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# Effect of fig on relapse during retention period after orthodontic treatment (animal study)

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*Abstract*

***Objective:*** *to evaluate the effect of fig on relapse during retention phase after orthodontic treatment in animals.* ***Materials and methods:*** *Twenty rabbits were divided into two groups, Group 1 (control group): normal diet. Group 2: Fig added to the normal diet. Each rabbit received orthodontic appliance to apply force on the lower incisors in order to create a 3–4 mm space. Following space opening, the device served as passive retainer for six weeks, during which the animals got fig with regular diet. The appliance was removed after six weeks, and an impression was taken. The teeth then allowed to relapse for four weeks, then another impression was taken for post-relapse measurement. The space between incisors was measured. Animals were sacrificed and blocks were taken and prepared for histological study.* ***Results:*** *Relapse was significantly lower in Fig group than in the control group.* ***Conclusion:*** *Fig increases osteoblastic activity while decreases osteoclastic activity, both of which are beneficial consequences on bone health, which decreases the amount of post orthodontic relapse*

***Key words:*** *Retention, Herbal, Fig, Relapse*

## Introduction

The orthodontic tooth movement is the biological reaction of the tissues around the tooth after the application of a suitable mechanical force. The tooth movement is balanced by osteoblasts and osteoclasts.(1).

Following orthodontic treatment, there is a retention period during which orthodontists try to maintain the achieved results. The retention phase involves the use of several methods, including biological, physical, and mechanical retainers to retain the tooth in its final position. (2).

Fig (Ficus carica) is one of the natural products that has many advantages for bone health. According to earlier researches, Ficus carica plays an important role in preventing osteoporosis (3,4)

Upon reviewing the literature, no research on the importance of the fig on relapse during the retention phase following orthodontic tooth movement was found. Thus, the aim of this study was to assess this objective.

## Materials and methods

### Study design

An equal group randomized control trial was established to assess the effect of fig on relapse during retention phase following the orthodontic treatment.

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2. Professor and head of Department of Orthodontics, Faculty of Dentistry Minia University, Dean of Faculty of Dentistry – Aswan University
3. Lecturer of Orthodontics, Faculty of Dentist,ry Minia University.

**Ethical regulations**

Study protocol was approved by the Research Ethics Committee in Faculty of Dentistry, Minia University, Egypt. (Research no: 605 / 2022).

**Sample size calculation**

The number of animals in each group was determined according to data obtained from previous study [5]. 10 animals in each group were determined to provide 80% power for One-way ANOVA test with post-hoc analysis at the level of 0.05 significance using G Power 3 Software[6].

**They were divided into two equal groups:**

**Group 1 (control group):** Regular diet.

**Group 2:** Fig added to the regular diet.

- **The rabbits were 2.5–3 kg in weight and aged between 8 and 10 months.**
- **Using computer-generated randomization software, the animals were randomized into two groups.**
- **Each animal included in the study placed in a sperate cage.**
- **According to the World Organization for Animal Health (OIE), the animals were managed by skilled clinicians.**
- **To reduce the chance of appliance breakage, using a soft diet.**

**Orthodontic appliance**

Orthodontic appliance prepared as Al Hamdany et al. design, using brackets bonded to the incisors rather than cemented band.[5] The appliance consists of orthodontic *brackets with MBT* 022 *Slot* (American orthodontics, USA) bonded to lower incisors of the rabbits. 17x25 stainless steel wire (American orthodontics, USA) added with a Niti coil spring (Ormco, England) placed between the brackets to apply about 40 gm[5] continuous force to get a 3-4 mm space between the incisors.

Throughout the entire experiment, the animals were anesthetized with a mix of ketamine hydrochloride 35 mg/kg (KETAMX 50) (Troikaa pharm. India) with xylazine hydrochloride 10 mg/kg (Xyla-Ject) (Adwia pharm. & chemicals co. S.A.E 10$^{th}$ of Ramadan, Egypt) intramuscular [5]

After one week of appliance activation, 3-4 mm space opened. Flowable composite applied on the opened coil spring to act as a passive retainer. The space opened measured at the day of appliance removal (T0) and after 4 weeks (T1) to measure the relapse.

