Intrusion Arches

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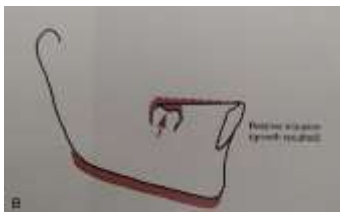
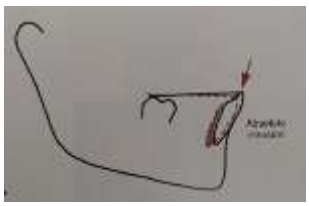
Abstract
Orthodontic intrusion is a common treatment approach in managing orthodontic esthetic and functional problems, including gummy smile and deep bite. This review presents contemporary reports related to the intrusion, types of dental intrusion, clinical observations, and the tissue reactions after the application of intrusive force, as well as indications and contraindications for intrusion. This paper concisely describes the fixed and removable appliances used for intrusion accomplishment.

Keywords: Biomechanics, Intrusion curve, Orthodontic intrusion.

Introduction
Intrusion as per Charles J.Burstone is characterized as " The Apical development of the geometric focal point of the root (centroid) in appreciation to the occlusal plane or plane dependent on the long pivot of the tooth[1],though Marcotte characterized it as "Tooth development that happen in a hub (apical) bearing and whose focal point of turn lies at endlessness. It is a hub kind of translation"[2]. According to Nikolai, Intrusion is characterized as " A translational type of the tooth development guided apically and parallel to the long hub".

Kinds of Intrusion Arches
1. Relative Intrusion (Leveling by expulsion)
2. Absolute Intrusion

	Relative Intrusion	**Absolute intrusion**
1.	This can be accomplished with continuous arch wires, by incorporating a reverse curve of spee in the mandibular arch, and an exaggerated curve of spee in the maxillary archwire.	Intrusion require a mechanical arrangement other than a continuous archwire attached to each tooth, this requests the teeth being apically pushed into supporting bone. Light continuous force directed towards the tooth apex is the key for pure intrusion.
2.	This is achieved by preventing eruption of the incisors while growth provides vertical space into which the posterior teeth erupt. 	This is pure intrusion of the incisors without extrusion of posterior teeth. 
3.	Relative intrusion of the incisor occur by labial tipping of the incisor and extrusion of posterior teeth. However in the leveling phase, any wire can relatively intrude teeth.	However, an intrusion wire, is used when there is a necessity for absolute intrusion of teeth. Pure absolute intrusion is also achieved with the help of mini- implants.
4.	Methods of relative intrusion include: Anterior bite plates Twin-blocks, where molar eruption occur by trimming the posterior blocks. Reverse curve of Spee	Methods of absolute intrusion include: J-Hook headgear Bypass and segmental mechanics micro-implants

Biomechanics of Intrusion Arches

To obtain true intrusion the point of force application is very important which is directed through the centre of resistance of the anterior teeth. For example an intrusion arch is tied to an anterior segment so the point of application of the intrusive force with respect to the axial inclination of the incisors will define the type of tooth movement.

If the incisors are flared, the intrusive force is applied at the bracket of the flared incisors which is anterior to the centre of resistance of the anterior teeth Fig. 1(a), further flaring will occur so the appliance design should include the distal extensions from the anterior segment Fig. 2(b) and separate left and right tip back spring to deliver the intrusive force.This will redirect the intrusive force along the long axis of the incisors and true intrusion can be obtained. Fig. 3(c)

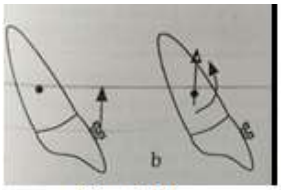


Fig 1(a)

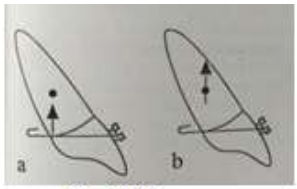


Fig 2(b)

