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Efficacy of Hycon Appliance as an Alternative Method of Space Closure in Class I Bimaxillary Protrusion Cases

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Abstract:

Background: For the orthodontist, orthodontic space closure has always presented a challenge. Using fixed appliances, space closure is often achieved through a number of techniques. However, the considerable force depreciation over time is a drawback of employing an elastic force system.

As the concept of Hycon appliance as an alternative for the conventional space closure methods is fairly unknown, the functioning of the appliance hasn't been verified and there are not many literatures available. Hence, the purpose of this study was to evaluate the efficacy of Hycon device as alternative method of space closure in patients of Angles class I Bimaxillary protrusion and to compare the time required and amount of space closed with the hycon appliance to that of conventional mechanics. **Material and Methods:** A prospective longitudinal study was conducted a total of 32 patients, 16– experimental group (hycon appliance) and 16- control group (conventional method), over a period of 12-18 months. Samples were collected of patients with Angles class I Bimaxillary protrusion reporting to the Department of Orthodontics and Dentofacial Orthopaedics, Rural Dental College, Loni, India. Pre and post treatment comparative analysis of both the group was done to evaluate the efficacy of the hycon appliance. **Results:** The total time and amount of space closuretaken in experimental group, to close space was significantly less as compared to control group. **Conclusion:** The Hycon device is a clinically feasible, comfortable, painless, effective and fast technique to accelerate orthodontic tooth movement.

Keywords- Angle's Class I malocclusion, bimaxillary protrusion, extraction space closure, accelerated orthodontics, Hycon appliance

Introduction:

The surrounding bone and soft tissue can restructure, which makes orthodontic tooth movement possible. Instead, independent of the cellular mediators of the response, orthodontic equipment is designed to generate a biomechanical force system that produces the required tooth and jaw movements needed to establish an optimal occlusion. In orthodontics, a primary problem is the length of therapy. Therefore, one major topic of study in orthodontics today is the search for

treatment techniques that shorten treatment times without sacrificing treatment outcomes.

For the orthodontist, orthodontic space closure has always presented a challenge. Using fixed appliances, space closure is often achieved through a number of techniques. However, the considerable force depreciation over time is a drawback of employing an elastic force system. Sometimes there is too much friction, too much bone, or the alveolar process narrows in the extraction sites, making gap closure difficult.

In 2005, Dr. Schuetz.[1] suggested a different approach to space closing that made use of the Hycon device. German orthodontist Dr. Winfried Schutz invented a novel tool that offered a technical method for incremental tooth movement for gap closure.

Utilizing a rectangular support wire put into an auxiliary tube of the double or triple first molar tubes, the most recent version—now known as the Hycon Device—works. This rectangular wire is connected buccally with a bolt-and-nut assembly, and the other end of the wire is tied to the anterior portion. To close the space, the patient is told to turn the bolt. All typical fixed appliances are compatible with the Hycon Device. Elastic forces are used by the gadget. The Hycon Device has an activation length of 0.35mm that may be reached with just one 360° rotation of the screw. This allows a precise space-closing activation to be applied across a small distance at a reasonably high force level.

As the concept of Hycon appliance as an alternative for the conventional space closure methods is fairly unknown, the functioning of the appliance hasn't been verified and there are not many literatures available. Hence, the purpose of this study was to evaluate the efficacy of Hycon device as alternative method of space closure in patients of Angles class I Bimaxillary protrusion and to compare the time required and amount of space closed with the hycon appliance to that of conventional mechanics.

Material and Method:

Study design: A prospective longitudinal study was conducted in Department of Orthodontics and Dentofacial orthopedics, Rural Dental College, Pravara Institute of Medical Sciences, Maharashtra, India, for the period of 12-18 months with the ethical clearance of the university.

Sample Size: The total sample size of the study was 32, which was subdivided into 2 groups using lottery system, with Angles class I malocclusion, both the groups had a sample size of 16 subjects each.

- The **Group A** (Experimental group) subjects placed with space closure done with HYCON appliance.
- The **Group B** (Control group) subjects treated with conventional orthodontic treatment with sliding mechanics.

Calculated using A.P Kulkarni excel sheet software for 90% confidence limit and power of study to 80%

Inclusion Criteria: Patients with periodontally healthy teeth, Bimaxillary protrusion, extraction of upper premolars where molars are finished in functional ClassI occlusion and ready to give written informed consent.