Herbal materials feeding[7] was by forced feeding on daily bases regularly every morning for six weeks. Fig (Abu Auf company, Egypt) used was dried turkish fig, the fig was mixed with water to get a soft mix ,100 gm of fig mixed with 200 ml water to get a soft mix with concentration of 2gm/1ml. The dose used was 2 g/kg body weight daily. [8]

After Six weeks, the appliance was removed. The condensation silicon impression material (Zetaplus, Zhermack, Italy) was used to take the impressions. A desktop cast scanner from Shining 3D in Hangzhou, China (Ds Mix lab scanner) was used to scan the poured casts.

Using Materialise Mimics software (Materialise Mimics, Belgium) and a digital

caliper, the distance between the incisors was measured both digitally and manually at the gingival level between the mesiolabial line angle on the mesial wall of the incisors. Two measurements of the distance between the incisors were made: one at T0, after the end of retention period, and another at T1, the day after the 28-day relapse. At the end of the experiment, the animals were sacrificed and prepared for histological study.

**Results**

Using IBM-SPSS ver. 24 the statistical analysis was done. One-way ANOVA test was used to compare the difference in mean between groups. Also, Post-hoc test with Bonferroni Corrections were used to compare the mean difference between groups. The p-value <0.05 was considered significant.

## A) Macroscopic findings:

### 1)Digital measurement:

| Digital Measure | Control (1) (n = 10) | Fig Group (2) (n = 10) | P-value |
|---|---|---|---|
| **Relapse** | | | |
| • Mean ± SD | 1.02 ± 0.1 | 0.72 ± 0.03 | **< 0.001** |

**Table 1: Comparison of Differences (relapse) in Digital Measurements in the studied groups**

For the digital measurements, the Fig group had significantly lower relapse compared with control group.

### 2)Manual measurement:

| Manual Measure | Control (1) (n = 10) | Fig Group (2) (n = 10) | P-value |
|---|---|---|---|
| **Relapse** | | | |
| • Mean ± SD | 1.11 ± 0.2 | 0.87 ± 0.08 | **< 0.001** |

**Table 2: Comparison of Differences (relapse) in Manual Measure in the studied groups**

For the manual measurements**,** the Fig group had significantly lower relapse compared with control group**.**

**3) Comparison between digital and manual measurements:**

The Interclass Correlation Coefficient, or "ICC," shows a good agreement "strong correlation "between the digital and manual measurements.

| | Control (n = 10) | Fig Group (n = 10) | Total (n=20) |
|---|---|---|---|
| **ICC (95% CI)** | | | |
| • Pre-exam. | 0.89 (0.41-0.98) | 0.85 (0.24-0.98) | 0.89 (0.72-0.96) |
| **P-value** | **= 0.030** | **= 0.046** | **< 0.001** |
| • Post-exam. | 0.31 (-0.74: 0.87) | 0.99 (0.97-1.00) | 0.97 (0.93-0.99) |
| **P-value** | = 0.366 | **< 0.001** | **< 0.001** |
| • Difference | 0.26 (-0.75: 0.92) | 0.17 (-0.78: 0.84) | 0.91 (0.76-0.96) |
| **P-value** | = 0.387 | = 0.431 | **< 0.001** |

**Table 3: Agreement between Digital and Manual Measurements**

**B) Microscopic findings (Histological examination):**

**H&E-stained slide analysis**

The findings demonstrated that the Fig group had more osteoblasts and more newly formed bone tissues.

| | Group | Mean new bone area (mm2) | Mean % of new bone formation | Mean No of Osteoblasts | Mean No of Osteoclasts | Mean Bone density |
|---|---|---|---|---|---|---|
| 1 | Control | 1.86 | 28.4% | 36-37 | 5-6 | +1.7 |
| 2 | Fig | 2.03 | 33.9% | 45-46 | 1-2 | +1.5 |

