Permatter

Retention Treatment Protocols

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A century of Retention Treatment

Our concerns about the stability of orthodontic treatment still seem to be the same as those expressed by Calvin Case in 1920: “If there is one part of orthodontia more than another that is absolutely indispensable to the success of this specialty and its establishment upon a firm foundation as one of the arts and sciences, it is the permanent retention of regulated teeth. . . . what does this temporary pleasure and satisfaction to ourselves and our patients amount to, if we find in a few years that the very cases which create in us the greatest pride, are going back to their former malpositions and disharmonies, in spite of everything we have been able to do with retaining appliances.”(1)

Image 1 - Edward Hawley Angle

The most dominant, dynamic, and influential figure in the specialty of orthodontics was Edward Hawley Angle (1855-1930). He is regarded as the “**Father of Modern Orthodontics**.” Through his leadership, orthodontics was separated from the other branches of dentistry (e.g., crown and bridge, prosthetics), and the result was the specialty of orthodontics. He was the first to limit his practice to orthodontics.

Hawley said: “If anyone would take my cases when they are finished, retain them and be responsible for them afterward, I would gladly give him half the fee.”(2).

1-Case, C.S.: Principles of retention in orthodontia, Int. J. Orthod. Oral Surg. 6:33-51, 1920, reprinted in Am. J. Orthod. 124:352- 361, 2003.
2-Hawley, C.A.: A removable retainer, Dent. Cosmos 61:449- 554, 1919.

As Case and Hawley pointed out, retention treatment is difficult precisely because of the uncertainty of orthodontic stability and there is no perfect solution for every case. Two different retainer systems, fixed and removable retainers, are used in clinical practice. Removable retainers have the disadvantages of aging, reduced wearing comfort such as impaired patient speech, and their clinical Success depends on sufficient patient compliance.(3) Mainly fixed retainers guarantee the stability of anterior teeth, since they require little patient compliance. Bonded lingual retainers have become increasingly popular as a method of retention since the late 1970s, particularly in the mandibular incisor area.(4)

Fixed retainers consist of a wire that is passively bonded to the lingual surface of the incisor teeth in both the upper and lower jaws.(5) The usage of bonded fixed retainers for the first time has been reported in the literature by Knerim(5) Initially, straight round or rectangular archwires were preferred for bonding fixed retainers.(5,6)

However, in 1983, after 10 years from Knerim, Zachrisson suggested the use of multistranded archwires due to their irregular surface area, which provides sufficient mechanical retention when bonded with composite.(6)

Image 2 - Bjorn Zachrisson

3- Cobourne MT, DiBiase AT: Handbook of Orthodontics. Edinburgh, New York:Mosby; 2009
4- Zachrisson BU: Clinical experience with direct-bonded orthodontic retainers. Am J Orthod Dentofacial Orthop 1977, 71:440–448
5- Knierim, R.W., Invisible lower cuspid to cuspid retainer. Angle Orthod, 1973. 43(2): p. 218-20.
6- Zachrisson, B.U., The bonded lingual retainer and multiple spacing of anterior teeth. J Clin Orthod, 1983. 17: p. 838-44.

In 2001, for the first time the usage of nitinol material for retention treatment was observed by Eric J. Liou. He reported a case from canine to canine for retention treatment and minor alignment for a relapsed case with usage of nitinol material as well.(7) However, bending nitinol material is not easy and that's why the usage of nitinol for retention treatment has never been commercialized until nowadays.

Nickel titanium, also known as nitinol, is a metal alloy of nickel and titanium, where the two elements are present in roughly equal atomic percentages. Different alloys are named according to the weight percentage of nickel; e.g., nitinol 55 and nitinol 60. Nitinol can deform 10 to 30 times as much as ordinary metals and return to its original shape.(8). Nitinol is highly biocompatible and has properties suitable for use in orthopedic implants. Due to nitinol's unique properties it has seen a large demand for use in less invasive medical devices. Nitinol tubing is commonly used in catheters, stents, and superelastic needles. In colorectal surgery,(9) the material is used in devices for reconnecting the intestine after removing the pathogens.

