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Case Report

# Versatile extrusion spring – for true vertical extrusion of infra-occluded orthodontic tooth

**Suresh Kangane [1], Aavesh Bhoir[2]*, Pravinkumar Maroore [3], Yatishkumar Joshi[4], Trupti Nakhate[5]**

Dept. of Orthodontics and Dentofacial Orthopaedics, MIDSR Dental College, Latur, Maharashtra, India

## Abstract

Infra occlusion of teeth can be due to many factors like tissue resistance, unavailable space in arch. In orthodontic treatment such a tooth can be extruded by various mechanics. A tooth that is translated along its long axis in a coronal direction is called an extrusion. In literature many case reports are available for orthodontic extrusion of canine but less reports have been there about orthodontic traction for impacted and intruded premolar. So, this case report represents versatile extrusion spring for extrusion of infra-occlusion premolar without anchor loss of adjacent teeth.

**Keywords:** Extrusion, Versatile extrusion spring, Infra-occlusion of teeth, Orthodontic treatment

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## 1. Introduction

The main objective of orthodontic therapy is to improve aesthetics and to improve masticatory system. Certain variables, like as impaction, infra-occlusion, and supernumerary teeth, make it impossible to move teeth to their optimal positions all the time. Among them impaction of teeth and its relocation in arch is challenging. Impaction of canine teeth is having more incidence than impaction of premolar.[1]

It is estimated that the incidence of impaction in premolar teeth is approximately 0.5%. Mandibular second premolars are thought to make up approximately 24% of all impactions, excluding molars, and are said to be more common among premolars than their maxillary counterparts.[1,2]

Orthodontic traction of the impacted premolar is a superior option for cases with a better prognosis, such as growing patients without significant arch space limits. In order to guide and position the tooth in the arch, orthodontic traction may or may not be used after the impacted tooth is surgically exposed. The most frequent side effects of this kind of surgery include gingival recession, bone loss, and root resorption surrounding the extracted tooth.[3]

A tooth that is translated along its long axis in a coronal direction is called an extrusion. Orthodontic extrusion is the term used when a tooth's movement is accelerated by an applied force. Application of the ideal traction forces will cause the periodontal ligament to be stretched out, which will cause the bone at the alveolar crest to apposition to some extent.[4]

There are numerous case studies of orthodontic canine extrusion in the literature, but less about orthodontic traction for impacted and intruded premolars. So this case report represents extrusion spring for extrusion of infra-occlusion premolar without anchor loss of adjacent teeth.

### *1.1. Extrusion Spring*

Armamentarium: (**Figure 1**)

1. 0.018-inch A J Wilcock wire
2. Bird beak plier
3. Universal plier

*Corresponding author: Aavesh Bhoir
Email: bhoiraavesh123@gmail.com

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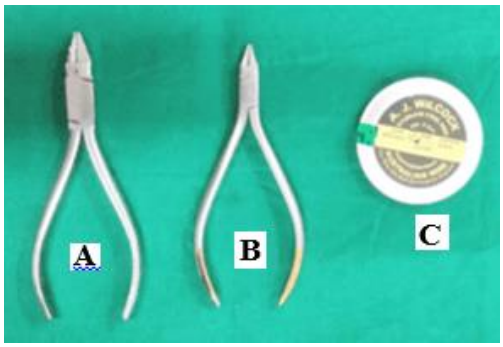


**Figure 1:** Armamentarium; **A):** Universal plier; **B):** Bird beak plier; **C):** 0.018" A J Wilcock wire

*1.2. Components of spring: (**Figure 2**)*

1. Vertical arm
2. Double helical loop
3. Occlusal horizontal U arm

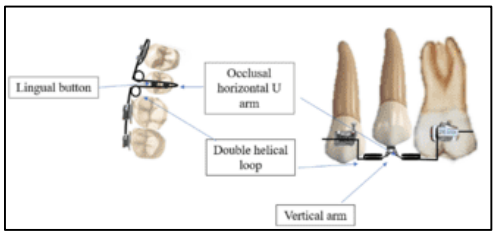


**Figure 2:** Components of extrusion spring

*1.3. Design and fabrication: (**Figure 3**)*

1. 0.018-inch stainless steel wire is shaped into arch form.
2. Distal to first premolar bracket wire is marked and 90 sharp bend is given with help of universal plier towards occlusal plane and parallel to occlusal plane bend is given.
3. Double helical loop is made with help of bird beak plier on mesial side of horizontal arm of wire and extended towards intruded premolar till palatal surface and then U bend is given.
4. Double helical loop is made on distal side of horizontal arm of wire and 90 bend is given mesial to molar tube and wire is bend 90 towards molar tube so that distal end will pass from tube
5. Lingual buttons bonded on exposed surfaces of premolar or occlusal surface of premolar whose extrusion has to be done.
6. Before placement of wire consolidation done in complete arch.
7. Wire is placed in maxillary arch ligated with ligature wire on all teeth elastic chain is placed from lingual button to U shaped horizonal occlusal arm which will apply extrusive forces on teeth.

