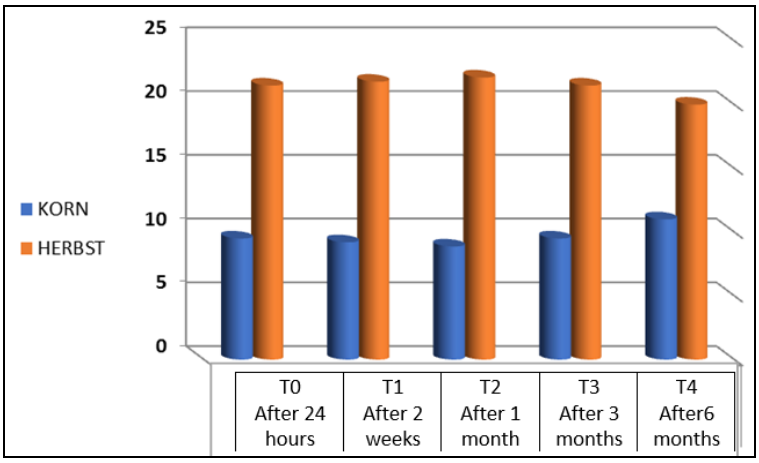

Fig 5: comparison between the two appliances in response to the fifth question.

6 -Comparing the two appliances in response to the question 6: Do you feel shy about having your functional appliance in your mouth in front of others?

To perform the comparison a Mann-Whitney test was used and the following table shows the test results*:*

Table 8: Mann-Whitney test to compare average response levels for patient acceptance at the sixth question.

		Mean ratings				
		T0	**T1**	**T2**	**T3**	**T4**
		After24hours	**After 2weeks**	**After 1 month**	**After 3 months**	**After 6 months**
Appliance	Korn	16.00	15.00	13.00	12.50	15.50
	HERBST	15.00	16.00	18.00	18.50	15.50

Mann-Whitney	105.000	105.000	90.000	105.000	112.500
Sig	07.717	0.720	0.073	0.317	1.000
Result	Not significant	Not significant	Not significant	Not significant	Not significant

From the previous table, we observed

Mean ratings did not differ significantly between both appliances during periods of treatment, and therefore both appliances were similar in this result until 6 months, as shown in the following figure:

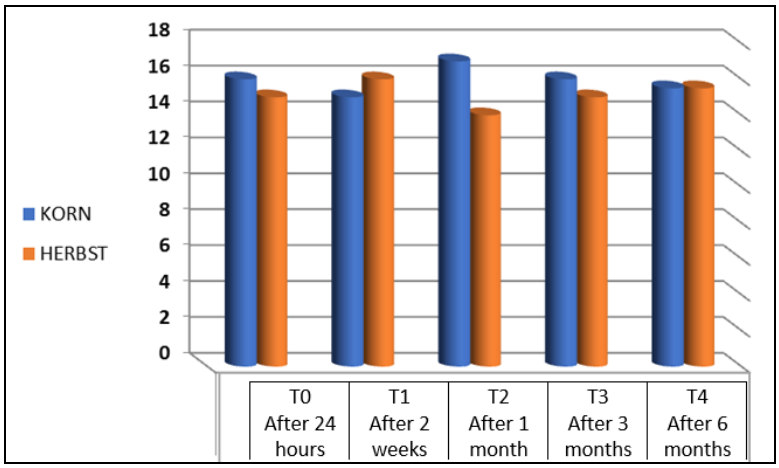

Fig 6: shows the comparison of the two appliances in response to the sixth question.

7 -Comparing the two appliances in response to the question 7: Does wearing the appliance deprive you of certain types of food?

To perform the comparison a Mann-Whitney test was used and the following table shows the test results*:*

Table 9: Mann-Whitney test to compare average response levels for patient acceptance at Question Seven.

		Mean ratings				
		T0	**T1**	**T2**	**T3**	**T4**
		After 24 hours	**After 2 weeks**	**After 1 month**	**After 3 months**	**After 6 months**
Appliance	Korn	10.00	11.40	9.50	11.00	15.50
	HERBST	21.00	19.60	21.50	20.00	15.50
Mann-Whitney		30.000	51.000	22.500	45.000	112.500
Sig		0.000	0.004	0.000	0.001	1.000
Result		significant	significant	significat	significant	Not significant

From the previous table, we noticed

Mean ratings of Korn appliance patients were significantly lower than mean ratings of Herbst appliance patients until 3 months and thus on Herbst appliance patients suffered from more deprivation of certain foods Korn appliance patients while after 6 months that suffering was absent, as shown in the following figure.

