Physical Device for Measuring Tension in a Wire

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Abstract. This paper provide a physical device for measuring tension in a wire of an orthodontic brace. The wire is having a closed circumference and capable of being wind in a winding position around brackets of two teeth. The device includes an anchoring member, a holding portion and a display. The anchoring member is having a first end attachable with the wire in the winding position and a second end attachable with the holding portion of the device. The device upon pulling the wire by anchoring the anchoring member along with its length, measures the tension exerted by the wire on the teeth and displays the measured data on the display of the device.

1. Introduction
Orthodontics in dentistry is associated with improvement of the general appearance of a patient's teeth and deals with the diagnosis, prevention and correction of misaligned or mal-positioned teeth and jaws. Orthodontics braces are the device which is used for correction of misaligned or mal-positioned teeth and jaws [1]. Orthodontics braces are provided with wires and brackets. The brackets are fixed with each of the teeth and wires are winded around the teeth and are fixed with the brackets [2]. The medical practitioner (orthodontist) adjusts the required tension on the wires depending on the complexity of misaligned teeth. Further, periodic adjustment of the wires is required for the proper alignment of the misaligned or mal-positioned teeth and jaws. The wires may be replaced with a rubber band or rubber chain or any other elastic material [3-5].
If the tension required on the wire arranged between the mal-aligned teeth is known to the practitioner at each stage of the treatment, the alignment period and the diagnosis term can be substantially reduced. Improper adjustment of the wire in varied tension may unnecessarily extend the term of diagnosis and thereby delaying the alignment period [4,6]. Wires or elastic materials are available with predefined tension which can be applied across the brackets [7]. However, these wires cannot be customized according to the need of the patient. Hence there is a requirement of a dental device which...
can measure the tension of the wire / elastic wound around a bracket of two teeth in an orthodontic brace treatment which may overcome few or all drawbacks of the existing dental devices.

1.1. Research Objectives
The present study aims to:

a) To provide a device for measuring tension in a wire configured around a bracket of two teeth in an orthodontic brace treatment.

b) To provide a device for measuring tension in a wire of an orthodontic brace, which substantially shortens the time duration of treatment.

c) To provide a device for measuring tension in a wire of an orthodontic brace, which reduces the alignment period of the treatment.

2. Literature Review
Ravera et al. [8] designed a pendulum force measuring device, which simulated the oral environment and measured the effect of orthodontic force on the crown and root. In order to prevent undermining resorption light forces should be used during orthodontic treatment. The optimum force used in orthodontic treatment should be enough to produce tooth movement without tissue damage and with maximum comfort for the patient. Excessive forces can lead to severe pain, damage of the periodontal ligament and root resorption [9]. The improper teeth positioning is the most common clinical features [10]. It usually causes the uneven tooth alignment and dental arch deformity. And it not only affects the function of mastication, but also has a certain impact on the pronunciation. The tooth decay, dentin hypersensitivity, and more mouth diseases will be accompanied by it. Kumar et al. [11] planned an integrated bracket, which integrates the pressure pickup into the bracket and can directly measure the pressure between the archwire and the bracket, but it cannot truly reflect the actual relationship between the archwire and the bracket in the clinical state. Upadhyay et al. [12] have established a measuring device with a three-dimensional orthodontic force, which replaces the actual teeth with a simplified cylinder. It can preliminarily measure the orthodontic force of all the teeth on the dental arch and distinguishes the difference between passive ligation and other ligation methods. Jhiang et al. [13] realized the calculation of bending stress by using the hyper-elasticity of the archwire in the process of studying the bending properties of hollow nickel-titanium alloy wires.

3. Materials and Method
In the orthodontic braces treatment, wires, elastic members or the like are used to adjust the tension between the teeth. In the orthodontic braces, brackets are attached with each tooth, and the wires are configured around the brackets of two teeth. The wire is having a closed circumference and is capable of being wind in a winding position around the brackets of two teeth. The wires can be attached with the adjacent brackets. The wires are tightened according to the required tension. Once the tension is set across the brackets, the device can be used to verify the tension across the wire. The device is a force measuring instrument having an anchoring member, a holding portion and a display. The anchoring member is adapted to attach with the wire. Specifically, a first end of the anchoring member which is the distal end of the device is attachable with the wire in the winding position. A second end of the anchoring member is attached to the holding portion of the device. In an embodiment, the anchoring member can be detachable from the holding portion and can be replaced with anchoring members of different length and sizes. Upon pulling the device after anchoring the anchoring member with the wire along the length of the anchoring member and away from the wire facilitates the device to measure the tension across the wire. The device measures the tension across the wire and displays the measured data on the attached display. To calculate the forces on the lateral incisor we used the stresses which act on the bracket of the lateral incisors.

A device used for an orthodontic brace treatment in accordance with the orthodontics applications is presented in the paper. The device is specifically for measuring tension in a wire of an orthodontic
brace. In the orthodontic brace treatment, wires, elastic members or the like are used to adjust the tension between the teeth. If the tension is adjusted between the teeth according to the need, the teeth are likely to be aligned in a proper orientation which may help the patient an easy recovery.

In the orthodontic braces, brackets are attached with each tooth, and the wires are configured around the brackets of two teeth. The wire is having a closed circumference and are capable of being wind in a winding position around the brackets of two teeth. The wire can be attached with the adjacent brackets. The wire can be replaced with elastic members such as rubber bands, and the like. The wires are tightened according to the required tension. Once the tension is set across the brackets, the device can be used to verify the tension across the wire.

The device is a force measuring instrument having an anchoring member, a holding portion and a display. The anchoring member is adapted to attach with the wire. The anchoring member is an elongated member having a hookable portion configured on a first end of the anchoring member for anchoring the device with the wire. Specifically, the first end of the anchoring member which is the distal end of the device is attachable with the wire in the winding position. The tension across the wires are at the maximum in the winding position.

A second end of the anchoring member is attached to the holding portion of the device. In the present embodiment, the anchoring member is fixed with the holding portion of the device. In an embodiment, the second end of the anchoring member is connected pivotally and detachably with the holding portion to provide enough degree of freedom for the anchoring member. The anchoring member may be detachable from the holding portion and can be replaced with anchoring members of different length and sizes. The holding portion is for holding and providing sufficient gripping to the device. Upon pulling the device after anchoring the anchoring member with the wire along the length of the anchoring member and away from the wire facilitates the device to measure the tension across the wire. Specifically, the device measures the tension across the wire and displays the measured data on the display attached therewith. The display can be either analogue or digital. The holding portion and the display are integral to the device.

Advantages

The advantages and features of the present research will be understood better with reference to the following detailed description and claims taken in conjunction with the accompanying drawings, wherein like elements are identified with like symbols, and in which:

1. The present research has an advantage of providing a device for measuring tension in a wire configured around a bracket of two teeth in an orthodontic brace treatment.
2. The device substantially shortens the time duration of treatment. It also provides accurate and precise historical data of the wire tension allowing the medical practitioner to ease the examination procedure.

4. Conclusion

In this paper a device used for an orthodontic (brace) treatment is provided. The device is specifically for measuring tension in a wire of an orthodontic braces. Moreover, this device provides measuring of tension in a wire of an orthodontic brace, which provides accurate and precise historical data of the wire tension allowing the medical practitioner to ease the examination procedure. This device is able to measure extra oral force accurately and precisely so that we can modify growing facial structures.

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