*1.4. Reactivation of spring*

1. After one month of placement spring is reactivated by increasing height of vertical arm by opening 90" bends at level of bracket slots and again adapting wire according to arch form
2. Reactivation of 2-3 mm is permissible to prevent occlusal interference.
3. After activation elastic chain changed from lingual button to occlusal arm.

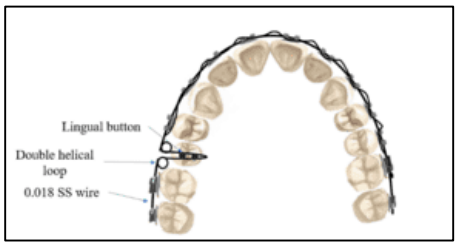


**Figure 3:** Design of extrusion spring

*1.4. Biomechanics of spring*

1. After placement of spring and elastic chain to lingual button 60 gm of force is applied to tooth
2. As centre of resistance of premolar and active component i.e. direction of elastic chain is in the same line, which creates true Vertical force vector and it leads to extrusion of teeth. **(Figure 4**)
3. For adjustment of horizontal occlusal arm helices can be opened according to position of infraoccluded teeth.
4. Reasons for less unwanted tooth movement – stiff arch wire (0.018" SS), complete ligation including all teeth, distal end of wire is cinched back, vertical arms are positioned just distal to premolar bracket and mesial to molar tube so that spring will be stable.

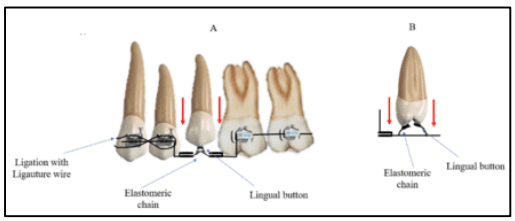


**Figure 4:** Biomechanics of extrusion spring representing vertical force vector; **A):** Buccal view; **B):** Distal aspect

**Figure 5:** Intraoral occlusal view.

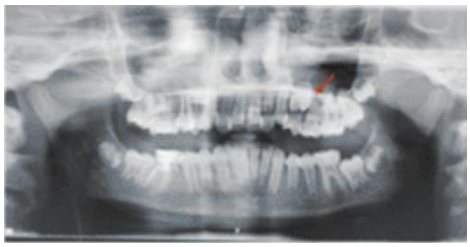

**Figure 6:** pre-treatment OPG showing impacted premolar (red arrow)

## 2. Case Report

### *2.1. Diagnosis*

A female patient age 12 year reported to the department of orthodontics with chief complain of malaligned teeth in upper and lower jaw. On examination patient was having class 2 molar relation on both side with moderate crowding in upper and lower anterior region there was over-retained deciduous second molar on left side. (**Figure 5**) On OPG examination there was impacted maxillary left second premolar in between first premolar and over-retained deciduous second molar. (**Figure 6**)

### *2.2. Treatment plan*

As patient was having moderate crowding in maxillary and mandibular anterior region so to correct skeletal class II jaw bases, fixed functional appliance therapy was planned with extraction of left maxillary over-retained deciduous second molar for passive eruption of second premolar.

### *2.3. Treatment progres*

As per treatment plan fixed functional appliance – AdvanSync 2 appliance therapy was started along with fixed orthodontic treatment by 0.022" MBT prescription. Extraction of over-retained deciduous second molar was done. After 7 months of treatment with follow up of every month it was evaluated that passive eruption of second premolar is not possible as it was impacted and disto-palatally rotated, so surgical exposure of impacted second premolar was done followed by orthodontic traction along with couple forces for correction of rotation. (**Figure 7**, **Figure 8**)

**Figure 7:** Surgical exposure of second premolar

**Figure 8:** Orthodontic traction with couple forces for correction of rotation

After two months of follow up tooth was aligned with correction of rotation, but tooth was intruded in arch. So, extrusion spring was made with 0.018-inch SS wire. (**Figure 9**)

