BANDING VS BONDING – AN OVERVIEW

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Abstract

Orthodontic treatment is branch of dentistry which corrects various types of malocclusions and improves smile esthetics and functional occlusion efficacy. This requires application of force on teeth using archwires, springs, loops, elastic chains etc to move teeth in their proper position. This can be possible by fixing some attachments on to the teeth. These attachments can be fixed either by banding of teeth or bonding. In banding procedure, bands are pinched around teeth, on which attachments are fixed, attachments may be bracket, molar tube, lingual button or lingual sheath. In bonding, attachments are directly fixed on teeth by using resin material. This article will discuss in brief about banding and bonding to conclude which is better.

Keywords: Band material, bonding, malocclusion, teeth, and brackets.

Introduction

The value of a beautiful smile is undeniable as smile of an individual is the first thing that is noticed by others. An attractive pleasing smile in modern day society is considered an asset in work place and social interaction as smile plays a prime role in facial expression and appearance.[1] So most of orthodontic patients seek orthodontic treatment to improve their smile and facial esthetics. To create esthetic smile and optimum function of dentition, alignment of teeth in their appropriate positions is needed. This is possible through moving the teeth by applying optimal force to the teeth[2]. In no growing patients space is needed to create to move teeth for correcting the malocclusion.[3] This optimal force is applied on teeth using archwires, springs, loops, elastic chains and elastics etc. which is transmitted to the teeth using a rigid attachment that is bracket. The procedure of placing brackets precisely on tooth surface is called as bracketing.[4] The bracket can be placed on to the tooth surface either by banding or by bonding. Both banding and bonding has their own advantages and disadvantages. The terminal attachment of fixed appliance is placed most commonly on first molar of both arches. This may be molar band with welded molar tube or directly bonded molar tube. As the average time duration of orthodontic treatment is two years. The bonded bracket should be strong enough to withstand the applied orthodontic forces and mastication forces without dislodgement leading to lower failure rates while at the same time these should be safe enough to avoid damage to the surface of teeth during debonding following the end of the treatment.[5] The desired tensile bond strength of metal brackets to tooth structure required to carry out orthodontic treatment is said to be approximately 6 MPa–8 MPa.[6]

The decreased failure rate of attachments reduces the likelihood of emergency visits of patients, improve patient experience and also prevent lengthy treatment times. It has been suggested that 'Loose attachments leading to reduced interest of patient, reduce profitability and disturb the appointment scheduling. Failure rate of attachments should be less than 5%.[7]

Prior to the introduction of enamel bonding techniques, the use of orthodontic bands on first permanent molar teeth was universal. An orthodontic band is a thin seamless metal cylindrical ring, usually made of stainless steel. Bands help to bind orthodontic attachments to teeth. Nowadays bands are mostly placed on the maxillary or mandibular molars. Bands are also placed on other teeth where the surface or shape of tooth is not suitable for bonding bracket. Some orthodontists prefer placing bands on mandibular premolars also bond failure rates on premolar is high during treatment.[8]

Many orthodontists still favour the use of molar bands due to beliefs regarding reduced failure rates and reliability. With improvements in band designs and innovative mechanical retention features further decrease failure rate. Simultaneously, bonded molar tubes have also become increasingly popular due to lower failure rates resulted from advances in design of attachment and materials science. Some authors claimed that molar tubes are more efficient, convenient, allow easier maintenance of oral hygiene and reduce demineralization of tooth surface.[9]

Banding

Orthodontic bands were originally made of precious metal alloys including gold. Stainless steel was later introduced as an alternative to gold alloys. In selecting the alloy for fabricating band, properties necessary for a band material to function well in the oral environment and its easy adaptation to the varied sizes and shapes of teeth were considered. Teeth have variable anatomy specific to each individual including tapered crown forms and compound curves requiring a very formable adaptable material. Bands were originally custom fit for each patients tooth from a ribbon of band material supplied in rolls. A short strip of the band material was stretched and formed around the tooth (pinched) with the overlapping ends soldered together to form a complete ring that is band. This method was quite slow and labor intensive. This needed experienced hands to fabricate a well fitting band. Stainless steel is the alloy of choice which meets all of

these criteria to varying degrees.[8]
Ideal requirements of band material:

- It should fit contours of teeth as closely as possible, thereby enhancing the placement of attachment in relationship of tooth
- It should not extend subgingivally any more than necessary
- It should resist deformation under stress in mouth
- Bands should be made of an alloy that is resistant to tarnish in mouth.
- Material should have enough springiness that it can be forced over the height of contours of teeth and spring back slightly into undercut area.
- It should be polished on surface as possible to reduce the adhesion of food debris.