In dentistry, the material is used in orthodontics for brackets and wires connecting the teeth. Additionally, nitinol can be used in endodontics, where nitinol files are used to clean and shape the root canals during the root canal procedure. Because of the high fatigue tolerance and flexibility of nitinol, it greatly decreases the possibility of an endodontic file breaking inside the tooth during root canal treatment, thus improving safety for the patient.

Permatter® is the pioneer in the robotic archwire bending field for orthodontic archwires, especially for nitinol material. The concept of the system was started to build in 2014, particularly for bending lingual orthodontic archwires. In 2017, the founders of Permatter® realized the lack of the "nitinol lingual retainer" in the retention treatment and rerouted the goal for building and developing the robotic bending system for better orthodontic retention treatment.

Manufactured over 25.000 fixed-retainers till date

7- Eric J Liou, L I Chen, C S Huang : Nickel-titanium mandibular bonded lingual 3-3 retainer: for permanent retention and solving relapse of mandibular anterior crowding, Am J Orthod Dentofacial Orthop. 2001 Apr;119(4):443-9.
8- https://en.wikipedia.org/wiki/Nickel_titanium
9- "NiTi Surgical Solutions". www.nitisurgical.com. Archived from the original on 2007-12-08.

Why Permatter® ?

Exceptional Durability

Latest Permatter® V.3.4 boasts unparalleled longevity compared to all other conventional retainers.

Permatter® V.3.4: Ultimate Tensile Strength - 1200 MPa

Twisted Stainless Steel was described as the “golden standard” for orthodontic retention treatment until nowadays.Twisted Stainless Steel has critical problems like debonding, breaking, metal fatigue, biofilm accumulation and cytotoxicity in the period of "long term" usage.

Twisted Stainless Steel - 0.215” : Ultimate Tensile Strength - 700 MPa

Braided Stainless Steel - 0.215”: Ultimate Tensile Strength - 650 MPa

Ribbon Titanium 2 - 027” x .011”: Ultimate Tensile Strength - 480 MPa

Breakage and Failure Rate: The breakage and debonding rate for our current Permatter® stands at an impressively low between 0.1% - 1% , significantly outperforming the average rate from 7.3 to 50%reported for conventional retainers.(10) While breakage may occur, it's crucial to note that it is rarely attributed to design or material flaws; instead, application errors are the primary cause. Detailed instructions for advanced retention treatment are described below.

10- Maciej Jedliński, Katarzyna Grocholewicz, Marta Mazur,Joanna Janiszewska-Olszowska: What causes failure of fixed orthodontic retention? – systematic review and meta-analysis of clinical studies - doi: 10.1186/s13005-021-00281-3

Workflow for Advanced Retention

Utilize digital impression exclusively for capturing the patient's dental situation. This approach eliminates the possibility of impression-taking errors altogether.

Advantages of Digital İmpression

Precision: Digital impression offer unparalleled accuracy, capturing detailed images of the patient's dental structure with high fidelity.

Comfort: Patients often find digital impression more comfortable compared to traditional impression-taking methods, reducing discomfort and anxiety during the procedure.

Efficiency: Digital impression streamline the process, minimizing the time required for data acquisition and subsequent fabrication of dental appliances.

Error Reduction: By eliminating the need for physical impressions, digital impression significantly reduce the likelihood of errors associated with traditional impression-taking techniques.

Enhancing Patient Experience:

Embracing digital impression technology enhances the overall patient experience by offering a modern, hassle-free approach to dental diagnostics and treatment planning.

Investing in Digital Dentistry:

As digital dentistry continues to advance, incorporating digital impression into practice workflows represents a progressive step towards delivering superior patient care and achieving optimal treatment outcomes.

Note: Embracing digital impression technology not only enhances clinical precision but also contributes to a more positive patient experience, ultimately elevating the standard of care in dental practice.

