

Orthodontic Analogies: Simplifying Complex Concept In Orthodontics

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Abstract:

The treatment of malocclusion of teeth requires fabrication of orthodontic appliances to activate force system. There are many variables involved in the structural and material properties of each component. It is important to understand these variables for construction of an efficient and tissue friendly appliance. Orthodontic analogies are comparisons that draw parallels between orthodontic concepts and other aspects of life. These analogies help to explain orthodontic procedures and principles in a more relatable and understandable manner. Various orthodontic analogies are roller coaster effect, Row-boat effect, Wagon-wheel effect, Drawbridge effect, Trampoline effect, Bowing effect. These analogies describe various phenomenon that occur during orthodontic treatment in which some of them are unwanted effects of orthodontic tooth movement like roller coaster effect, rowboat effect and some of them are effective phenomena of tooth movement like drawbridge effect.

Keywords: words: orthodontics, analogies, malocclusion, orthodontic treatment

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INTRODUCTION:

Successful treatment of the adult patient with an in order to correct malocclusion, orthodontic equipment must be made in order to activate the force system.¹ An appliance is composed of several components. The arch wires coil springs, and elastic modules apply the actual forces when the brackets are banded or bonded to the teeth. Each component's structural and material qualities are influenced by a wide range of factors.² Understanding these characteristics is crucial for designing an effective and tissue-friendly appliance.³

Orthodontic analogies are comparisons that draw parallels between orthodontic concepts and other aspects of life. For example, comparing the process of adjusting brackets to refining a skill over time or likening the alignment of teeth to the organization of

thoughts in writing. These analogies help to explain orthodontic procedures and principles in a more relatable and understandable manner.

VARIOUS ORTHODONTIC ANALOGIES ARE:

- Roller coaster effect
- Row-boat effect
- Wagon-wheel effect
- Drawbridge effect
- Trampoline effect
- Bowing effect

ORTHODONTIC ANALOGIES:

1) ROLLER COASTER EFFECT -

In the early years, various problems occurred during orthodontic treatment mechanics because of heavy forces and increased tip in anterior brackets.⁴

At the time of space closure sometimes there is occurrence of lateral open bite, rotation of molars in counter-clockwise direction and deepening of anterior bite such effect is known as **roller coaster effect**. (fig.1)⁵

Retraction can occasionally result in negative outcomes like anterior teeth extrusion or anterior torque expression failure.

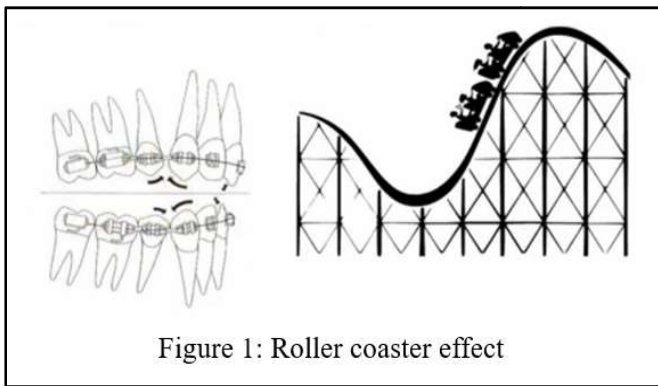


Figure 1: Roller coaster effect

Causes: -

- Applying strong pressure to soft arch wire
- Anchorage loss
- Improper ligation method

Prevention: -

- Avoid heavy forces during initial appointments
- Anchorage preparation early in the treatment
- Proper ligation technique using ligature wire
- Space closure on heavy rectangular stainless-steel wire only

Management of roller coaster effect:

1. Deep bite correction -
 - In class 2 hypodivergent patients - true intrusion of incisors with help of temporary anchorage devices (TADs) mini-implants with accentuated curve of spee arch wire.^{6,7}
 - In other malocclusion - intrusion of anterior and extrusion of posterior teeth - reverse curve of spee arch wire, intrusion utility arch, three-piece utility arch etc.⁸

2) ROW-BOAT EFFECT-

If the canines are mesially tipped, regardless of presence of the space distal to them, full engagement of the brackets results in a tendency of the incisors teeth to procline.

Considering apex of canine root is tip of arc, when arc is pushed the boat will be shoot forward so canine and other tooth move forward.(fig.2)

Rowboat effects can also be seen after engaging distally orientated canines in a continuous wire, which results in extrusion and proclination of incisors

The row boat effect is caused by the maxillary teeth's susceptibility to migrate forward during anterior lingual root torque.⁹

When such tension is applied, there is a tendency for class II relapse after headgear or class II elastics.

