

A NEW DEVICE MEASURES RETENTION CLINICALLY FOR IMPLANT RETAINED OVERDENTURE

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ABSTRACT

This article describe a new device that can be used for clinical measurement of retention for implant retained overdenture. This device overcomes the problems of the used techniques in terms of vertical direction of force. The force will be perpendicular to the patient's occlusal plane. The method allows also complete standardization between time intervals.

The device consists of plate form with vertical arms and middle screw that move vertically to guide the movement of the force meter in vertical direction. A fork is used to connect the force meter to the implant retained prosthesis through four hooks to canine and first premolar areas bilaterally moving it completely vertical.

INTRODUCTION

Implant retained overdenture led to obvious improvements in patients' satisfaction with their oral status.^[1] Implant retained overdenture should be considered as the minimum standard of care for edentulous patient.^[2, 3] such overdenture improve retention and stability of the constructed denture. Also improving mastication efficiency, biting force,^[4] patient satisfaction and oral health related quality of life compare to complete denture.^[1]

Retention is that quality inherent in the dental prosthesis acting to resist the forces of dislodgment along the path of placement.^[5]

Prosthesis retention have been identified as perhaps the most important factors for producing more favorable implant overdenture treatment outcome and improved patient satisfaction.^[6]

Lower retention of the implant overdenture leads to less denture stability during chewing and thus to a reduced masticatory performance.^[7]

Implant retained prosthesis retention is provided by both the mucosa and implants. Assessment and measurement of the retention clinically can be done by objective and subjective ways. The subjective method is performed by examiners independently observed a subject's implant overdenture and recorded the numbered criteria that best described

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the denture retention. The retention criterion was defined as a score.^[6] The problems in that way is that it is not accurate or standardized as it directly depends on the examiner sensation and observation.

Objective methods of measuring retention include using of a dynamometer. The problem in that method is that we can't apply vertical forces due to limitation of the mouth opening so the result will be oblique force not perpendicular to the occlusal plane. Another method was by using a custom made dynamic measuring device which consists of two units: a manual testing stand and a push/ pull force gauge. The force gauge has a metal holder at its bottom part containing a hole to attach the specimen to be tested. The cyclic arm of the device is used to apply a vertical pull out force of the prosthesis until separation from the abutments while the peak retention force is recorded using the force gauge.^[8] The connection between the cyclic arm and the denture was through a tray with compound impression material which somehow can allow some sort of movement of the denture making the results not accurate.

Also absence of chin rest which will make the measurement be done every time from different position of the head.

Retention also can be tested by a device that allowed us to apply an increasing, vertical force on the denture. The force was administered through a straight metal bar that was fitted with strain gauges. The bar was rigidly connected to the denture. The patient was instructed to keep his chin firmly on a chin support. Bending of the bar with increasing vertical forces was registered by the strain gauges and the applied force was expressed in Newton.^[9]

The connection between the straight metal bar and the denture was through metal tubes inserted inside the denture which make is not possible to be applied only in cases with increased restorative space.

Accordingly, the aim of this article is to develop a new way that allow us to measure retention clinically for implant retained overdenture.

MATERIALS AND METHODS

The device is made from aluminum alloy to make is durable and lighter in weight.

The device consists of: (fig. 1)

- Horizontal plate form parallel to the floor.
- Two parallel cylindrical metal rods to guide the movement of the force meter perpendicular to the plate form.
- Middle screw connected to the plate form by ball bearings that allow movement of the screw when rotated.
- Movable horizontal part that was connected to the screw that carry the force meter and move vertically guided by the two metal rods perpendicular to the plate form by rotation of the screw.
- Fixed horizontal part that carry the wheel which rotate the metal screw moving the force meter.
- Force meter.
- Horizontal fork connected to the force meter that deliver the vertical force to the prosthesis intraorally.
- Chin rest allow the patient to rest his chin in fixed place.

To measure the retention clinically using that device we follow those steps: (fig. 2)

1. Put the device on a table in front of the patient and adjust its feet to make the horizontal plate form parallel to the floor.
2. Fix the force meter to the moving horizontal part of the device.
3. Place the fork at the measuring end of the force meter.

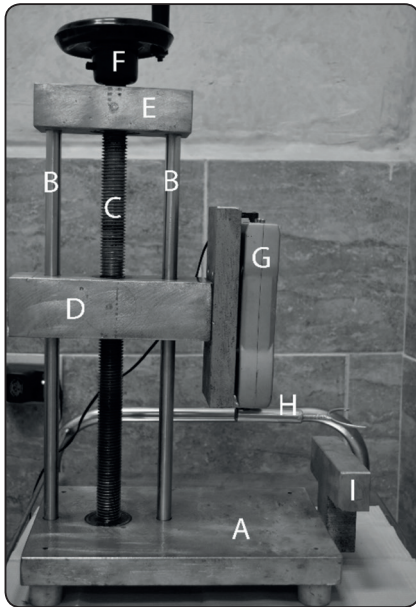


Fig. (1) Show the force meter mounted on the stand. A= Horizontal plate, B= cylindrical metal rods, c= Middle screw, D= Movable horizontal part, E= Fixed horizontal part, F= wheel, G= force meter, H= fork, I= chin rest.



Fig. (2) Show the patient facing the force meter while measuring.

4. Attach four right angle metal hooks to the overdenture at the same horizontal high at canine and first molar areas bilaterally.
5. Instruct the patient to wear the overdenture and remove the opposing denture.
6. The patient place his chin at the chin rest of the device while allowing the fork to be under the four right hooks.

7. Rotate the wheel of the device to move the force meter vertically until the overdenture is removed from its place.
8. Repeat these steps three times and calculate the mean to get the readings.

DISCUSSION

In vitro studying of retention forces of implant overdenture provide several advantages for example it allows standardization of dislodging force direction and magnitude. However, it has several draw backs such as absence of oral environment like humidity, presence of saliva, temperature variation and masticatory load.^[10, 11] even if artificial saliva is used it differs in composition from natural saliva which may affect the retention values of the attachment.^[12]

On the other hand, measurement of retention clinically is difficult to perform due to inability to perform purely vertical force intraorally.

The described device combines the advantages of the in vitro and in vivo measurement of the retention. As by using this device we try to standardize the measuring methodology to get the most accurate readings regarding application of pure vertical force perpendicular to occlusal plane in presence of oral environment.

Further studies is recommended to upgrade that device because the speed of the moving force meter should be fixed and motorized not by hand so motor should be added to the device to move it at fixed speed of 50 mm/min.

Also, the chin position of the patient is not fixed three dimensionally only by that chin rest. Further development is needed to fix it while keeping the occlusal plane parallel to the floor and perpendicular to the force meter.

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