Exclusion Criteria: Patients with periodontally compromised dentition, HIV, HBSAg, Coagulation disorders and diabetes mellitus, neurological or psychiatric disorder, Non extraction cases.

Methodology:

Pre- Placement: All the essential diagnostic records including clinical diagnosis and radiographs i.e OPG, Lateral Cephalogram were collected from the patient. (Figure 1, Figure 2)

Fig.1 :Hycon device with wire

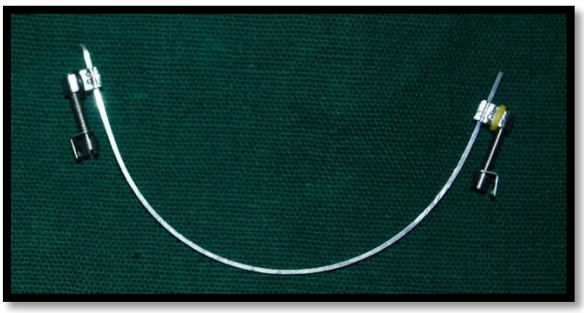


Fig. 2: screw device and other devices in oral cavity. (a) screw device; (b) adjustment driver; (c) upper view; (d) occlusal surface

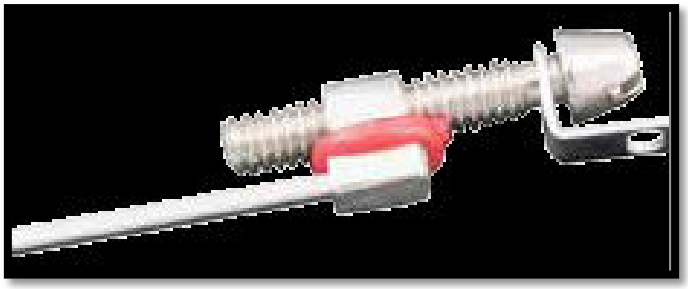


Fig. 3: Application of the tension wire on the HYCONS

Fig.4: Intro-oral view of Hycon appliance

Hycon Appliance Placement:

- **The Hycon Tube-** The HYCON TUBE consists of a bolt and nut combination in which the nut is mounted on a support wire. A friction brake is installed to prevent the bolt from uncontrolled turning.

The HYCON® TUBE comes in two support wire dimensions: a.018" x.025" support wire for the.018" slot technique and a.019" x.025" support wire for the.022" slot technique.

• Straight wire appliance with an auxiliary tube on the molar bands is a prerequisite for the HYCON TUBE. Following levelling and alignment, a thick, rectangular, straight steel wire was inserted. A figure 8 ligature wire was used to ligate the teeth in the front region.

• HYCON TUBE PREP: The tension wire, also known as the Ligature wire, is twisted into a "U" shape and threaded through the two holes in the wire linking attachment from the outside. It is then pulled sharply in the direction of the tension. (Figure 3).

Fig. 3: Application of the tension wire on the HYCONS

The auxiliary tube on the molar band was filled with the support wire from the mesial side, pointing the nut towards the buccal side, in order to insert the HYCON TUBE. Using Weingart pliers, the HYCON was repaired by bending the support wire back. (Figure 4)

Fig.4: Intro-oral view of Hycon appliance

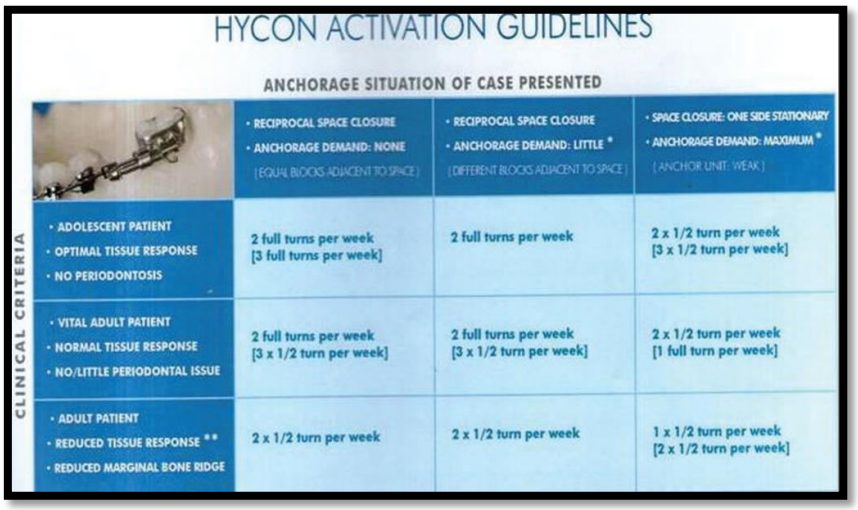
Linking the HYCON DEVICE: The screw is connected to the tooth or collection of teeth on the opposite side of the gap via a tension wire. The Kobayashi ligature's eye was tied to the tension wire.