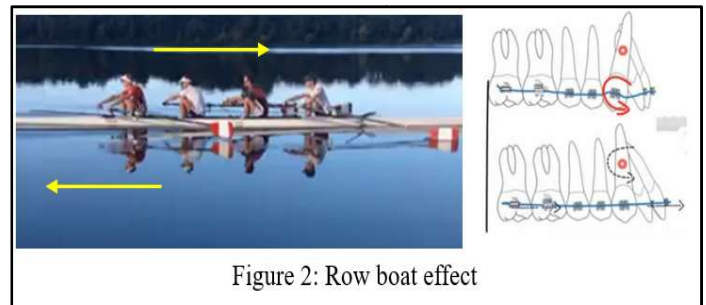


Figure 2: Row boat effect

Causes:

Excessive mesial root inclination of canine

Prevention:

This can be prevented by avoiding full arch engagement, laceback on canine, segmental retraction of the canine, by-passing canine brackets or by-passing incisors, until enough spaces are provided for anterior alignment.¹⁰

Strong anchors must be used to stabilize the canine crown in order to avoid the rowboat effect. An ideal substitute for extraoral anchorage in situations where molar anchorage is crucial is a microimplant. A laceback is applied directly to the canine bracket, and the TAD is positioned between the roots of the second premolar and the first molar.

3) **WAGON-WHEEL EFFECT:**

Andrew described this phenomenon as **wagon wheel effect**, represents relationship between torque applied by arch wire and tip.

The mesial convergence of the central and lateral incisor crowns at the gingival region occurs once per 4° in lingual crown torque. About a 4:1 ratio applies here. (fig.3)

In the straight wire appliance, adding palatal root torque to the anterior segment approximates the anterior roots. Therefore, adding torque negates the pre-existing incisors' tip by a ratio of 4 to 1. For example, adding 4° of palatal torque on the incisors will decrease tip by 1°.¹¹

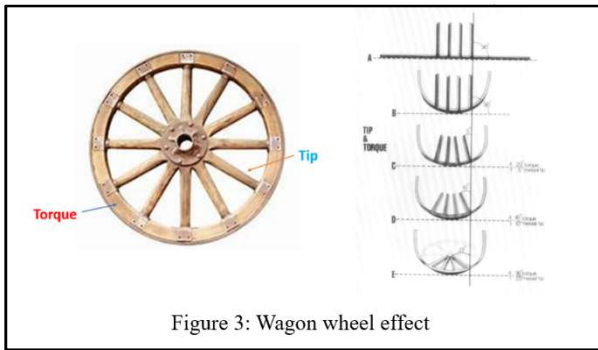


Figure 3: Wagon wheel effect

4) **DRAWBRIDGE EFFECT:**

When comparing incisors as two movable bridge and descent of bridge is comparable to retraction of teeth, which will lead to up righting and extrusion of incisors to close open bite.(fig.4).¹²

This occurs by rotating teeth around centre of resistance, beneficial to close open bite but sometime unwanted effects occur by proclination of teeth leading to open bite.

In situations where orthodontic treatment is used to correct anterior open bite after maxillary and mandibular incisor retraction, uprighing, and extrusion, this phenomenon is called as the **drawbridge effect**.¹³

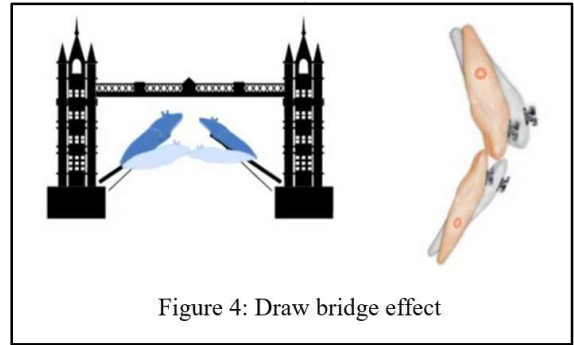


Figure 4: Draw bridge effect

5) **TRAMPOLINE EFFECT:**

When a patient misses regular adjustments, space closure can persist for several months despite the elastomeric module's poor quality and consequently low force delivery. This could be the result of an intermittent pumping activation brought on by the trampoline effect that occurs during mastication. (fig.5)¹⁴

In patients with stronger masticatory forces, this jiggling action is more pronounced in the lower arch and in low-angle conditions. These assumed variations would easily satisfy clinical criteria because low angle cases and lower space closure typically call for greater stresses. The passive laceback leverages occlusal pressures to retract a canine through the trampoline effect. Biting forces cause the dentition (trampoline) to shift microvertically, which causes the laceback to loosen temporarily.¹⁵ The bending of the lace back retracts the canine and shortens its anteroposterior length. This chewing procedure is repeated numerous times.

