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COMPARISON OF THREE DIFFERENT ROOT CANAL OBTURATION MATERIALS IN TERMS OF ADAPTABILITY

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Abstract:
Objective: In this study, the capacity of gutta-percha, gutta Flow, and Soft-Core obturation materials to attach to root canal walls was tested for each of the three materials.
Methods: A total of 30 mandibular premolar teeth were selected using the materials and methods listed below. The teeth were standardised with the use of ProTaper rotary files. It was decided to use three groups of gutta-percha with AH Plus sealer, one for each of the following: lateral compaction technique, Soft-Core system, and Guatta-Flo system. Using a stereomicroscope at a magnification of 40, these three levels of tooth roots were sectioned off and studied under a stereomicroscope at a magnification of 40. As a consequence of the application of image analysis, the area of voids (AVs) as well as the frequency of occurrence was determined.
Results: Gutta Flow had the lowest mean AV, 1.17 percent, with a standard deviation of 0.50, followed by gutta-percha, which had a mean AV of 1.49 percent, with a standard deviation of 0.26, and Soft-Core, which had a mean AV of 1.83 percent, with a standard deviation of 0.71. There was no statistically significant difference between the three groups and their respective root levels, according to the results of the statistical study. Gutta-Flow and gutta-percha, which have the highest number of voids, are the next two materials on the list.
Conclusion: Gutta Flow's capacity to adapt to the walls outperforms both the Soft-Core system and laterally compacted gutta-percha with AH Plus sealer in terms of flexibility. Gutta Flow is an excellent endodontic obturation substance that works well in a variety of situations.

抽象的：
目的：在本研究中，对三种材料中的每一种都测试了牙胶、牙胶流和软芯充填材料附着在根管壁上的能力。

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方法：使用下面列出的材料和方法选择总共 30 颗下颌前磨牙。牙齿使用 ProTaper 旋转锉进行标准化。决定将三组牙胶与 AH Plus 密封剂一起使用，以下各一组：横向压实技术、软芯系统和 Guatta-Flo 系统。使用放大倍数为 40 的立体显微镜，切下这三个水平的牙根，并在放大倍数为 40 的立体显微镜下进行研究。发生的频率被确定。
结果：Gutta Flow 的平均 AV 最低，为 1.17%，标准差为 0.50，其次是古塔胶，其平均 AV 为 1.49%，标准差为 0.26，而 Soft-Core，其平均 AV 为 1.49%，标准差为 0.26。平均 AV 为 1.83%，标准差为 0.71。根据统计研究的结果，三组及其各自的根级之间没有统计学上的显着差异。 Gutta-Flow 和gutta-percha 的空隙数量最多，是列表中的后两种材料。
结论：在灵活性方面，Gutta Flow 适应墙壁的能力优于 Soft-Core 系统和使用 AH Plus 密封剂横向压实的古塔胶。 Gutta Flow 是一种出色的牙髓充填物质，适用于各种情况。

Introduction:

The three-dimensional obturation of the root canal system aids in the improvement of periapical healing and the prevention of disease progression. The hermetic seal produced at the apical dentinocemental junction will have an impact on the success of obturation in some cases. Because of its nontoxicity and lack of irritation to periapical tissues, gutta-percha was the most commonly used ingredient in root canal fillings until recently. Because of its inability to bind to canal dentin, Gutta-percha 2,3 is considered a disadvantage. 4 As a result, it is frequently used in conjunction with root sealer to achieve the desired obturation outcome.

GUTTA-PERCHA vertical and lateral compactions with AH Plus are common applications for this resin-based sealer (Dentsply De Trey, Konstanz, Germany). Due to AH Plus's lack of gutta-percha binding, its ability to seal is called into question, despite the fact that it has adequate long-term dimension stability. 5 When compared to modern root canal filling processes and materials, cold lateral compaction has been utilised widely for a very long time. 4

