



Evaluation of Treatment Outcome of Lower Incisors Crowding Using Clear Aligners with Laser Acceleration (Randomized Control Study.) .

A Proposal

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Introduction :

One of the world's greatest novelists , once said, "Every tooth in a man's head is more valuable than a diamond." ⁽¹⁾

This statement makes sense because teeth are the most attractive part of the face .which gives the appearance of perfection .Any inconsistency or flaws in the teeth, such as dental crowding, can change one's beauty , which is undesirable. In this regard orthodontic treatment became very important. ⁽¹⁾

A deviation from an ideal occlusion or an accepted societal norm is referred to as malocclusion . Malocclusion is widely accepted to be multifactorial, with genetic factors as well as habits, dietary preferences, habitual oral or tongue posture, and swallowing characteristics all playing a role. Dental malocclusion is very common in children and adolescents all over the world . It is linked not only to oral disorders, but also affects patient's psychological, social, and functional health . ^(2,3)

Dental crowding, also known as Swarming ,can be explained as an inconsistency between tooth size and arch dimension .⁽¹⁾

Modern orthodontic treatments strive to provide patients with a comfortable and enjoyable treatment experience . As a result, several studies have recently emerged that focused on patient-centered outcomes during a wide range of orthodontic interventions. ⁽²⁾

The rise in the number of adult orthodontic patients has increased demand for aesthetic and comfortable alternatives to traditional fixed appliances. Clear aligners that meet this demand are also vulnerable to rapid technological advancements in aligner materials and manufacturing techniques. The removable appliance was used solely to move teeth in the first generation of aligners. Following that, a second generation of aligners was developed that relied more on attachments bonded to teeth. The most

recent, third generation, has been modified to automatically place various types of attachments where difficult tooth movements are required. These technology advancements have increased the number and complexity of cases treated with this method.^(4,5)

Since the introduction of Invisalign in 1997, treatment with clear aligners has become a rapidly growing sector in orthodontics. Clear aligners offer more aesthetically pleasing and comfortable treatment experience, improve oral hygiene, cause less pain than fixed orthodontic appliances, reduce the number and duration of appointments, and necessitate fewer emergency visits. However, the cost of production, reliance on patient cooperation, and inability to treat certain malocclusions limit their use.^(6,7)

Orthodontic treatment typically lasts between 24 and 36 months. In general, patients reject this treatment modality due to the lengthy treatment period. In extended treatment protocols, root resorption, caries, and decreased patient compliance are more common. As a result, accelerating orthodontic tooth movement is appropriate to avoid those side effects and can encourage patients to complete the treatment . Acceleration of orthodontic tooth movement (OTM) has been used successfully to reduce levelling and alignment time using surgical interventions such as corticotomy, corticision, piezocision, and micro-osteoperforation. ^(6,8)

Orthodontic treatment is generally based on the rule of bone remodeling that occurs as a result of applying forces to a tooth, creating areas of tension and pressure on the periodontal ligament. The events that lead to tooth movement are intricate, incorporating interactions between cells in the alveolar bone and the periodontal ligament. The process is characterized by acute inflammation, followed by chronic inflammation, and then by acute inflammation (after reactivation of orthodontic forces). These changes in periodontal tissues cause bone remodeling, which is necessary for orthodontic tooth movement. Many studies have now been conducted to investigate various methods of accelerating tooth movement, such as drug injections, electric

stimulation, corticotomy, pulsed electromagnetic fields, and mechanical and physical methods. ^(6,9)

Low-Level Laser Therapy is one of these interventions (LLLT). Low-Level Laser (LLL) has analgesic, anti-inflammatory, and bio stimulatory properties. Among all methods studied to accelerate induced dental movement and thus reduce orthodontic treatment time, Low-Level Laser is the least invasive, easiest, safest, and fastest to apply. Initially, histological studies revealed that LLLT promotes remodeling processes in alveolar bone by increasing the number of osteoblasts and osteoclasts. As a result, there has been an exponential increase in the number of studies conducted to investigate the effectiveness of laser treatment in accelerating tooth movement. LLLT, on the other hand, has a high patient acceptability and is simple to use, especially with the availability of small portable devices. ^(10,11)