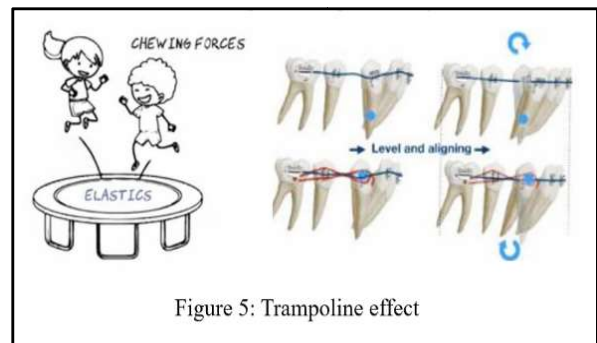


Figure 5: Trampoline effect

6) BOWING EFFECT:

Increased overbite caused by incisor extrusion following the placement of a straight wire in the angulated canine brackets and incisor brackets. (fig.6)

Unless it is necessary to repair an anterior open bite with maxillary incisor extrusion, deepening of the bite during treatment is typically not a desired outcome.

Before ligating it, insert the archwire into the canine bracket slot to diagnose or predict the effect. To prevent incisor extrusion, the anterior portion of the wire should not be tied to the brackets if it passes below them. Step-up can be bent to avoid gingivally bypassing the incisors if a bendable wire is utilized. Installing a continuous intrusion arch in addition to the straight wire is an additional technique. Thus, the intrusion arch would counteract the straight wire's extrusive effect.¹⁶

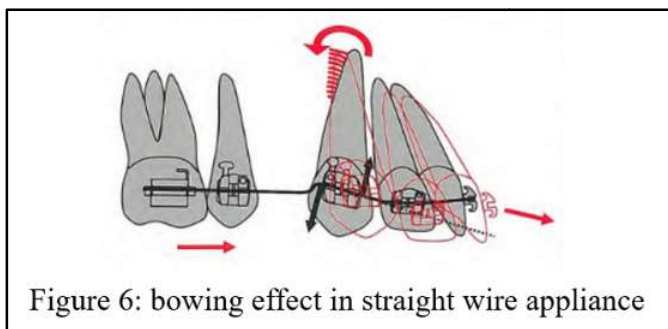


Figure 6: bowing effect in straight wire appliance

In particular, the "bowing effect"—unwanted lingual inclination, anterior tooth extrusion, inter-bicuspid width expansion, and inter-molar width contraction occurs during the space closure stage of lingual orthodontics. The application of a single palatal force resulted in unintended dental movement patterns, such as anterior teeth inclination, premolar expansion, and molar intrusion (also known as the "bowing effect").(fig.7) Thus, the "bowing effects" can be prevented by application of "double cable" mechanics.¹⁷

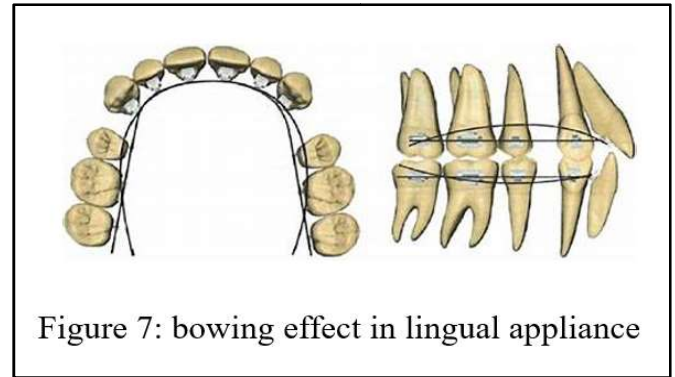


Figure 7: bowing effect in lingual appliance

CONCLUSION

Orthodontic analogies serve as an invaluable tool for elucidating intricate concepts in orthodontic biomechanics. Treatment mechanics used during orthodontic treatment plays important role to reduce the treatment time and achieve predictable results. Even if some complications occur during the treatment, it is manageable if orthodontists are aware of the cause and mechanics of the effect caused during treatment. By harnessing the relatable imagery of orthodontic procedures can effectively bridge the gap between tangible experiences and relatable ideas.

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