It is possible that while using the cold lateral condensation technique, there is inadequate condensation pressure or that there is a mismatch between the tapers of the spreader, gutta-percha cone, and canal, this will result in voids between the gutta-percha cones. Because of this, a variety of materials and processes have been developed to improve the ability to seal surfaces. The Soft-Core technique (Aps, Copenhagen, Denmark) was developed in 1978 by Johnson and is a method of thermoplasticized canal obturation that makes use of a metal carrier coated with an absorbent gutta-percha covering that is heated to allow for thermoplasticized canal obturation. 4,7 Among the many advantages of Soft-Core are shorter chairside times and quicker gutta-percha setup. 8 In order to obturate cold fluids, the GuttaFlow technique (Coltene/Whaledent, Altstatten, Switzerland) uses a sealant in conjunction with gutta-percha (Coltene/Whaledent). A suspension of gutta-percha particles suspended in a polydimethyl siloxane base is what GuttaFlow is made of. GuttaFlow has a high degree of flexibility as a result of its increased flowability and seal. 9

Considering GuttaFlow's fluidity, it is perfect for applying a thin sealer film to a variety of surfaces. Several features, including antimicrobial, insolubility, biocompatibility, and post setting expansion, make it a viable obturating material, according to the company.

There have been a plethora of approaches used in the past to assess root canal filler material adaption to the root canal walls, including dye penetration and radioisotope tests, microbe penetration, and electrochemical techniques. 10,11 Unlike the others, each method has its own set of advantages and disadvantages. But it has been shown that viewing root cross-sections with a stereomicroscope provides a three-dimensional viewpoint of the surface under investigation, which helps to eliminate human error when interpreting parameter values. 7

Material and Methods:

Making a Selection

Thirty-five single-rooted human mandibular premolar teeth of the same length were utilised in the experiment. The teeth had been pulled three months earlier because of time Each tooth had no additional tissue or calculus on it. There was only one canal, a closed apex and no curvatures in the teeth, according to a visual After the crown of each tooth had been removed using diamond discs, root segments could be extracted from the tooth's cementoenamel junction. At regular intervals, the integrity of the apical foramina was examined using a size 15 K-file with the tip barely visible. Overall, individual working lengths were found to be about 0.25 millimetres short of what is considered Study participants were disqualified if their teeth were larger than 15mm in diameter, had sclerotic canals, or had changed tip.

Preparation of Canal

ProTaper nickel-titanium instruments were used to prepare the samples in accordance with the manufacturer's instructions. In order to operate a 64:1 gear reduction handpiece at a constant speed of 300 revolutions per minute (rpm) while keeping a consistent speed, an electric stepper motor with torque control was used. In a crown-down technique, rotary instruments were utilised successively till F3. A total of 3 mL of 5 percent sodium hypochlorite was injected into each canal, followed by 1 mL of 5 percent sodium hypochlorite in between each A 17 percent solution of ethylenediaminetetraacetic acid was used to cleanse each channel (EDTA). With the help of paper tips, the canals were dried All irrigation was done using a 27-gauge needle. Following careful instrumentation and irrigation, each canal was dried using sterile paper points.

Incomplete or complete occlusion of the root canal

Root canal obstruction occurs when the root canal becomes blocked. After being randomly assigned to one of three groups of ten teeth each, the teeth were obturated in the order listed below:

- This group is sealed with gutta-percha and AH Plus sealer.
- A master gutta-percha cone with a diameter of 30/0.02 had to be inserted into the WL canal in order to obtain a tug-back. The manufacturer's instructions were followed while making the AH Plus sealer mixtures. Along the canal's entire length, paper tips were used to apply the sealant. Following a meticulous application of sealant on top of the gutta-percha master cone, it was carefully put into the canal
- The use of a fine finger spreader in conjunction with additional gutta-percha points was used to achieve lateral compression. This was due to the canal's compaction, which prevented the spreader from going any deeper than 2 millimetre This layer was removed with

the help of a heated instrument, and then crushed vertically with hand pluggers to remove any remaining gutta-percha. These specimens were sealed using the AH Plus sealer and the Soft-Core system.