**Table 4 : Histomorphometry analysis of the studied groups**

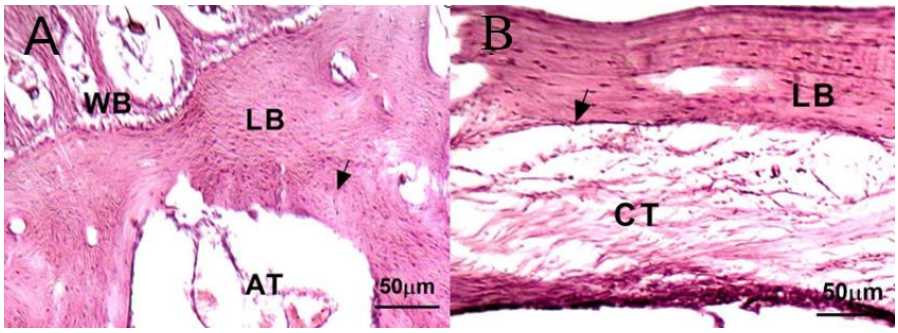


**Figure (1):** Histomorphometry comparing the amount of newly formed bone (A) control group (B) Fig group. WB: wavy bone, LB: Lamellar bone

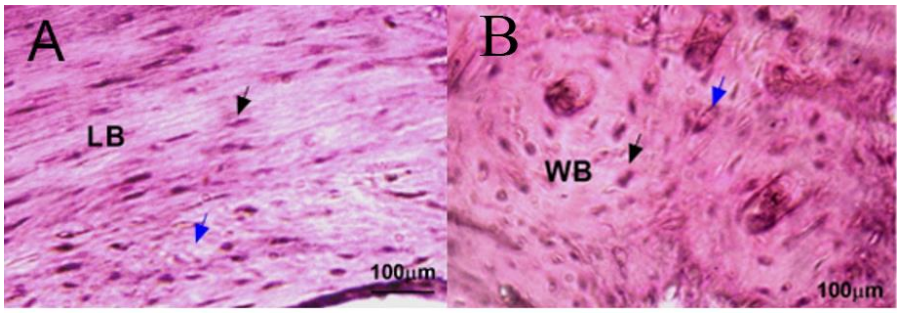


**Figure (2):** Histomorphometry comparing the amount of osteoblast cells and osteoclast cells (A) control group (B Fig group: Osteoblasts: black arrow, Osteoclasts: blue arrow

## Discussion

The retention phase after orthodontic treatment is crucial to maintain the achieved results and avoiding relapse, which is the main problem after the orthodontic treatment [2]. The major goal of this study was to determine how the fig affects orthodontic relapse.

Rabbits were selected for this study because the bone remodeling is finished in a just six weeks due to their rapid bone turnover rate [9]. The lower incisors of the rabbits were chosen because they were easier to access which made it simpler to follow up the tooth movement.[10]

The appliance used was designed as Al Hamdany et al description [5] but using bonded brackets rather than cemented band as it has smaller size than bands and easier be removed without excess cement on the teeth that facilitate more accurate measurements.

To make sure the animals were hungry, forced feeding was carried out every morning on a regular basis. Dried turkish fig used, the fig was mixed with water to get a soft mix, dose used was 2 g/kg body weight daily using the same ratio suggested by Bashandy et al. [8]

Fig used was dried fig mixed with water to get a soft mix , this form was used rather than fig extract as previous studies to simulate the regular form used in daily life [11] . Digital and manual measurements were used to measure the space between teeth.

The results showed that the fig group had a significantly lower rate of relapse when compared to the control group, which is similar

with a previous study [12] as it can be explained as that the hexane soluble fraction of the fig can inhibit osteoclast differentiation by suppression of many factors, as decreasing the expression of nuclear factor-activated T cells c1 NFATc1 and c-Fos, which have a the major role for regulation of osteoclast differentiation.

Histomorphometry revealed that the fig group had the lower number of osteoclast cells and the higher number of osteoblasts, bone density, and bone area produced, which is supporting the positive clinical measurements.

**Conclusions**.

Fig acts as potent inhibitor of osteoclastogenesis so that decreases the relapse after orthodontic tooth movement.

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