Precautions

Precautions Regarding Active Elements Before Digital İmpression:

It is crucial to adhere to specific recommendations outlined in specialist literature to optimize treatment outcomes and minimize the risk of complications. One such recommendation involves allowing the **last wire** to settle in place for **at least 3 months** before the debonding process. **Debonding earlier will increase the tooth mobility and will risk the outcome of retention treatment.**

Reasoning Behind Waiting Period:

Debonding the wire earlier than the recommended timeframe may subject the teeth to excessive force, significantly elevating the risk of breakage or debonding. This waiting period allows for proper settling and reduces the likelihood of adverse effects on dental integrity.

Caution with Active Elements:

During digital impression procedures, the presence of active elements like power chains or active wires introduces additional considerations. These elements can increase the risk of breakage or failure rate of fixed retainer, potentially compromising the accuracy of digital impression.

Mitigating Risks:

Dental professionals should exercise caution and carefully assess the presence of active elements before proceeding with digital impression. Taking necessary precautions can help mitigate the risk of breakage and ensure optimal outcomes for the patient.

Preventing Breakages Caused by Active Elements:

To minimize the risk of breakages associated with active orthodontic elements, follow these key recommendations:

1. Allow Sufficient Stabilization Time:

Ensure that the last wire has adequately stabilized the patient's teeth for a **minimum of 3 months** before proceeding with any debonding or digital impression procedures. This time frame allows for proper settling and reduces the risk of exerting excessive force on the teeth during retention treatment.

2. Avoid Digital İmpression with Active Elements:

Refrain from conducting digital impression procedures while active elements such as power chains or active wires are in place. These components can exert additional forces on the teeth, increasing the likelihood of breakage or misalignment. Wait until these elements have been removed or until the teeth have reached a stable state before proceeding with digital impression.

3. Conduct Thorough Patient Assessment:

Prior to any orthodontic procedures, assess the patient's dental condition carefully. Evaluate the stability of the teeth, the status of any active elements, and the overall treatment progress. This comprehensive assessment will help identify any potential risk factors and allow for appropriate planning to minimize breakages and complications.

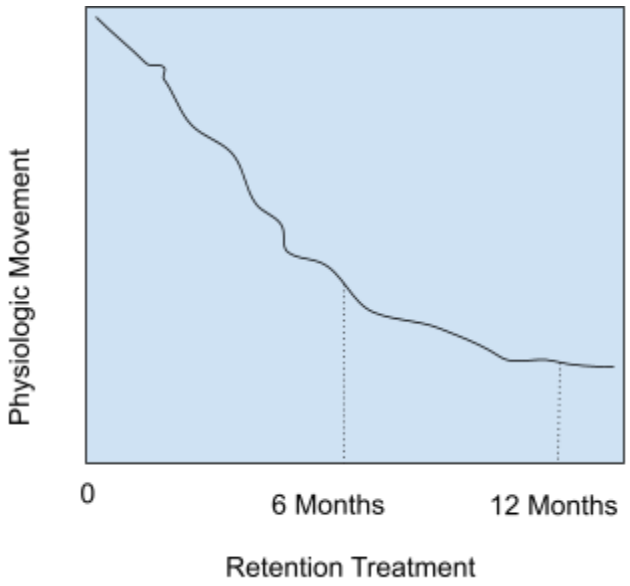
4. Patient Education and Compliance:

Educate patients about the importance of following recommended treatment timelines and guidelines. Encourage compliance with wearing orthodontic appliances as instructed and attending regular follow-up appointments. Emphasize the role of patient cooperation in achieving successful treatment outcomes and avoiding complications.

Physiologic Tooth Mobility After an Orthodontic Treatment

Egli et al. (11) reported that bond failures occurred mainly during the first year; the failure rate was higher during the first year (33%) than the second year (7%). Taner and Aksu (12) who evaluated the failure rate of bonded retainers over a 6-month period reported that the highest failure rate was detected in the first month. These findings suggest that the frequency of bond failure is probably related to tooth mobility (12).

