

Original Research

“Hycon Device” A Choice For Orthodontic Space Closure : A Clinical Study

Daya Shankar¹, Neeraj Verma², Piyush Mudgal³

¹Assistant professor, ²Senior Resident, Department of Dentistry, Patna Medical College and Hospital, Patna, Bihar, ³Consultant orthodontist, Rewari, Haryana

ABSTRACT

Background: Tooth movement in orthodontics depends upon the magnitude and duration of applied force, alveolar bone density and morphology, periodontal ligament density and width, cellularity of the attachment apparatus and root size and form. The present study was conducted to assess the clinical efficiency of newly introduced Hycon device in orthodontic extraction space closure. **Material & Methods:** A total of 20 patients who undergoing orthodontic treatment requiring bilateral extraction (first premolar) in the same arch to be selected for treatment. A split mouth technique was used where one side included the Hycon device supported extraction space closure (group I) and on the contralateral side space closure was done using NiTi closed coil springs (group II). **Result:** The results of the study showed that the Hycon device is an efficitive alternate device for the extraction space closure and faster rate of space closure than the NiTi closed coil springs when compared for a duration of 90 days.

Key words:

Received: 13 March, 2019

Revised: 10 July 2019

Accepted: 11 July 2019

Corresponding author: Dr. Neeraj Verma, Assistant professor, Department of Dentistry, Patna Medical College and Hospital, Patna, Bihar, India

This article may be cited as: Shankar D, Verma N, Mudgal P. “Hycon Device” A Choice For Orthodontic Space Closure : A Clinical Study. J Adv Med Dent Scie Res 2019;7(8): 165-168.

INTRODUCTION

Space closure is an important step in Orthodontic mechanotherapy, solely dictated by clinician treatment objective, irrespective of method employed. Space closure should be individually tailored based on the diagnosis and treatment planning.¹ Various methods are used to close extraction spaces in orthodontics.¹⁻⁵ With the advent of the preadjusted appliance, sliding mechanics became the most preferred method of closing extraction spaces.^{1,5} For purpose of space closure, various force systems have been advocated such as pletcher springs, elastic chains, elastic modules³. These generally produce forces in the range of 100-200 grams. The advantages of elastic-chains and elastic modules include ease of use, low cost, reduce potential for intraoral trauma, minimal need for patient compliance and wide range of colors and transparency.⁶

A new device for extraction space closure was developed in Germany in the 1980s. In the original design, a small screw was connected to the first molars and to the anterior segment. The most recent version, now called the **Hycon**

Device.³The Hycon device was developed by Dr. Winfried Schuetz³ in 2005. It has a bolt and nut assembly where the device is either soldered or anchored, buccally to the base archwire in the molar region and the bolt is tied to the anterior segment using a ligature wire. Unlike closing loops and sliding mechanics, which rely on elastic forces, the Hycon device is based on a design that has been used successfully since the early days of orthodontics—a screw-type mechanism. With the Hycon device, a single 360° turn of the screw provides an activation length of 0.35mm. This makes it possible to deliver a precise space-closing activation at a relatively high force level, but over a short distance. The force generated by a single activation was measured at 410g in a strength testing machine.³

Previous literature have not evaluated rate of space closure between the Hycon device and NiTi closed coil springs. The present study will enable us to determine the efficiency of Hycon device and NiTi closed coil springs for extraction space closure.

AIM AND OBJECTIVES

1. To assess the rate of extraction space closure using the “Hycon device” over a period of 3 months.
2. To compare the rate of extraction space closure between the “Hycon device” and NiTi closed coil springs over a period of 3 months.

MATERIALS AND METHODS

Source of the study: The present study involved a sample size of 20 patients, undergoing treatment in Department of Dentistry, Patna Medical College and Hospital, Patna, Bihar.