- The International Organization for Standardization verifier was used to determine the size of the Soft-Core system obturator. The AH Plus sealer was then used to seal the canal. To complete the operation, the obturator was placed in the Soft-Core oven. It was withdrawn from one of the top slots and placed all the way to the WL position when it showed that the oven was ready. A twisting action was used to remove the handle and insertion pin from the gadget. It was necessary to remove the surplus plastic core material using an inverted cone bur. An electric hand plugger crushed the gutta-percha vertically, creating a fine powder. Gutta Flow obturation studies were performed on Group III specimens. As a result, we chose to use a 30/0.02 master gutta-percha cone, which was placed in canal up to the WL until a tug-back was attained

Gutta Flow capsules were vibrated for 30 seconds in an amalgamator before use, as directed by the manufacturer. If any material protruded from the foramen after filling the canal with Gutta-tip Flow's positioned 3 millimetres below WL, the foramen would have been sealed. By pressing the mixing gun against a glass slab, a fresh mix was created. Before placing the gutta-percha master cone into the hole, the WL was sealed with Gutta Flow. After backfilling the canal, the device's tip was re-inserted into the canal and the master cone was squeezed to cover the space left behind. Using an excavator, construction workers removed leftover material from the building site. Gutta-percha was vertically condensed using an electric hand plugger in this experiment. Radiographs of the buccal and mesial aspects of all groups were taken to evaluate the quality of the root canal filling, which should be thick with no gaps and extend to within one millimetre of the root end in all cases. Using the IRM approach, all of the roots were recovered.

A Guide to Sampling and Sorting Selected

Coronal (middle of coronal-third), middle (middle of middle-third), and apical segments were created for each root based on its length (at the middle of apical third). In this experiment, sectioning was performed with an Isomet saw submerged in water coolant. There is a 2 mm thickness to the A stereomicroscope with a magnification of 40 was used to examine the samples. With image analysis, the area of voids and the number of void-containing sections were identified (either in the filling core or along the root canal wall). Measurements were taken for future reference of the length and width of each root canal, as well as the size of any cavities in the each object's cross-sectional area was divided by the number of vacancies to arrive at.

Statistical Analysis:

The recorded data was analyzed by using the SPSS software, version 25.0. The quantitative variables like area of voids in three endodontic' materials, in percentages with mean and standard deviation is evaluated. While frequencies of voids in gutta percha, soft core and gutta flow within the root canal is also analyzed. The independent t test is used to show the difference between the endodontic' materials. P value less

than 0.05 is considered significant with 95% confidence interval.

The percentages of area of void in all three compared endodontic' material with their means and standard deviation as listed below:

Results:

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Gutta.percha	10	1.20	1.90	1.4900	.26854
Soft.core	10	.80	2.80	1.8300	.71344
Gutta.flow	10	.40	1.90	1.1700	.50343
Valid N (listwise)	10				

The independent t test is used to analyze the difference between percentages of area of voids of gutta percha and soft core, soft core and gutta flow and gutta percha and gutta flow. The resulted p value in all compare means is less than 0.05. hence the test is insignificant statistically.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
materials1.2	Equal variances assumed	9.595	.006	-1.410	18	.175	-.34000	.24106	-.84645	.16645
	Equal variances not assumed			-1.410	11.500	.185	-.34000	.24106	-.86777	.18777
materials2.3	Equal variances assumed	1.715	.207	2.390	18	.028	.66000	.27612	.07989	1.24011

	Equal variances not assumed			2.390	16.182	.029	.66000	.27612	.07518	1.24482
material 1.3	Equal variances assumed	4.088	.058	1.774	18	.093	.32000	.18043	-.05907	.69907
	Equal variances not assumed			1.774	13.738	.098	.32000	.18043	-.06768	.70768

The frequency of void in all 10 individuals treated with gutta percha is 8 as shown below:

FREQUENCY OF VOIDS IN GUTTA PERCHA	Frequency	Percent
0	3	30.0
1	6	60.0
2	1	10.0
Total	10	100.0

The frequency of void in all 10 individuals treated with soft core is 16 as shown below:

FREQUENCY OF VOIDS IN SOFT-CORE	Frequency	Percent
1	4	40.0
2	6	60.0
Total	10	100.0

The frequency of void in all 10 individuals treated with gutta flow is 12 as shown below:

