

Self-ligating systems

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Objectives

- Understand the theory of self ligating brackets
- Explain the practice of self ligating brackets

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History of SLB

- The first self-ligating bracket, the Russell attachment, was introduced by Stolzenberg in the early 1930s.
- During the past several decades, interest in self-ligating brackets has been rekindled, with the introduction of various types of new self-ligating systems.
- These self-ligating brackets have been touted to possess many advantages over conventional edgewise brackets.

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- Damon (1998) reported that SLB resulted in:
 - faster tooth movement
 - reduced treatment time
 - stable expansion of the arches
 - less painful treatment

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Disadvantages

- However, self-ligating brackets have some disadvantages including:
 - higher cost
 - possible breakage of the clip or the slide
 - higher profile because of the complicated mechanical design
 - potentially more occlusal interferences and lip discomfort
 - difficulty in finishing due to incomplete expression of the archwires.

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- The claim of reduced friction with self-ligating brackets is often cited as a primary advantage over conventional brackets.
- This occurs because the usual steel or elastomeric ligatures are not necessary, and it is claimed that passive designs generate even less friction than active ones.
- With reduced friction and hence less force needed to produce tooth movement, self-ligating brackets are proposed to have the potential advantages of producing more physiologically harmonious tooth movement by not overpowering the musculature and interrupting the periodontal vascular supply.
- Therefore, more alveolar bone generation, greater amounts of expansion, less proclination of anterior teeth, and less need for extractions are claimed to be possible.

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Properties of an Ideal Ligation System

- The concept that brackets are ligated via tie wings is so prevalent that it is worthwhile considering a list of ideal properties of any ligation system.
- Be secure and robust,
- Ensure full bracket engagement of the archwire,
- Exhibit low friction between bracket and archwire,
- Be quick and easy to use,
- Permit easy attachment of elastic chain,
- Assist good oral hygiene, and
- Be comfortable for the patient.

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Secure Robust Ligation

- It is highly desirable that once ligated, the system is very resistant to inadvertent loss of ligation.
- Wire ligatures are good in this respect, whereas elastomeric ligatures are much less so, especially if left for too long without being replaced.
- The force decay of elastomerics has been well documented

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Full Bracket Engagement

- It is a great advantage if the archwire can be fully engaged in the bracket slot and maintained there with certainty. Wire ligatures do not stretch to an extent that engagement once achieved at ligation is subsequently lost, so they can meet this requirement.
- Elastomerics are worse since they may frequently exert insufficient force to fully engage even a flexible wire and the subsequent degradation of their elastic performance may cause a significant loss of full engagement as the elastomeric stretches.
- Twin brackets with the ability to "figure 8" the elastomerics are a significant help in this respect but certainly not a complete answer.

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Low Friction

- Wire ligatures produce substantially lower friction forces than elastomerics.
- However, the forces generated by wire ligation still reach high and very variable levels relative to those force levels that are thought to be optimal for tooth movement.
- Low friction levels are considered to enhance orthodontic tooth movement.
- Most tooth movements with most mechanical procedures involve relative movement between the archwire and bracket.
- These movements include leveling, buccolingual alignment, rotation, correction of angulation, opening of space, and any space closure with sliding mechanics.
- Friction between the bracket and the archwire is a force that must be overcome before the intended tooth-moving forces can have their effect and this relative movement between the bracket and the archwire can occur.

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Quick and Easy to Use

- This is a significant disadvantage of wire ligatures and the principal reason for the decline in their use is very slow compared with elastomeric ligation.
- The use of wire ligatures adds almost 12 minutes to the time needed to remove and replace two archwires.
- This is the major reason for the decreased use of wire ligation.

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Easy Attachment of Elastic Chain

- Conventional brackets have tie wings, which are very convenient for the attachment of elastic chain.
- Some self-ligating brackets don't have tie wings.
- This is less convenient for attachment of elastic chain

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Maintenance of Optimal Oral Hygiene

- Elastomerics accumulate plaque more than do wire ligatures and there is some evidence to support this.
- There is also some evidence that the use of wire ligatures reduces bleeding on probing of the gingival crevice when compared with elastomeric ligatures.
- However, a scanning electron microscopy study found no difference in bacterial morphotypes when using elastomerics or steel ligatures.

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Frequently Proposed Limitations of Conventional Ligation

- Failure to provide and to maintain full archwire engagement results in poor control of tooth movement.
- Frictional values are increased.
- For elastomerics, the force decays and therefore tooth control is not optimal.
- Both wire and elastomeric ligatures sometimes become displaced.
- Oral hygiene is potentially impeded.
- Wire ligation is a time-consuming clinical procedure.

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Proposed Core Advantages of Self-Ligating Brackets

- More certain full archwire engagement
- Low friction between the bracket and the archwire
- Less chairside assistance needed
- Faster archwire removal and ligation

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Alignment of Severely Irregular Teeth

- A combination of low friction and secure full engagement is particularly useful in the alignment of very irregular teeth and the resolution of severe rotations, where the capacity of the wire to release from binding and slide through the brackets of the rotated and adjacent teeth would be expected to significantly facilitate alignment.
- This relationship between friction and derotation has been described and quantified and the potential adverse forces shown to be very large.

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Active Clip or Passive Slide

- Among the brackets that are currently available, SPEED, System R (In-Ovation), and Quick brackets have a sliding spring clip, which encroaches on the slot from the labial aspect, potentially placing an active force on the archwire.
- Time2 brackets have a very similar clip, but for closure it rotates around a tie wing rather than slides into place.
- These four brackets are all described as having potentially active clips.
- In contrast, Damon brackets have a slide that opens and closes vertically and creates a passive labial surface to the slot with no intention or ability to encroach on the slot and store force by deflection of a metal clip.



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- The intended benefit of storing some of the force in the clip as well as in the wire is that in general terms a given wire will have its range of labiolingual action extended and produce more alignment than would a passive slide with the same dimension wire.
- This difference in labiolingual force delivery needs more detailed consideration.

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- It is probable that with an active clip, initial alignment is more complete for a wire of given size to an extent that is potentially useful clinically.
- However, the increased clearance between a given wire and a passive slide will generate lower forces and may facilitate dissipation of binding forces and the ability of teeth to push each other aside as they align.

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Cost and Treatment Efficiency

- Currently available self-ligating brackets are more expensive than most good quality tie wing brackets.
- A modest balancing factor is the cost of elastic ligatures that are, of course, not required.
- However, this significant extra cost must be measured against savings in time—A study of treatment efficiency by Harradine found the following:
 - An average time saving from a reduction in archwire placement/removal of 24 seconds per arch,
 - A mean reduction of 4 months in active treatment time from 23.5 to 19.4 months,
 - A mean reduction of four visits during active treatment from 16 to 12,

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Recent studies have reported:

- Bracket type does not influence:
 - The duration of treatment
 - The number of visits required
 - The percentages of PAR score reductions were also unaffected by the choice of appliance.

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Recent studies have reported:

- Evidence that SLB results in greater posterior arch expansion and reduced lower incisor proclination is equivocal.
- Any differences in mandibular intermolar expansion compared to conventional ligation are minimal.
- Data does not support that SLB can facilitate stable arch expansion and non-extraction treatment.

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Less painful?

- The theory that forces on the teeth are lower because lighter archwires can be used with equal effectiveness, and the teeth move more readily in response to the applied forces because of decreased resistance to sliding.
- Three studies found that patients reported lower pain levels with various self-ligating brackets and 2 other studies found no difference.

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Questions?

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