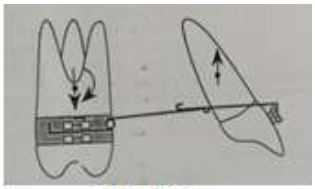
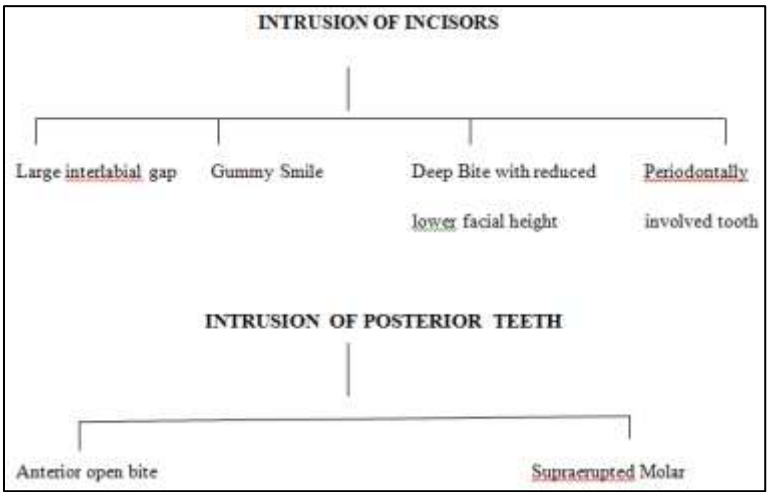


Fig 3(c)

Indications



Intrusion of Posterior Teeth

Back teeth intrusion is one of the treatment alternative for treating foremost open chomp and over emitted molar tooth. Treatment approaches vary while treating open bite in grown-up and developing patients. In developing people, the powers which are acting vertical way and are connected against the molars serve not exclusively to barge in molars yet in addition to control its vertical ejection.In grown-ups, with the non attendance of vertical remuneration of ramal development, the genuine intrusion of molar teeth is expected to let the mandible autorotate and close the open bite anteriorly.[12]

Overerupted molars require genuine intrusion with the utilization of regular settled machines to maintain a strategic distance from intemperate crushing of the over emitted tooth which may prompt endodontic treatment.To dodge this issue a cautious mechanics is required.

Table 2: The different intrusion arches are reviewed in this table

S. No.	Intrusion arches	Year	Given by	wire	site of application
1.	Utility arches	1950s	Robert m Ricketts	0.016x 0.016 Blue elgiloy wire	INCISORS
2.	Connecticut intrusion arch	1998	Ravindra Nanda	0.016X0.022NiTi,0.017X 0.025 NiTi alloy Ni free βIII CNA	INCISORS
3.	Burstone Intrusion Arch	1950s	Burstone	0.017x0.025 inch TMA wire	INCISORS
4.	Tip Back Springs (Intrusion Springs)		Burstone	0.017x0.025 inch TMA wire	MOLARS

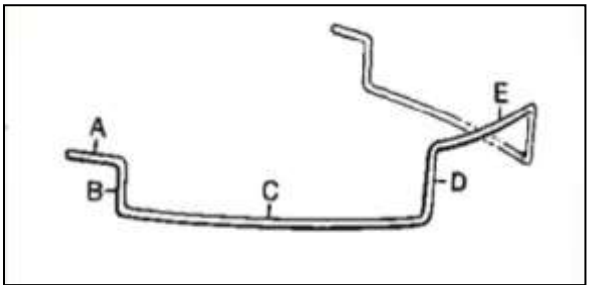
5.	Three Piece intrusion arch	1995	Shroff, lindauer, Burstone, Leiss	Anterior segment 0.019x0.025 SS Posterior segment 0.017x 0.025 TMA Tip back spring	Intrusion and retraction of flared anterior teeth
6.	K- Sir		Kalra	0.019x0.025 TMA Wire	Intrusion and retraction of flared anterior teeth

There are two essential structure for an intrusion curve
1. Continuous curve
2. Segmental curve

Utility Arches

Utility is a constant wire that reaches out crosswise over both buccal sections that connects just the principal perpetual molars and the four incisors. This assistant curve wire created by the biomechanical standard portrayed by burstone (1966, 1977). Utility curves are created from chrome-cobalt wire (eg Blue elgiloy wire). For a 0.018 opening machine, the proper size of wire for mandibular curve is either 0.016x 0.022 or 0.016x 0.016 wire and for maxillary curve 0.016x 0.022 wire is prescribed. For a 0.022 opening apparatus 0.019x 0.019 wire can be utilized in either curve. Rectangular wire is favored over round wire to forestall unfortunate tipping of incisors and to control torque. Power level considered perfect for lower incisor intrusion is 60-100 gms of force.