FREQUENCY OF VOID IN GUTTA FLOW	Frequency	Percent
0	1	10.0
1	6	60.0
2	3	30.0
Total	10	100.0

Discussion:

To avoid microleakage within the root canal system of the tooth, endodontic therapy is used. In the building of a three-dimensional root canal obturation, the materials employed determine the success of the procedure. 12 Vacuums are an important indicator of the quality of canal filling. Assigned to study groups by stratified randomization, the canals were created by a single operator using well-established techniques to minimise anatomical variance and canal variability as well as to allow for standardisation of operation. Rather than at predetermined intervals from the apex, teeth were sectioned according to the root length in this investigation. This was done in order to capture the same data at different root levels of the tree, which was the goal 9

Your perspective may dictate the importance of root canal therapy's removal of the smear layer. As a general rule, root canal filling materials penetrate dentinal tubules more readily when the smear layer is missing. A 17 percent EDTA solution and a 5 percent sodium hypochlorite solution were used in the previous study to dissolve the smear layer and increase root canal filling material penetration and adaptation. 2,13

Following the Soft-Core group in this study, GuttaFlow and laterally condensed gut-percha ranked second and third, respectively. Gutta-percha can be removed from the solid core carrier in a Soft-Core composite material, according to previous research. 14 An insufficient adaption of the solid carrier's defect-prone surface results in direct contact with the canal walls and an increase in canal space. However, despite the fact that both gutta-percha and soft-core were laterally compressed, the centre thirds of both groups had more voids. In the middle thirds of the premolar teeth, there are little oval canals.

It was revealed that numerous oval canals lacked instrumentation as a result of the inaccessibility of the file, which could lead to poor quality 14 Out of all the categories, the apical third had the fewest vacancies. A circular apical third of canals may boost the master point's matching fit and adaptability, resulting in a more adaptable filling material. A higher proportion of AVs was observed in the GuttaFlow group than in the gutta-percha group; however, because GuttaFlow had the smallest holes of the three groups, it was found to have the lowest percentage of AVs. 9 The microleakage age of Gutta Flow created using a single-cone technique is comparable to that of gutta-percha produced using lateral condensation, but lower than that of gutta-percha produced using vertical condensation, according to similar research A single gutta-percha master cone combined with gutta flow provided an apical seal similar to that produced by heated vertical gutta-percha/AH Plus sealer compaction 16.

17 It was found that, over the course of time, GuttaFlow approaches outperformed those that used AH Plus to help compress and obturate a single cone, in terms of apical and coronal sealing performance. 18 When Punia et al. compared GuttaFlow to resilon, thermafil and lateral condensation, GuttaFlow had the highest rate of microleakage at the apex. No statistically significant differences in root canal wall flexibility were seen in the 19 tests that compared cold lateral condensation with Soft-Core obturation. 8 When compared to cold lateral condensation and hybrid gutta-percha condensation, Softcore produced the highest mean number of voids. Softcore's apical leakage

was found to be at least twice as bad as the other two gutta-percha obturation methods. 20 There were no holes or cavities in any of the root canals, as previously stated.

The gutta has three major divisions: the gutta-apical, the percha's middle, and the coronal thirds. The gaps were discovered in the interphase between sealer and obturation material, as well as between sealer and root canal walls, in the gutta-percha and Soft-Core groups, but they were almost fully contained within each of the three groups in the GuttaFlow group. 14 A modest number of small spaces were found in GuttaFlow's core, while huge voids were found in the other two groups.

This sealer was the most homogeneous of the three, with no defects, compared to gutta-percha lateral condensation and Soft-Core processes. GuttaFlow's flow ability is further enhanced by the inclusion of fine-grained gutta-percha particles (nanoparticles 30), resulting in a greater coating capacity and adaptation to root canal walls and dentinal tubule surfaces. 21 A uniform sealer dispersion is achieved by using a production technique and sealer with a high viscosity. 9 You will find that GuttaFlow is more adaptable than gutta-percha lateral condensation and Soft-Core materials in this experiment, despite the presence of small holes inside the material's core. In conjunction with the gutta-percha cone's snug fit on the walls, the manufacturer's claim of a 0.2 percent expansion could explain this.

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