One simple method to stop the arch wire from shifting in the middle is to apply a drop of self-curing glue to the midline mark.
HYCON DEVICE ACTIVATION: The patient typically turns the HYCON clockwise every three to four days with the aid of a small safety screwdriver (Figure 7). The patient should move the screw clockwise until they feel a tiny tension to reduce the slack in the connection.

Fig. 7: Frontal view of the HYCON® safety screwdriver

Reactivation requires unscrewing the device and retightening the tension wire in accordancewith any remaining space after the screw has been worked all the way. (Figure 8)

Fig.8: Hyon activation guidelines



Results:

According to the result of our study, the total time and amount of space closuretaken in experimental group, to close space was significantly less as compared to control Group. In experimental group, the amount of space closure was enhanced with the help of Hycon device. (Table 1-2)

Table 1: Observation Table of Control group

Patient no	Age	Sex	Amount of Space available after premolar extraction at the start in (mm)				Amount of Space Closure after 180 days (mm)				Amount of space available after 180 days			
			UR	UL	LL	LR	UR	UL	LL	LR	UR	UL	LL	LR
1	21	Male	7	7	6	5.9	5	5	4.5	5.5	2	2	1.5	0,4
2	24	Female	7.1	7	5.8	6	5	5	5	5	2.1	5	0.8	1
3	24	Male	7	6.8	6	6.1	4	4.5	4.5	5	3	2.3	1.5	1.1
4	23	Male	6.9	7	6	6	3.5	4	5	5	3.4	3	1	1
5	28	Male	7	7	6	6	4	5.5	5.5	5	2.1	2.9	1	2
6	22	Male	7.1	6.9	6	6	5	4	5	4	3	2.5	0.9	0.6
7	24	Male	7	7	5.9	6	4	4.5	5	5.4	2	3.5	1.5	2
8	18	Female	7	7	6	6	5	3.5	4.5	4	3.1	1.5	1	1.4
9	25	Female	7.1	7	6	5.9	4	5.5	5	4.5	2	1.5	1	1.4
10	16	Female	7	6.8	6	6	5	5.5	5	4.5	0.5	1.3	1	1.5
11	18	Male	7	7	6	6	6.5	7	6	5.8	1.9	0	0	0.2
12	19	Female	6.9	7	6	6	5	6	5	6	1.5	1	1	0
13	22	Male	7	7.1	6.1	6	5.5	5	5	5.2	0.5	2.1	1.1	0.8
14	20	Male	7	7	6	6.2	6.5	5.5	6	5	1	1.5	0	1.2
15	18	Female	6.9	7	6	6	6.5	5	4	6	0.4	3	2	0
16	21	Female	7	7.2	5.9	6	5	5	4	4.5	2	2.2	1.9	1.5

Table 2: Observation table of experimental group

Patient no	Age	Sex	Amount of Space available after premolar extraction at the start in (mm)				Amount of Space Closure after 180 days (mm)				Amount of space available after 180 days			
			UR	UL	LL	LR	UR	UL	LL	LR	UR	UL	LL	LR
1	20	Male	7	7.1	6	6	6	7	5.5	6	1	0.1	0.5	0
2	23	Female	7.2	7	5.9	6	6	6	6	5.7	1.2	1	0.2	0.3
3	24	Male	7	6.9	6	6.1	6	6	5.5	6	1	0.9	0.5	0.1
4	27	Male	7.1	7	6	6	5.5	6	6	6	1.6	1	0	0
5	28	Female	7	7.2	6	6	6	6.5	5.5	6	1	0.7	0.5	0
6	21	Male	7.1	7	6	6	6	6	6	6	1.1	1	0	0
7	24	Male	7.1	7	6	6	6	6.5	6	6	1.1	0.5	0	0