Fundamental segment of utility curve
A. Molar fragment
B. Posterior vertical fragment
C. Vestibular fragment
D. Anterior vertical fragment
E. Incisal fragment



Utility Arch

Connecticut Intrusion Arch

CTA is created from NiTi combination to give the upsides of shape memory, spring back and light, ceaseless power appropriation. It join the characterstics of both utility just as customary intrusion curve. Two wire sizes accessible are 0.016x 0.022 and 0.017x 0.025. The maxillary and mandibular rendition have foremost element of 34mm and 28mm. The NiTi Connecticut intrusion curve utilized for total intrusion of front teeth, including molar tip back for Class II rectification, occlusal cants, incisor flaring etc.[7]

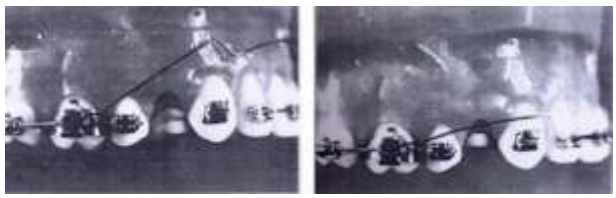
Connecticut Intrusion Arch

Dimensions of Preformed CTA

	Maxillary CTA	Mandibular CTA
Anterior dimension	34mm	28mm
Posterior dimension: long (non-extraction)	22mm	22mm
Posterior dimension: short (extraction and mixed dentition)	15mm	15mm

Burstone Intrusion Arch

In this 0.017x0.025 inch TMA wire is utilized to produce low powers, for longer term for compelling intrusion. The wire produced using compound have high memory and low burden avoidance rates which produce little augmentations of deactivation after some time and diminishing the quantity of reactivation arrangements. In this powers are produced from spring instrument in a determinate power framework.

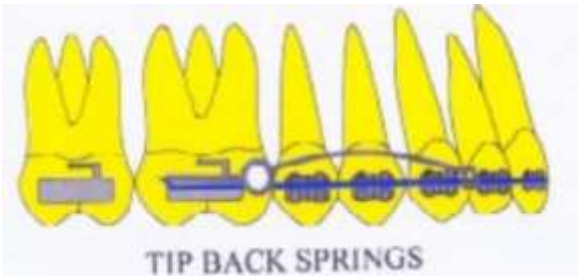


Burstone Intrusion Arch

Tip Back Springs

It is made of 0.017 x 0.025 TMA wire, Upper and lower curves must be levelled and adjusted and unbending tempered steel wire of 0.017x 0.025 inch measurement. TMA wire without helix and SS wire of same measurement with helix can be utilized to give ideal power to intrusion. Grapple molar are strengthened with transpalatal curve in upper and lingual curve in the lower. A helix is shaped gingivally mesial to the molar tube and the mesial end of spring is twist into a snare and connected with distal to

parallel incisor which as indicated by burstone is the focal point of opposition of four incisors.[9]