Study Subjects: A total of 20 patients who undergoing orthodontic treatment requiring bilateral extraction (first premolar) in the same arch to be selected for treatment with Self Ligation brackets (3B Orthodontics). A split mouth technique was used where one side included the Hycon device supported extraction space closure and on the contralateral side space closure was done using NiTi closed coil springs.

| Inclusion criteria | Exclusion criteria |
|--|--|
| <ul style="list-style-type: none"> ➤ Patient with in the age group of 17 to 22 yrs. ➤ Patient planning to undergo fixed orthodontic treatment. ➤ Patients in which bilateral extraction (first premolar) is required. ➤ Signed informed consent for orthodontic treatment. | <ul style="list-style-type: none"> ➤ Mutilated cases ➤ Presence of active periodontal or gingival diseases ➤ Uncooperative patients |

Criteria for selection of sample:

Armamentarium used:

- Self ligating bracket with MBT Prescription(3B Orthodontics,0.022 slot size)
- Hycon device (Adenta USA)
- NiTi closed coil springs of 150 gms (GAC Sentalloy)
- Dontrix gauge for measuring the force
- Digital Vernier Calliper
- Weingart plier, Artery forceps and ligature wire
- Hycon device (fig: 1)



Figure 1: The Hycon device

Anchorage preparation: The anchorage preparation was done by ligating the second premolar, first molar and second molar as a single unit. **Activation procedure:** The Hycon device was activated with one full turn (360⁰) that closes the extraction space by 0.35 mm. The device was reactivated one full turn twice a week with a screw driver given to the patient under the supervision of the treating doctor.³

NiTi Closed Coil Springs: NiTi Springs were used in the study to close the spaces on the other side under a force of 150 grams. The NiTi Springs were not replaced during the treatment but were activated as necessary. NiTi springs have been shown to produce a constant force over varying lengths with no decay.⁴

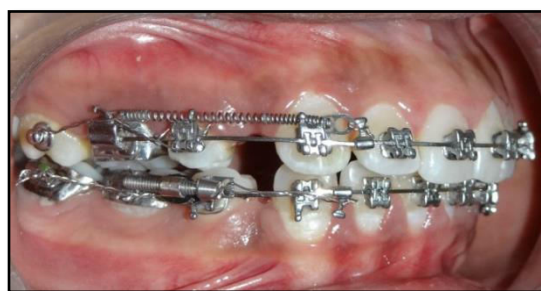


Figure 2: The Hycon device and NiTi closed coil spring connected to crimpable hook

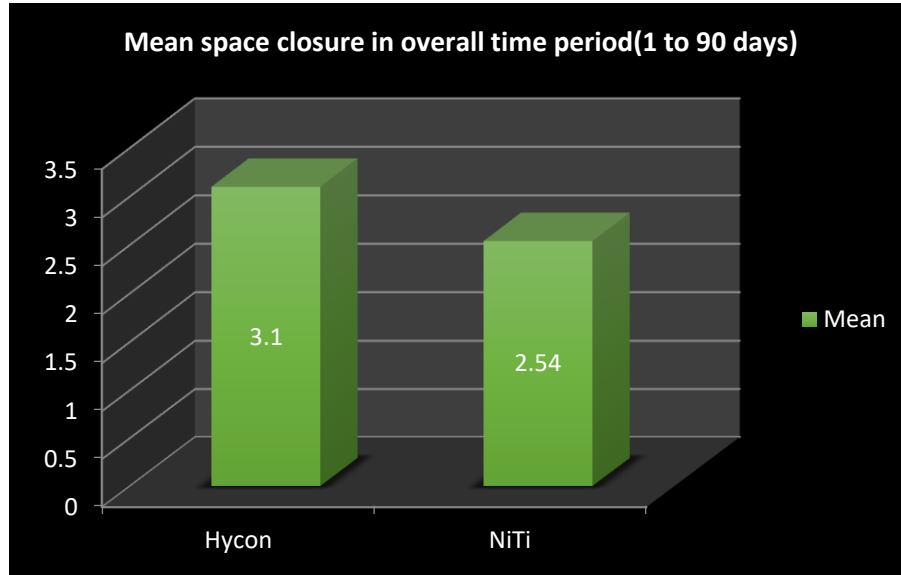
Group I consisted of sides on which the Hycon device were used to close the extraction spaces. Group II consisted of sides on which the NiTi closed coil springs were used to close the extraction spaces (fig.2). Dontrix gauge was used to measure the force delivered by the NiTi closed coil springs. The amount of space closure was measured every 4 weeks for 3 months. Vernier calipers were used to measure the distance between the cusp tip of canine and buccal groove of the first permanent molar.⁴ The rate of space closure was calculated per month in millimeter.