8	19	Male	7	6.9	6	6	6	5.5	5.5	6	1	1.4	0.5	0
9	25	Female	7.1	7	6	6	6	6.5	6	5.8	1.1	0.5	0	0.2
10	27	Female	7	7	6	6	7	6	5.7	6	0	1	0.3	0
11	18	Male	7	7.2	6	6	6.5	7	6	5.7	1	0.2	0	0.3
12	19	Female	7	7	6	6	6	6	6	6	1	1	1	0
13	22	Female	7.1	7	6	6	6.5	6	6	5.7	0.6	1	0	0.3
14	27	Male	7	7.2	6	6	6.5	6	6	6	1	1.2	0	0
15	18	Female	7	7.1	6	6	6.5	6	6	6	1	1.1	0	0
16	20	Male	6.9	7	6	6	7	6	6	6	0.9	1	0	0

The Mann–Whitney U-test testand Wilcoxon signed-rank test was used for quantitative data comparison of all clinical indicators. Chi-square test was also used. Level of significance was set at P≤0.05. (Table:3-5)

Table 3: Inter group comparison of Amount of Space available after premolar extraction at the start in (mm)

`		Mean	Std. Deviation	P value
UR	Case	7.03	.07	0.12
	Control	7.0	.06	
UL	Case	7.03	.09	0.15
	Control	6.98	.09	
LL	Case	5.99	.02	0.48
	Control	5.98	.06	
LR	Case	6.006	.02	0.98
	Control	6.006	.06	

Table 4: Inter group comparison of Amount of Space Closure after 180 days(mm)

		Mean	Std. Deviation	P value
UR	Case	6.21	.406	0.001 (S)
	Control	4.96	.93	
UL	Case	6.18	.403	0.001 (S)
	Control	5.03	.84	
LF	Case	5.85	.22	0.001 (S)
	Control	4.93	.57	
LR	Case	5.93	.12	0.001 (S)
	Control	5.02	.62	

Table 5: Inter group comparison of Amount of space available after 180 days (mm)

		Mean	Std. Deviation	P value
UR	Case	.97	.32	0.001 (S)
	Control	2.03	.94	
UL	Case	.85	.35	0.001 (S)
	Control	2.206	1.15	
LL	Case	.21	.301	0.001 (S)
	Control	1.04	.56	
LR	Case	.07	.12	0.001 (S)
	Control	.98	.62	

Discussion:

Adult patients seeking orthodontic treatment have increased over the past few decades, and [i]they frequently prefer shorter treatment times. Shortening the orthodontic treatmenttime is still very difficult. Reducing treatment duration without sacrificing treatment results is a significant challenge in orthodontics. Therefore, if we are to safely reduce the duration of orthodontic treatment, we must identify and, more crucially, harness the cellular regulators of tooth movement.

There have been many researches on the biology of tooth movement. By identifying and leveraging the responses of the target cells, we can devise two separate strategies to accelerate tooth movement: either directly stimulate the target cells by employing artificial, physical, or chemical means to augment their quantity and activity, or indirectly stimulate the body to attract and activate additional target cells. Several methods have been made to accelerate orthodontic tooth movement. Physiological, biological, biomechanical, and minimally invasive procedures are the four main categories into which most attempts fall.

Self-ligating brackets, which use a biomechanical technique, have become more and more common in recent years. They have prior orthodontic experience. When compared to fully programmed devices, a number of tests conducted in the past to evaluate the effectiveness of self-ligation in accelerating orthodontic tooth movement by Harradine in 2007 revealed that the self-ligating system was effective in doing so. However, when compared to a fully programmed device, investigations by Pandis (2007)[2], Miles (2007)[3], and MaCallum (2010) [4] found no difference in the rate of tooth movement. The primary cause of this approachfailure is that, independent of the kind of tooth movement, it's a basic metabolic process.

Beeson DC et al.[5] (1975) were the first to present the physiologic approach, which uses direct electric current to accelerate orthodontic tooth movement; nevertheless, their findings did not demonstrate an increase in tooth movement. There have been no reports of clinical use in humans. Some physiological treatments include endogenous piezoelectric stimulation, photobiostimulation, and low-level laser therapy. However, these methods have drawbacks, such as the requirement for regular exposure, an expensive apparatus, and variable effects depending on dosage.