Low-Level Laser Therapy (LLLT) is a simple, localized, nonsurgical, noninvasive method with no side effects that is gaining popularity among OTM researchers. LLLT has been shown in numerous studies to improve vascularization, collagen fiber organization, and osteoblastic activity. ⁽¹²⁾

Laser is an abbreviation for "light amplification by simulated emission of radiation," one of the greatest technological advances of the twentieth century. Lasers were first used in medicine in 1963. One year later, the first laser applications in the field of dentistry were performed using a ruby laser on hard issues . ⁽¹³⁾

The effects of LLLT on tooth movement were studied in both clinical and animal studies . Numerous human studies have shown that LLLT can simulate the velocity of tooth movement . At that point, it is emphasized that the effects of laser application on bio simulation is dose dependent . ⁽¹³⁾

By reviewing the available Literature , little studies demonstrated the acceleration of orthodontic tooth movement by aligner associated with LLLT , so the goal of the

present study is directed to evaluate the rate of correction of lower incisor crowding by clear aligner and LLLT versus clear aligner alone .

Aim of the study :

The present study will be performed to evaluate the effect of low-level laser therapy (LLLT) on the rate of orthodontic tooth movement through the correction of lower incisors crowding using clear aligners .

Subjects and methods :

Patients with lower anterior mild to moderate crowding will be collected from AlAzhar University from Faculty of Dental Medicine for Girls and post records will be collected after relieve of crowding .

Study design: Randomized Control Study.

Randomization will be done by using Microsoft Office Excel 2007 . patients information will be entered into a computer ,then the computer randomly assigns the patients to two groups that helping to prevent bias.

Control group (n=11) patients will receive a conventional therapy with clear aligners and the investigational group (n=11) will receive the new treatment therapy by using clear aligners for the treatment of mild to moderate lower anterior crowding with laser acceleration .

Sample size calculation⁽¹⁴⁾:

This power analysis used leveling and alignment improving % as the primary outcome. Based upon the results of . AlSayed Hassan MMAA et al (7102); the mean (Standard deviation) values were 89.42 (7.16) and 71.7 (16.18) %, respectively. The effect size (d) was 1.416. Using alpha (α) level of (5%), β level of 0.8 (Power = 80%); the minimum estimated sample size was 9 subjects per group. Sample size was increased to 11 subjects per group to compensate for a dropout rate of 20% after 6 months. Sample size calculation was performed using G*Power version 3.1.9.2.

Ethical approval:

The research protocol approved by ethical committee of Faculty of Dental Medicine, girls, Al-Azhar University, (P-OR-22-05). The steps of the procedure will be explained to the patients / parents and an informed consent will be signed .

Inclusion criteria⁽¹⁵⁾ :

1. A well-behaved, compliant, and motivated patient.
2. Patients from 16 to 23 years old .
3. Patients with mild to moderate anterior lower crowding.
4. Full complement of teeth (except for wisdom teeth).
5. Class I Angle malocclusion .

Exclusion criteria⁽¹⁶⁾ :

1. Patients with missed anterior teeth .
2. Class II or III Malocclusion (dental or skeletal) .
3. Any systemic diseases that may interfere with assigned treatment plan .
4. Periodontal affection especially at lower anterior teeth .

Method:

Each patient will have the following record taken before the delivery

:

- Orthodontic casts (upper and lower).
- Photography, both intraoral and extraoral ○ lateral cephalometric X-ray .
- Panoramic X-ray

Treatment groups:

The sample will be divided into two groups according to laser application, 11 patients each group :

Group (A): Clear aligners will be used to treat patients with lower anterior crowding with low level laser acceleration .

Group (B): Clear aligners will be used to treat patients with lower anterior crowding without laser acceleration .

Statistical analysis :

Measurements will be taken and the collected data will be tabulated and analyzed statistically.

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