Kyungmin Clara Lee et al. (13) reported evaluated the changes in tooth mobility using the Periotest following orthodontic treatment and demonstrated that tooth mobility decreased rapidly in the course of the first 6 months and then decreased at a slower rate during the next 6 months, with no significant decrease in mobility during the second year (13). Tooth mobility immediately after orthodontic appliance removal is higher than at a later stage during the retention period. These findings indicate that the loosening of fixed retainer might be related to tooth mobility and suggest that a careful recall to check for possible loosening is critical **during the first year of retention. That's why it is recommended that a clear thermoplastic retainer be incorporated with the Permatter® wire for best results for at least 2 year usage.**



11- Egli F, Bovali E, Kiliaridis S, Cornelis MA (2017) Indirect vs direct bonding of mandibular fixed retainers in orthodontic patients: Comparison of retainer failures and posttreatment stability. A 2-year follow-up of a single-center randomized controlled trial. Am J Orthod Dentofacial Orthop 151:15–27
12- Taner T, Aksu M (2012) A prospective clinical evaluation of mandibular lingual retainer survival. Eur J Orthod 34:470–474
13- Kyungmin Clara Lee, Seung-Weon Lim, Jin-Hyoung Cho, Heesoo Oh, Hyeon-Shik Hwang: Survival rates of mandibular fixed retainers: comparison of a tube-type
retainer and conventional multi strand retainers

Preventing Retainer Breakages Due to Bonding Errors

Bonding errors represent a common cause of retainer breakages, often resulting from inadequate preparation of bonding sites or improper bonding techniques. To mitigate the risk of breakages and ensure the longevity of retainers, it is crucial to prioritize meticulous attention to bonding procedures. Here's how:

1. Proper Site Preparation:
Thoroughly prepare the bonding sites on the teeth to ensure optimal adhesion. This includes cleaning and etching the tooth surface according to manufacturer guidelines. Proper preparation promotes better bonding and reduces the likelihood of detachment.

2. Selecting High-Quality Bonding Materials:
Use high-quality bonding materials that are compatible with both the retainer and the tooth surface. Ensure that the bonding agent provides strong adhesion and durability to withstand the forces exerted during normal oral activities.

- **NOTE:** According to the debonding tests results**,** Permatter® shows better results with the usage of **“3M - Transbond™ LR Light Cure Adhesive”.**

3. Precise Bonding Technique:
Adhere to precise bonding techniques as recommended by orthodontic professionals. Apply the bonding agent evenly and avoid air bubbles or gaps between the retainer and the tooth surface. Properly position and secure the retainer to minimize stress on the bonding site.

4. Regular Monitoring and Maintenance:
Periodically evaluate the integrity of the bonding sites and the condition of the retainer during routine dental check-ups. Address any signs of wear, damage, or loosening promptly to prevent further complications and ensure continued effectiveness.

Limitations in Retention

In certain clinical scenarios, such as cases requiring further treatment or exhibiting malocclusion, achieving optimal retention conditions may be challenging. The stability of a retainer cannot be guaranteed when factors such as a deep bite or other malocclusions are present.

For optimal retention outcomes, it's important to consider specific indications where retainers may not be recommended:

Deep Bites in the Upper Jaw:
Retainers may not be suitable for individuals with deep bites in the upper jaw, as this can impact the effectiveness of retention.

Deficient Overjet:
Individuals with deficient overjet may not benefit from retainers, as the lack of horizontal overlap between the upper and lower front teeth can affect retention.

Occlusal Points in the Anterior Region:
Presence of occlusal points in the anterior region may pose challenges for retention, as these irregularities can interfere with the stability of the retainer.

Open Bites:
Open bites, where there is insufficient vertical overlap between the upper and lower teeth, may not be conducive to successful retention with traditional retainers.