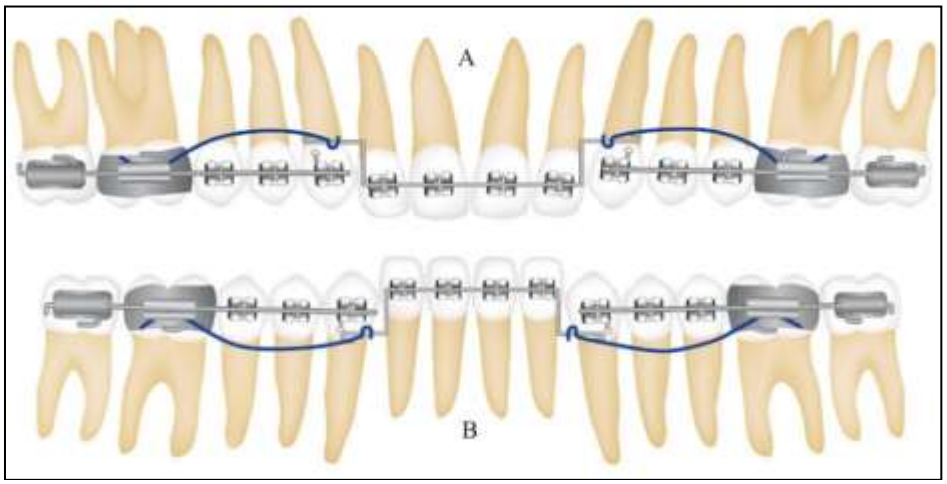


Three Piece Intrusion Arch

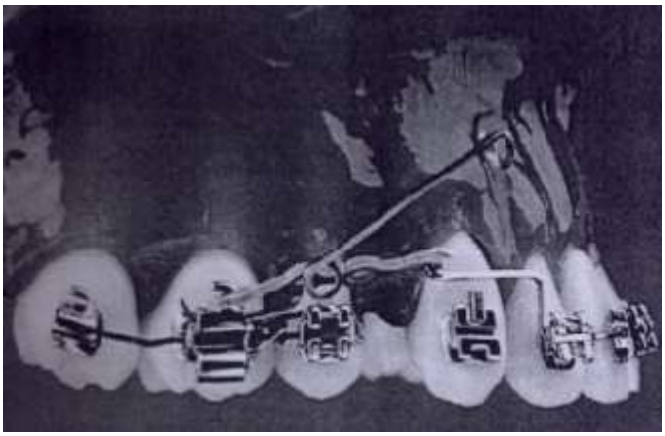
This is utilized with the end goal of concurrent intrusion and withdrawal of flared foremost teeth and rectification of their pivotal tendency with port control. For intrusion along the long hub of the tooth the meddlesome power must be coordinated lingually by the utilization of a mellow distal power. Nosy power alongside the mellow distal power results in withdrawal and intrusion of the front fragment. It comprise of 0.019x0.025 SS wire in the front section and two-sided 0.017x 0.025 TMA Tip back spring in the Posterior segment.[10]

Parts of three piece intrusion curve:-

1. Anterior section
2. Posterior section
3. Intrusion springs
4. Distal part



Posterior segment Anterior segment

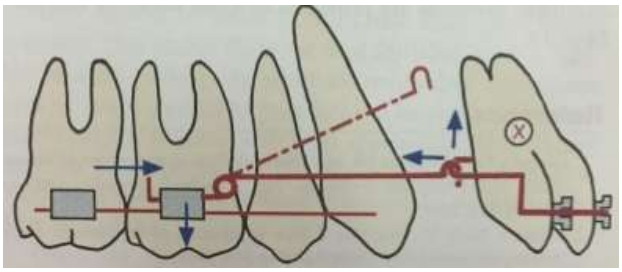


Anterior segment with posterior section

1. It is bent gingivally distal to the laterals and then bent horizontally creating a step of approximately 3mm.
2. Distal part extends to distal end of canine bracket where it forms a hook.

Posterior segment

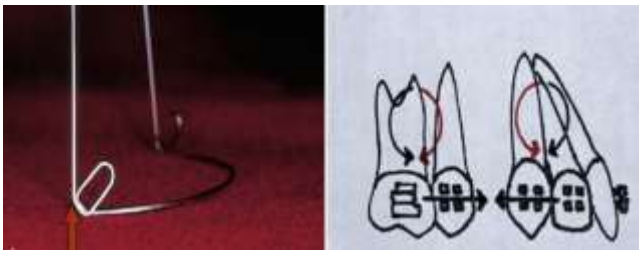
1. Aligned posteriors
2. Transpalatal arch can be given for more consolodition