In an attempt to speed up orthodontic tooth movement, pharmacologic approaches such as endogenous agents, such as inflammatory mediators like cytokines and prostaglandins, and hormones have been used exogenously. The majority of studies on this topic have been conducted on animals, Harell (1977), Lee (1990), Yamasaki K (1984)[6], and Speilmann T (1989) administered chemically produced prostaglandin E (PGE). They concluded that during the course of the study, no side effects were observed in the gingiva and in the alveolar bone.

Currently, the most successful method for quickening orthodontic tooth movement in both experimental and clinical settings is the surgically aided approach [10]. Corticotomy-assisted rapid orthodontic tooth movement, micro-perforations, corticision, and quick canine retraction through distraction of the PDL and dentoalveolus are some of the procedures used in this approach. Adult patients benefit from this treatment method. However, there are disadvantages to these methods, including discomfort, external damage, crestal bone resorption, and bone dehiscence.
So, search for acceleration techniques which are simple, inexpensive, patient friendly and comfortable enough to be repeated as often as needed throughout the course of treatment is still continuing. One such effort for accelerating orthodontic tooth movement was made by Dr.Schuctz, they introduced an innovative approach that used Hycon appliance for accelerated orthodontic tooth movement. Various studies byDr.Schuctz (2005), Hideyuki Iyano (2006)[7], Daya Shankar (2019)[8] stated it to be an effective agent in accelerated orthodontics.

Conclusion:

1. The Hycon device is a clinically feasible, comfortable, painless and effective technique to accelerate orthodontic tooth movement.
2. The rate of orthodontic tooth movement by Hycon device showed highly significant tooth movement then the conventional sliding mechanics.
3. The time taken for space closure was much less than control group.

While the search for more practical, effective, inexpensive, and less invasive approach continues, we require further researchto concludepredictable results.

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Declaration-
All authors actively participated in discussing the manuscript's findings and have revised and approved the final version of the manuscript.

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Refrences:

1. McLaughlin R, Kalha A, and Schuetz W. An Alternative Method of Space Closure: The Hycon Device, J Clin Orthod 2005;39:474-484
2. Pandis N, Polychronopoulou A, Eliades T. Self-ligating vs conventional brackets in the treatment of mandibular crowding: a prospective clinical

trial of treatment duration and dental effects. Am J Orthod Dentofacial Orthop. 2007 Aug, 132 (2):208-15.

3. Miles PG. Self ligating vs conventional twin brackets during en mass space closure with sliding mechanics. Am J Orthod Dentofacial Orthop 2007; 132:223-225.
4. McCallum H, Griffin MP. Efficiency of self-ligating vs conventionally ligated brackets during initial alignment. Am J orthod Dentofacial orthop.2010 Aug; 138(2):el-7;discussion 138-9.
5. Nimeri G, Kau CH, Abou-Kheir NS, Corona R. Acceleration of tooth movement during orthodontic treatment--a frontier in orthodontics. Prog Orthod. 2013;14:42. Published 2013 Oct 29.
6. Yamasaki, K., Shibata, Y., & Fukuhara, T. (1982). The Effect of Prostaglandins on Experimental Tooth Movement in Monkeys (Macaca fuscata). Journal of Dental Research, 61(12), 1444–1446.
7. Daya Shankar1, Neeraj Verma2, Piyush Mudgal, ‘‘Hycon Device’’ A Choice For Orthodontic Space Closure: A Clinical Study.Journal of Advanced Medical and Dental Sciences Research,2019.
8. Shimizu Y. Movement of lateral incisor of the MacacaFuscata as loaded by vibrating force (in Japanese) Nippon Kyoseishika Gakkai Zasshi 1986;45:56-72.
9. Seifi, M., Shafeei, H.A., Daneshdoost, S. et al. Effects of two types of low-level laser wave lengths (850 and 630 nm) on the orthodontic tooth movements in rabbits. Lasers Med Sci 22, 261–264 (2007).
10. Wilcko WM, WilckoT,Bouquot JE, Ferguson DJ. Rapid orthodontics with alveolar reshaping: two case reports of decrowding. Int J Periodontics restorative Dent.2001 feb (1):9-19.