Indications for banding:

- Banding is preferably done in posterior teeth as bands are able to resist occlusal forces better than bonded attachments. Also bonding needs moisture free area and in posterior tooth area it is difficult to maintain.
- Teeth that need both labial & lingual attachment such as molar with both headgear & lingual arch tubes.
- Teeth with short clinical crown or round buccal surfaces where bonded bracket are difficult to place correctly.
- In young adolescents and recently erupted teeth with high gingival margins favors banding rather than bonding.
- Teeth where frequent breakage of attachment occurs

Advantages of banding:

- Welding or soldering of the attachment is possible that enhances retention. Facilitates both buccal and lingual attachment of auxiliaries.
- Bands provide a broad surface & facilitate the attachment of multiple auxiliaries that can be positioned with precision in an extraoral environment followed by a single cementation procedure.
- Superior reliability due to better resistance to occlusal interferences.
- Interproximal areas are well protected by the banding.
- Removal of the band along with the attachments is easy.

Disadvantages of banding:

- Time consuming procedure compared to bonding.
- Difficulty in maintaining oral hygiene.
- Risk of dental caries under band if it becomes loose by loss of cement seal.
- Difficulty in banding in case of tooth with aberrant shape.
- Difficulty in doing procedures like proximal stripping.
- Placement of band will open small spaces in arch.
- Banded tooth is more prone to caries & decalcification[10]

Steps in banding

Banding of a tooth includes following steps:

1. Separation of teeth
2. Selection of band material
3. Pinching of band
4. Fixing the attachments
5. Cementation of band

Separation of teeth

Due to tight inter dental tooth contacts, it may be impossible to force the band past the contact area. Also it is very uncomfortable to both patient and clinician. So tight contact areas need to be broken before pinching the band. Various types of separators are used for this purpose. To create sufficient separation between teeth, separators need to place for 24 hours or more between the teeth to be separated.

Selection of band material

Band material of suitable width and thickness is selected according to tooth to be banded as variable band materials with different thickness and width are available.

Pinching of band

Proper length of band material is taken and its ends are welded. Then it is passed through the contacts of teeth around the tooth. After this band is tightly pinched around the tooth with band pinching plier to form a ring. Extra band material is cut off and ends are band and adapted close to band. The bent parts spot welded. The gingival margins are trimmed to conform to the contour of gingival margin of teeth. Rough margins are made smooth and polished to prevent any injury to oral tissues.

Fixing the attachments

After completion of band pinching, appropriate attachment is fixed onto the band. Variable attachments are fixed such as brackets for anterior teeth and molar tubes and lingual sheath for posterior teeth. Attachments are fixed welding soldering.[10]
Cementation of band
It is final step in banding. Cementation of band needs adequate moisture control.
Ideal requirements for cements used for fixing bands:

1. Strong enough so that it can keep the band on the tooth for the length of the treatment.
2. It should not be too strong that the tooth surface is damaged when the band is removed.
3. Easy to use clinically.
4. Should have property to protect teeth against dental caries.
5. Cost should be reasonable.[10,11]

Zinc phosphate, zinc silicophosphate and zinc polycarboxylate cements were used as principal band cements until the early 1990s. Glass ionomer or glass ionomer based cements used commonly for band cementation now[12,13]