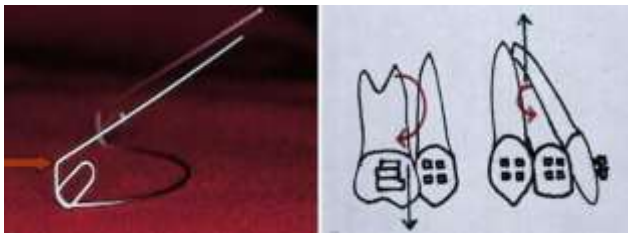
K Sir Arch

In this 0.019x 0.025 TMA gives adequate solidarity to oppose bending, and adequate solidness to produce the required minutes. TMA wire and curve wire configuration consolidate to create relative low powers, low burden redirection rate and a scope of enactment that enable the machine to close spaces. TMA can be initiated twice as much as SS without experiencing perpetual twisting. K Sir curve result in intrusion just as just as withdrawal of foremost teeth in the meantime, this abbreviates the treatment time contrasted with regular edgewise mechanics.

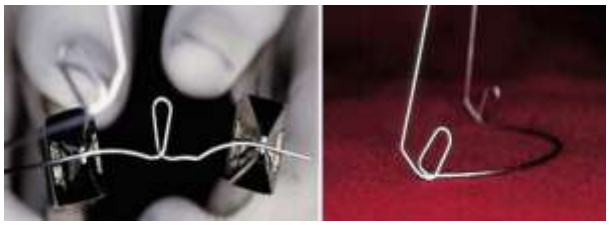
K-sir arch is a modification of a segmented loop mechanics



90° bends placed in archwire at level of U- loops



Archwire with off center 60° V-bend placed about 2mm distal of U- loop

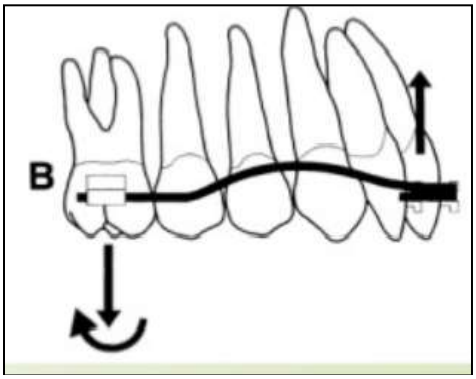


Archwire after trial activation

One Couple Vs Two Couple System

One Couple System is normally utilized for intrusion, regularly of incisors which would have ejected excessively. An Intrusion curve commonly utilize molar safe haven against at least two incisors. The meddling power must be light, the responsive power against the stay teeth should likewise be light, well beneath the power level required for expulsion and tipping that would be the receptive development of the grapple molar. This may prompt the buccal tipping of the molars to keep that molar teeth are integrated with an inflexible lingual curve. In grown-ups, more often than not the pre molar teeth are added to the grapple unit.[4] Utility curve is a two couple arrangement utilized for the remedy of front profound overbite. Two

couple framework vary from one couple framework by tying an intrusion curve in the section of four incisors and not simply by one point get in touch with (one couple). It is a 2x 4 archwire appended to two molars and four incisors which produce two point contact and can't factually determinate the power henceforth it is a vague two couple system.[11]

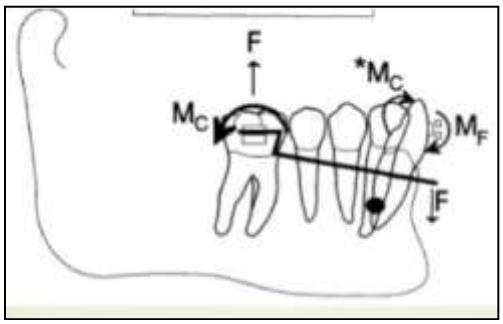


1. The end that is fixed as a point contact only force is generated,the end which is engaged in the bracket slot a force and a couple is generated.
2. One couple system - Couple is generated only at the site of full engagement.
3. It is statically determinate,magnitude of the forces and moments produced can be determined clinically after the appliance is inserted into the brackets.