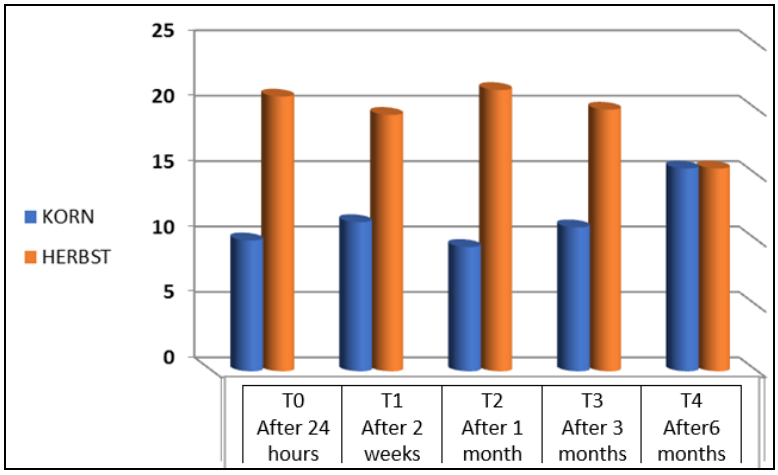

Fig 7: Comparison between both appliances in response to the seventh question.

Discussion

This study aimed to assess patients' acceptance of two types of fixed functional appliances. Many scientific researches and reports evaluated the effects of different types of removable and fixed functional appliances on growth and dentofacial changes in patients with skeletal class II malocclusion

accompanied with mandibular deficiency [20].

Clinical trials are one of the best types of researches conducted on patients and aimed to reach conclusions about the ability or effectiveness of treatment procedure [21]. Fixed functional appliance was applied concurrently with fixed orthodontic appliance; where dental movements can be made in three spatial directions simultaneously with the stage of correcting the skeletal discrepancy. And this was accomplished due to the design of both appliances used in our study (Korn MA, Herbst Appliance) which allowed simultaneous and complete treatment with fixed orthodontic treatment. Our work corresponds with study of Gonner, 2007 [22].

It is important to know the way in which patients adjust to the pain and discomfort associated with the use of orthodontic appliance.

The various factors in helping practitioners to improve the degree of patient acceptance of orthodontic treatments by choosing appliances that are patient-friendly and easy to adapt to. Objective assessment of pain is difficult and its measurement is not easy, as it represents a very complex phenomenon and varies from individual to individual, as not all patients feel the same amount of pain when exposed to the same stimulus [3, 5] Some have indicated that adolescents suffer more pain than adults [23].

In the current study, the severity of pain and discomfort and the extent of their persistence in the patient (mild - moderate - severe) were measured in 5 visits.

As for complaints of feelings of discomfort, pain, tension of soft tissues, or pressure on oral mucosa, the largest percentage of patients had mild to severe complaints during the first two weeks, but this percentage decreased clearly and quickly with the end of the two weeks when applying both appliances. Mild tension and pressure of oral soft tissues caused by advancement of the mandible which was started from the first 24 hours to two weeks, and after the second week it was observed that this complaint became less disturbing. This could be considered as an indication that the initial amount of protruding mandible was not severe and the new position of the jaw was within the limits of the adaptability that most patients possessed. This can be attributed to the neuromuscular reprogramming process, which is responsible for adapting patients to soft tissue tension [23].

2 -The inconveniences and pain work as inducers that negatively affect the process of adapting patients to orthodontic treatment, and therefore affect the degree of their acceptance of the orthodontic appliance. Pain and discomfort are common complaints or side effects that patients mention after each visit during orthodontic treatment [2, 3]. Studies have shown that 70-95% of orthodontic patients suffer from pain [3]. Where Oliver and Knappman indicated that 70% of the study sample had at least some degree of pain regardless of the type of orthodontic device applied (fixed or removable) [7].