Bonding

With the invent of orthodontics, orthodontists used to band teeth to correct malocclusion. But Banding was cumbersome procedure, so people were in continuous search for a procedure which can overcome all the possible difficulties of banding. Finally with the advent of acid etching new concept developed in orthodontics, which led to tremendous changes in orthodontics. Bonding is a method of fixing attachments directly over the enamel surface of the tooth using adhesive resins. It was in1977 that the first detailed post treatment evaluation of direct bonding; over a full period of orthodontic treatment in a large sample of patients was published. Today, most Orthodontists directly or indirectly bond attachments to the tooth. In late 1960s, Buonocore had suggested that it was the formation of resin tags that caused the adhesion of the resin to the acid-etched enamel surface of tooth. The resin penetrates the micro- porosities of etched enamel and results in micro-mechanical bond. As time went on, variations in duration

of the acid- etching procedure and concentration of the phosphoric acid, along with alternative acids were tested for the etching of enamel. Bonding had certain advantages over banding.

- Bonded attachments are esthetically superior.
- Bonding if faster & simple procedure than banding.
- Bonding of teeth is less discomfort for the patient.
- Arch length is not increased as occurs with banding.
- Bonds are more hygienic and increased gingival and periodontal health with bonded attachments.
- Partially erupted/fractured teeth can be bonded.
- Proximal enamel reduction is possible with bonded attachments.
- Interproximal areas are accessible for composite build-ups.
- Risk of caries under loose bands is eliminated.
- No band spaces are present to close at the end of treatment.

Types of bonding

Direct bonding: Direct bonding is the technique in which attachment is placed directly to tooth surface with the use of adhesive. For efficient bonding operator must be able to judge the proper position for the attachments and must carry it to place rapidly and accurately.

Indirect bonding: Indirect bonding is done by placing the brackets on a model in the laboratory, then using a template or tray to transfer the laboratory positioning to the teeth .The advantage is the more precise positioning of brackets that is possible in the laboratory.

Advantages of indirect bonding

According to Thomas RG[14]

- Indirect Bonding permits more accurate placement of brackets, during the laboratory phase, vision is optimal and timing is not critical. Brackets can be precisely positioned on the patient's model and changed if necessary.
- Indirect Bonding reduces chair side time of appliance placement from 2 to 3 hours to 25 to 45 minutes. Therefore increased office efficiency.
- Less patient discomfort, since separation is no longer necessary. Moreover long bonding and banding appointments are shortened.
- Interproximal caries can be detected more readily and restored if necessary with no bands in the way.
- Reduces risk of caries and decalcification as is possible under bands, especially loose bands.
- Improved tissue health during treatment.
- Partly erupted teeth can quickly be brought under control. No need to wait for full eruption to cement band.
- No band space to close upon completion.
- No need of costly band inventory.
- Overall better patient acceptance related to esthetics and ease of placement

Fried KH, Newman GV[15] found that indirectly bonded brackets seem to have greater bond strength because the brackets are positioned with pressure during the 3-5-minute setting period with the matrix tray. Pressure enhances adhesion by preventing formation of air bubbles, reducing shrinkage, and promoting a thin glue line. In addition, moisture is excluded from the matrix tray and polymerization takes place in a dry environment

HickhamJ[16] suggested brackets adhere better to the teeth because of less breath condensation and subsequent moisture contamination of the etched and sealed teeth. The rigid indirect tray also holds the brackets in stable positions while the composite cures.

KalangeJT[17] published an article regarding the advantages of indirect bonding. He divided advantages of indirect bonding as:

- Clinical advantage – which deals with the issues related directly to the delivery of orthodontic treatment; i.e. how indirect bonding helps in the 'hands-on' treatment mechanics.
- Technical advantage – relates to those aspects that maximize the accuracy built into the appliances.
- Time in motion combined with ergonomics and efficiency – involves the successful achievement of goals, and their effect on physicians physical condition.