Two Couple Appliances- Statically Indeterminate Systems

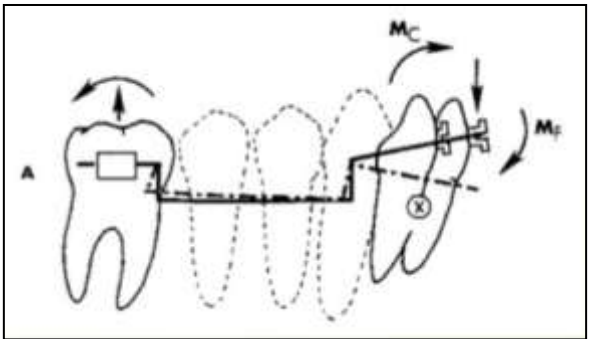
Both the ends of the wire is engaged into the brackets

1. Magnitude of the forces and moments produced cannot be determined clinically after the appliance is inserted into the bracket.
2. Because of the inability to measure force systems produced by two couple appliances clinically, they are referred to as being statically indeterminate.



Two Couple System (Utility Arches)

At the incisors a moment to tip the crown facially (M_f) is created by the distance of the brackets from the centre of resistance, and an additional moment in the same direction is created by the couple within the bracket (Mc) as the inclination of the wire is changed as it is brought to the brackets



Clinical Observations and the Tissue Reactions after the Application of Different Orthodontic Forces

Intrusion of the tooth involves resorption of the bone, particularly around the apex of the tooth In this movement, the whole of supporting structures are under pressure with virtually no areas of tension. Unlike extruded teeth, intruded teeth in young patients undergo only minor positional changes after treatment. Relapse usually does not occur, partly because the free gingival fiber bundles become slightly relaxed. Stretch is exerted primarily on the principal fibers. An intruding movement may therefore cause the formation of new bone spicules in the marginal region. These new bone layers the middle third of the roots. Rearrangement of the principal fibers occurs after a retention period of a few months.[11] Intrusion requires careful control of force magnitude. Light force is required because the force is concentrated in a small area at the tooth apex. A light contentious force, such as that obtained in the light wire technique, has proved favorable for intrusion in young patients. In other cases, the alveolar bone may be closer to the apex, increasing the risk for apical root resorption. If the bone of the apical region is fairly compact as it is in some adults, a light interrupted force may be preferable to provide time for cell proliferation to start, and direct bone resorption may prevail when the arch is reactivated after the rest period. Intrusion may also cause changes in the pulp tissue such vascularization of the odontoblast and pulpal edema.[12]

Conflict of Interest: None.

References

1. Burstone CR. Deep overbite correction by intrusion. *Am J Orthod* 1977; 72:1-22.
2. Marcotte MR. Biomechanics in orthodontics. 1st edition
3. Nikolai RJ. Response of dentition and periodontium to force. Bioengineering Analysis of Orthodontic Mechanics.Philadelphia: Lea and Febinger; 1985;146-93.
4. Proffit W, Fields H. Contemporary Orthodontics. 3rd ed. St.Louis: Mosby; 2000.
5. Nanda R. Biomechanics in clinical orthodontics.1st ed.
6. McNamara JA. Orthodontic and Orthopaedic treatment in mixed dentition.1st ed
7. Nanda R, Marzban R, Kuhlberg A. The Connecticut intrusion arch. *JCO* 1998;12:1-4

8. Kharbanda OP. Diagnosis and management of malocclusion and dentofacial deformities. 2nd ed.
9. Sahu S et al. Orthodontic intrusion:an insight. *IJOHMR* 2017;3(6):137-140.
10. Anjali N, Sarojini J, KA Mohan. Three piece intrusion arch – Simplified –A clinical time and motion study. JIOS 2009;43:38-49. Davidovitch M, Rebellato J. Two-couple orthodontic appliance systems utility arches: A two-couple intrusion arch. *Semin Orthod* 1995;1:25-30. *Orthod* 1995;1:25-30.
11. Stenvik A, Mjör IA. Pulp and dentine reactions to experimental tooth intrusion. A histologic study of the initial changes. *Am J Orthod* 1970;57:370-85.
12. Mostafa YA, Iskander KG, El-Mangoury NH. Iatrogenic pulpal reactions to orthodontic extrusion. *Am J Orthod Dentofacial Orthop* 1991;99:30-4.

How to cite this article: C Bansal, Tandon R, Singh K, Chandra P, Kumar R. Intrusion Arches. *Indian J Orthod Dentofacial Res* 2019;5(2):53-9.