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Review Article

A Comparative Analysis of the Most Common Obturation Techniques in Endodontics

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Abstract

The quality of root canal obturation has a significant impact on the outcome of endodontic treatment. By hermetically sealing the root canal system after it has been cleaned and sculpted, obturation helps to promote periapical healing and stop microbial infiltration.

There are many different obturation processes available, from sophisticated thermoplasticized and bioceramic-based approaches to conventional cold lateral compaction. The classification, comparison, benefits, and drawbacks of various methods are examined in this article, which offers a thorough analysis based on the most recent data [1].

Keywords: *Root Canal Obturation; Endodontic Treatment; Cold Lateral Compaction; Thermoplasticized Techniques*

Introduction

By cleaning, obturating, and contouring the root canal system, endodontic therapy seeks to avoid infection. Obturation, which seals the canal system apically and coronally, is essential for long-term success. Clinicians need to be aware of the relative efficacy of each technique, emphasising its benefits, drawbacks, and therapeutic implications in light of the most recent research [2].

Following chemomechanical preparation, obturation is a process used to entomb remaining germs and stop microorganisms from re-entering the body. Materials, technique, and the structure of the root canal system all affect how effective it is. Over time, methods such as thermoplasticized gutta-percha and cold lateral compaction have been improved to enhance the quality of coronal and apical seals [3].

Classification of obturation techniques [4]

The following general categories apply to root canal obturation techniques:

1. Cold gutta-percha techniques:
    - Cold lateral compaction.
    - The single cone method.

2. Thermoplasticized injection techniques (e.g. Obtura, Calamus):
    - Warm gutta-percha techniques.
    - Warm vertical compaction.
    - Carrier-based systems (e.g. Thermafil).
3. Seal-based methods [5]:
    - Single-cone bioceramic sealers.
4. Sealers based on resin
    - Methods based on zinc oxide and eugenol.

Advantages and disadvantages of various techniques

Cold lateral compaction [6]:

Advantages

- Economical.
- Easy to learn and execute.
- Broadly taught and utilised.
- Good length control [2].

Disadvantages:

- In irregular canals.
- Poor adaptability.
- Time-consuming.
- Void-prone.

Warm vertical compaction [7]

Advantages:

- Better adjustment to imperfections and canal walls.
- Successful lateral canal filling [4].
- A decrease in void formation.

Disadvantages:

- Technique-sensitive.
- Overfilling risky.
- Necessitates specialised equipment.

Thermoplasticized injection techniques [8]:

Advantages:

- Fast canal filling.
- Better uniformity of obturation mass.
- Outstanding flow into intricate canal anatomy [5].

Disadvantages:

- Expensive.
- Risk of overextension.
- Challenging to retreat from.

Carrier-based systems [9]:

Advantages:

- Reliable, consistent filling.
- Effective for canals that are narrow or curved [6].

Disadvantages:

- Limited alternatives for retreatment.
- Carrier peeling during installation.

Bioceramic-based techniques [10]:

Advantages:

- Superior sealing because to bioactivity and expansion.
- Antimicrobial and biocompatible [7].
- The single cone approach is simple to utilise.

Disadvantages:

- Sensitivity of technique during sealer installation.
- Difficult removal during retreatment.
- Insufficient long-term clinical data.

Comparison of the various techniques [11]

S.no	Method	Adjustment	Seal Quality	Usability	Retreat ability	Equipment Needed
1.	Cold Lateral Compaction	Moderate	Moderate	High	Easy	Minimal
2.	Warm Vertical Compaction	High	High	Moderate	Moderate	Advanced
3.	Thermo plasticized Gutta-Percha	High	High	Moderate	Difficult	High
4.	Carrier Based	High	High	Easy	Difficult	Moderate
5.	Bio ceramic with Single Cone	Moderate	High	Very Easy	Difficult	Minimal

Table

More on cold lateral compaction (CLC)

A method used in endodontics to fill and seal a cleaned root canal space is called cold lateral compaction. Its fundamental filler substance is gutta-percha, which resembles rubber. The gutta-percha is inserted into the canal using a sealer, and it is laterally compacted against the canal walls using a spreader. This approach is popular, easy to use, and reasonably priced, however it might not work well in canals with irregular shapes [12].

Steps to be taken:

- Placement of the master cone: A master gutta-percha cone that is the right size and shape for the finished canal is sealed and inserted into the canal up to the working length.
- Lateral compaction: The master cone is laterally displaced and space is created by inserting a finger or hand spreader next to it.
- Insertion of accessory cones: Smaller accessory cones that have also been sealed are placed in the empty space. Until the canal is so crowded that it can no longer hold any more cones, this process is repeated.
- Finishing and sealing: The leftover gutta-percha is vertically crushed and sealed after the excess is removed at the canal opening.

Discussion

Several studies have been used to draw comparisons and evaluate different techniques that are used to fill the root canal in primary and deciduous teeth. After meticulously evaluating the techniques, it is seen that the cold lateral compaction technique requires less equipment, minimal adjustment and is easily retreatable in cases where re endodontics is done. Whereas the techniques of warm vertical compaction, and thermoplasticized gutta percha require high adjustment, high quantities of sealer, require high skill equipment and are poorly retrieved. On the other hand using bio ceramic sealer simple usability factor is often preferred in single cone obturations and is less economical. Hence based on comprehensive and comparative analysis it is deciphered that due to its ease of use and dependability in simple situations, cold lateral compaction is still often taught and used, even in the face of more recent methods like warm vertical compaction and thermoplasticized gutta-percha systems [13].

Conclusion

The success of endodontic treatment depends on root canal obturation, and there is no one method that is always better. Techniques must to be customised for each case, taking into account elements such as equipment availability, operator expertise, anatomical variances, and root canal shape. Conventional procedures such as carrier-based systems, thermoplasticized methods, warm vertical compaction, cold lateral compaction, and bioceramic-based technologies are dependable. The physical seal and biological contact are being improved by new materials and technology [14].

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