RESULTS

The present study aimed to assess the amount of rate of extraction space closure with Hycon device as well as compare same between patients treated with passive self ligation appliance using the Hycon device on one side and NiTi closed coil springs on the contralateral side. The results of the study showed that the Hycon device closed the extraction space 22% faster than the NiTi closed coil springs when compared for a duration of 90 days. (Table 1). The results also showed that the amount of extraction space closure was more on the side with Hycon device. This was statistically significant as compared to side with NiTi closed coil springs.

Table 1: Comparison of extraction space closure between the two groups in overall time period. (day 1- day 90)

| Group | Mean | SD | p-value |
|----------------|------|------|---------|
| Group I(Hycon) | 3.10 | 0.57 | 0.001 |
| Group II(NiTi) | 2.54 | 0.35 | |



Graph 1: Graph showing the extraction space closure between the two groups in overall time period. (day 1- day 90)

DISCUSSION

In the present study, the rate of space closure was more on the side with Hycon device than the side with NiTi closed coil springs in overall time period (Table 1). Scheutz³ et al in his study concluded that with the activation of Hycon Device, there was a steady increase in the alkaline phosphatase level from a baseline of 60 international units to a peak of 160 international units. However in contrast to this, a pilot study showed that an active tieback produced an increase of 100 international units of alkaline phosphatase in the gingival crevicular fluid after a 3 week period of standard activation.⁷⁻⁹ This seems to indicate that the Hycon device had a more favorable bone remodeling response than was seen in traditional sliding mechanics. This could be the probable explanation for the results observed with the Hycon device. The results of the present study were found to be similar to the study conducted by Thundukattil VV, GopalNaik A, Unnikrishnan PK.¹⁰ This was an invitro study where the rate of extraction space closure by the Hycon device and active tie backs was compared using the FEM analysis. According to their study, the Hycon device closed the extraction space at a faster rate in comparison to active tie backs. However the present study was a clinical study, as compared to the invitro FEM model created by Thundukattilet al.¹⁰

The present study being a pioneer research work had shown that Hycon device consistently offers a more rapid space closure when compared with NiTi closed coil springs in

cooperating patients. This study was a split mouth design using self ligating bracket system.

Limitations of study:

1. Further studies should be done with increase number of sample size.
2. Patient compliance is required for activation of Hycon device.

CONCLUSION

- 1) Hycon device gave the more rapid extraction space closure than the NiTi closed coil springs .
- 2) Hycon device closed the extraction space at the rate of 1.03mm/month and NiTi closed coil springs closed the space at the rate of 0.84mm/month.

REFERENCES

1. Bennett JC, McLaughlin RP. Controlled space closure with a preadjusted appliance system. J ClinOrthod 1990; 24:251-60.
2. Charles J. Burstone: The segmented arch approach to space closure: Am. J. Ortho 1982;82:361-78
3. McLaughlin R, Kalha A, and Schuetz W. An Alternative Method of Space Closure: The Hycon Device, J ClinOrthod 2005;39:474-484
4. Dixon V, Read M J F, O'Brien KD, Worthington HV, Mandall NA. A Randomized clinical trial to compare three methods of Orthodontic space closure. J Orthod 2002; 29 :31-36

5. Bennett JC, McLaughlin RP. Orthodontic Treatment Mechanics and the Preadjusted Appliance, Mosby, London, 1993.
6. Buchmann N, Senn C, Ball J, Brauchli L. Influence of initial strain on the force decay of currently available elastic chains over time, *Angle Orthod* 2012;82:529-35.
7. Perinetti G, Paolantonio M, D'Attilio M, D'Archivio D, Tripodi D, Femminella B, Festa F, and Spoto G. Alkaline phosphatase activity in gingival crevicular fluid during human orthodontic tooth movement. *Am J Orthod Dentofacial Orthop.* 2002;122:548-56
8. Keeling, S.D.; King, G.J.; McCoy, E.A.; and Valdez, M.: Serum and alveolar bone phosphatase changes reflect bone turnover during orthodontic tooth movement, *Am. J. Orthod.* 1993;103:320-326.
9. Mao, J.J. and Nah, H.D.: Growth and development: Hereditary and mechanical modulations, *Am. J. Orthod.* 2004;125:676-689.
10. Thundukattil VV, GopalNaik A, Unnikrishnan P K. Evaluation of stress on the periodontium induced by a fixed retraction screw appliance and an active tie-back: A 3-dimensional finite element study. *APOS Trends Orthod* 2013; 3: 178-183.