Patients can adapt with ongoing pain and discomfort as treatment progresses. In our study when treating cases of skeletal class II malocclusion and dental class II div.1 with Herbst appliance or Korn MA appliance, it was observed that most patients accepted the treatment well, but both appliances caused some discomfort and pain which persist temporarily, as these complaints appeared mainly at the beginning of treatment, particularly during the first two weeks to three months, this corresponds to the study of Pancherz 1980, Pancherz 1985a and Bowman 2012 where patients experienced Tenderness and pain in mastication muscles and temporomandibular joint during palpation and the feeling of pain gradually decreased [11, 12, 24]. So for any new orthodontic appliance it is necessary to know exactly how much time is required for such adaptation to occur, so one of the current clinical goals has been to detect progress or know the way in which patients adapt after Korn MA and Herbst appliance was applied.

3 -The results of the questionnaire showed in our study that all patients suffer from speech and swallowing difficulties, from mild to severe during the first two weeks of treatment up to three months. Where patients experienced difficulty in speaking and swallowing when applying Herbst appliance more than the application of Korn MA appliance. This can be attributed to the design flexibility of Korn MA in relation to the design of Herbst. This corresponds to the study of Al-Ali 2012 [27], which was occurred decrease in the severity of complaints related to functional aspects with the progress of treatment due to the tongue adaptation to the new position which happened gradually caused by biting jumping from the advancement of mandible. This is also consistent with the study of Taslan 2010 [24]. In general, in our study, both appliances did not cause the degree of obstruction of swallowing and speech as the vestibular position of the bite-jumping mechanism for most fixed functional appliances, whether Herbst appliance or Korn MA appliance did not negatively affect the functions of swallowing and speech unlike appliances with the lingual position cause narrowing of oral cavity which negatively affects the space of the tongue and its role in the functions of swallowing and speech.

4 -In all periodic follow-up visits during treatment, most patients initially experienced restriction in mandibular movements when applying both appliances and then gradually decreased during the treatment stages. However, the restriction of the movements in Herbst appliance was more than Korn MA appliance. This can be attributed simply to the design of Korn appliance, which provides the patient with functional mandibular movement more free and less friction compared to functional appliances with telescopic mechanism, and this is consistent of Sander 1990 [25]. We can say that the simplicity of mandibular movements can increase the patient's adaptation and acceptance of the appliance used for treatment and therefore did not negatively affect the functions of swallowing or speech, and our results were similar to study of kinzinger 2005 [26].

5 -In our study conducted on young patients, the least common complaint was lack of self-confidence towards the society, which was observed slightly only during the first two weeks when using both appliances, this can be attributed to the design of (Korn MA or Herbst appliance) where located in buccal aspects and are not visible in the anterior oral side. The results of our study coincide with the study of (Sergl 2000, 1998a) [1, 18] in that the patient's self-confidence, especially during social communication where attention is focused on the face, eyes and mouth can be affected by two factors, the amount of appearance of orthodontic appliance used and the severity of speech difficulty.

6 -The results of our study also showed that patients refrained from eating certain types of food, especially the rigid ones when applying both appliances during the first two weeks and then decreased substantially after three months due to restriction of mandibular movements at the beginning of treatment.

The results of this clinical questionnaire can be used in clinical practice to inform the patient about complaints that may accompany the application of the appliance and that some of the changes that can occur are reversible which may

help to improve the degree of patient acceptance of treatment. These results correspond to study of (kinzinger 2005) [26].

From previously mentioned we can recognize that patient compliance and satisfaction is an important factor in selection specific type of orthodontic appliances which insure cooperation and adaption of our patients with appliance used.

Conclusions and recommendations

1. Oral soft tissue tension, pain and discomfort occurred when applying fixed functional appliances (Herbst and Korn MA) only during the first two weeks, then gradually decreased within three months until they finally faded in the remainder of the treatment.
2. There was restriction in mandibular movements and consequently can affect the function of swallowing and speech during the first two weeks and then decreased during the remaining stages of treatment.
3. There was no effect of the fixed functional appliances used on the patient's confidence and feelings of shame in front of others.
4. We recommend the use of Korn MA appliance as one of the alternatives of the fixed functional appliances used to correct skeletal class II malocclusion associated with mandibular retrognathia in cases that need dental movements by using the fixed orthodontic appliance in conjunction with the stage of correcting the skeletal discrepancy.

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