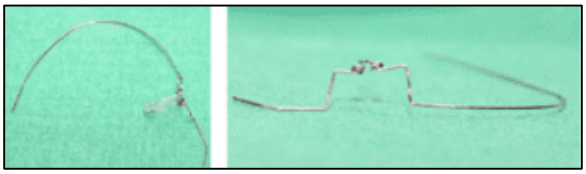

**Figure 9: A):** Occlusal view of extrusion spring**; B)** Buccal view of extrusion spring

Same Lingual button was used for application of forces which was used for rotation correction. Elastic chain was applied from lingual button to horizontal U arm, which apply vertical forces on intruded premolar. (**Figure 10**, **Figure 11**) After one month of follow up tooth was extruded and it was touching to horizontal U arm, so reactivation of spring was done by increasing height of vertical arm by 1 mm. elastic chain was again placed for more extrusion. After 2 months teeth were at the level of occlusal plane. So MBT bracket was bonded and further alignment was continued. (**Figure 12, Figure 13**)

### *2.4. Treatment result*

After surgical exposure and orthodontic traction, it was noted that position of teeth is infraocclusion. After placement of spring due to vertical extrusive forces premolar came at level of occlusal plane which are shown in image with yellow line as occlusal plane. These results are achieved within 2 months of placement of spring. (**Figure 14**, **Figure 15**)

**Figure 10:** Intraoral maxillary occlusal view showing extrusion spring

**Figure 11:** Intraoral maxillary left buccal view showing extrusion spring

Figure 12: Intraoral maxillary occlusal view showing aligned premolar

**Figure 13:** Intraoral maxillary left buccal view showing aligned premolar

**Figure 14:** Comparison of pre-treatment and post-treatment intraoral lateral view showing position of premolar (black arrow) (yellow line – occlusal plane)

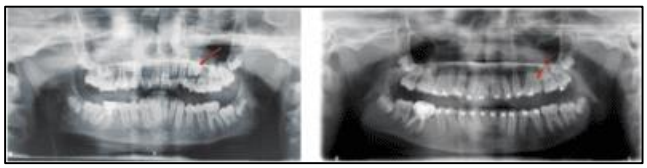

**Figure 15:** Comparison of pre-treatment and post-treatment OPG radiograph showing position of premolar (red arrow)

## 3. Discussion

Extrusion is one of the treatment procedures in orthodontic practises. Various indications are there for orthodontic extrusion of infraoccluded teeth. In a study involving the extrusion of over 100 samples of premolar teeth, a unique technique utilising nickel-titanium segmented arch wire and direct-bonded brackets was employed.[5]

An orthodontic extrusion force of 50–240 gms was observed in magnet assisted extrusion of teeth.[6] The patient's physiologic response and other elements, like root surface shape, will determine the force that is applied. The force exerted cannot be precisely measured; instead, its extent can only be estimated. Based on the clinically validated extrusion speed, the forces need to be modified.[7] An offset was inserted into the stainless-steel wire to prevent the tooth from tilting, and force was applied along the premolar's long axis using a J hook.

Orthodontic extrusion can be completed with either permanent or removable appliances, depending on the sort of force needed, anchoring, and the mobility of neighbouring teeth. Aesthetics and patient desire led to the selection of the fixed appliance, and UL4 and UL6 were found to be appropriate for anchorage. Depending on the therapeutic setting, a variety of extrusion techniques with distinct mechanical principles to control the applied forces are available. A clinical crown that is momentarily connected to a post, bracket, or rigid stainless wire within the root canal can be used to apply forces to the tooth. As mentioned by Bach et al. in, extrusion pressures can be applied to a tooth by an elastic chain, a looped wire, or a spring.[7]

J hook was selected since it is simple to make and the orthodontic bracket was insufficient to attach to teeth.[6] An elastic chain was used to achieve traction at first, and a ligature was employed to complete extrusion.[8]

In this case report premolar was impacted so surgical exposure was done to apply orthodontic attachment. It was rotated disto-palatally so to correct rotation orthodontic traction with couple forces were applied to correct it. But after correction teeth was in infra-occlusion, so to correct it innovative approach was used with help of extrusion spring. After placement of spring care was taken to prevent anchor loss by cinched back in molar region, consolidation to anterior segment.

After placement of spring and elastic chain to lingual button 60 gm of force is applied to tooth. As centre of resistance of premolar and active component i.e. direction of elastic chain is in the same line, which creates true Vertical force vector and it leads to extrusion of teeth. So true vertical extrusion was observed after two months of treatment along with reactivation of spring.

Depending on the clinical circumstances, different times are needed for forced eruption. The tooth should be stabilised following rapid movement in order to facilitate PDL fibre rearrangement, remodel bone, and prevent against relapse. In

normal circumstances, three to six weeks of stabilisation should be enough.[9] but According to certain research, a 7–14 week stabilisation period is necessary.[10]

## 4. Conclusion

1. Its simple design avoids unwanted tooth movement.
2. Because of its versatility, it can be used for any infraoccluded tooth.
3. This design of spring produces true extrusive vertical forces for extrusion of teeth.

## 5. Source of Funding

None.

## 6. Conflict of Interest

None.

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