Other advantages of Indirect bonding are:

- Improved ability to bond posterior teeth
- Proposed as a mandatory mode of placement in lingual orthodontics
- Easier ability to rebond brackets – matrices can be stored and can be used to rebond the bracket at the same place.
- Easier ability to build in overcorrections.
- Better in / out and better vertical control.
- Overall healthier ergonomics.
- Visualization of each tooth is not a problem— the patient's cast is held in the hand. The placement of each bracket can be measured precisely with whatever gauge the clinician chooses. In indirect bonding, there is no pressure on the clinician to make quick decisions because the "field" is always dry, easily accessible, and the adhesive has virtually unlimited working time.
- It allows individualizing and optimizing our treatment outcome.
- Less physical and mental stress.
- Enhanced temporomandibular joint health[17] – proper marginal ridge alignment and contact positions achieved during the leveling and alignment phases create a better functional environment and a more stable platform in which to make major anteroposterior changes. This prevents premature contacts and unnecessary interferences of teeth as Class II or Class III malocclusions change to Class I
- Increased post treatment stability[17] – indirect bonding significantly decreases the amount of tooth detailing, resulting in a longer period of gingival fibers to reorganize and provide post-treatment stability.

Disadvantages of indirect bonding:

- This method needs an additional laboratory procedure.
- Additional sets of impression needed.
- Extra laboratory procedure increases cost of this technique.
- More precision is needed while working both in laboratory and in clinical area.
- This technique needs time to correctly and efficiently apply it.
- Improper adaptation of transfer tray in the mouth, leads to insufficient precision in bracket position on teeth.
- Increased amount of applied resin results in excessive resin around the brackets which inversely affect oral hygiene of patient.
- Bonding of brackets to teeth with short clinical crown length is difficult.
- Technique sensitive - Correct technique must be followed closely. Those fearful of change will likely be reluctant to try the technique.[14,18-20]

According to HickhamJ[20] suggested that any technique that does not bond upper and lower arches simultaneously diminishes the advantages of moisture control, stability, and speed. Dependence on commercial laboratories negates the experience, knowledge, and judgment of the orthodontist. It only takes a minute for the doctor to check the bracket positions on the models. Like any bonding technique, indirect bonding depends on maintenance of a dry field to be effective. This is impossible without efficient saliva evacuation. Clinicians must follow an unvarying routine to achieve predictable results.

According to Husain A[21]suggested that occlusogingival insertion of a transfer tray causes the adhesive-coated bracket to scrape along the long axis of each tooth, resulting in more uneven distribution of the adhesive as compared with the perpendicular placement of direct bonding.

According to Zachrisson & Brobakken[19] suggested That bracket bases were not fitted closer to the tooth surface which decreased bond strength. It was difficult to work clean and to remove excess adhesive flash around the bracket bases leads to gingival inflammation and decalcification. The bonding adhesive does not fill out the entire contact surface. Thus artificial undercuts and deficiency areas which are prone to promote decalcification are not avoided.

Sheridan J stated it in an interview[22] "That advantage is more precision in bracket placement. The disadvantage is the possibility of a disaster if the transfer trays are not seated fully."

It would be tempting to postulate banding would be more uncomfortable for patients as the attachment physically surrounds the whole tooth and placement can involve trauma to the gingiva. However, no difference was demonstrated between bands and bonds, low levels of discomfort were reported and patient tolerated both the attachments well. First molars bonds have a higher failure rate than first molar bands. Bonded first permanent molars demonstrated higher levels of post-treatment demineralization than banded first molars. No difference in discomfort was experienced by patients when banding or bonding first permanent molars as part of fixed appliance treatment.

Conclusion

Clinically there is no difference in orthodontic therapy with banded teeth or bonded attachments. These two methods differ from each other in attachment options, separation of teeth, tooth protection, ease in application and sufficiency. Bonding in orthodontics has almost completely taken over banding except in some special situations. Bonding of brackets has changed the practice of orthodontics and has become routine clinical procedure in a remarkably short time. The simplicity of bonding can be misleading. The technique can undoubtedly be mis used, not only by an inexperienced clinician but also by more experienced orthodontist who do not perform procedures with care. Success in bonding requires understanding of and adherence to accepted orthodontic and preventive dentistry principles.

The future of bonding is promising. Modification of technical devices, sealants, adhesives, attachments and procedures are continuing at rapid rate. Careful study of the available information by the orthodontist will be mandatory in keeping up with progress and to use the available materials and techniques for the best results.

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