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roots

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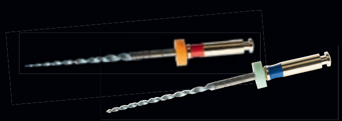

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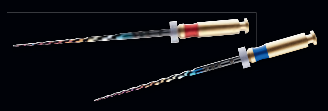

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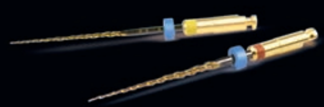

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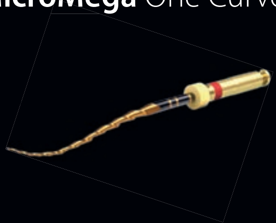

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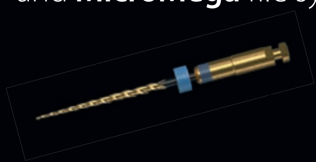

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Magda Wojtkiewicz

Managing Editor

Innovations

Innovation has become a very desirable thing. When we think about innovation, we think about a new product, material or technology to use. As customers, we like innovations. Every year, hundreds of thousands of people around the globe eagerly await the latest iPhone or other electronic device. A similar thing happens in the dental industry ahead of the International Dental Show (IDS), which takes place in Cologne in Germany every two years. Dentists, dental assistants, dental technicians, many other dental professionals and dental students enthusiastically look forward to the innovations to be presented at IDS.

Innovation concerns more than new products, materials and service however. Innovation can also be the use of existing products and procedures to improve efficiency, as well as the development of new methods or protocols of treatment.

Minimally invasive endodontics is considered an innovative treatment method. Unlike conventional endodontics, it is not only focused on eliminating bacteria from the infected root canal and preventing reinfection of the tooth, but it also aims to retain as much of the healthy tooth tissue as possible, which significantly impacts the long-term viability of an endodontically treated tooth. Minimally invasive endodontics is a great example of an innovative approach to existing methods, products and materials. This is a growing area of development and according to the IDS 2023 organisers, minimally invasive endodontics together with regenerative procedures will be in focus during the next exhibition.

Digitalisation is another area where innovative thinking can change the approach to treatment methods. An increasing number of digital tools are being developed which allow general practitioners to properly diagnose and perform endodontic treatment backward planning. According to the organisers, IDS 2023 will showcase an abundance of suitable software for endodontic planning and smooth communication between the different practices involved.

There will be a great deal to discover during IDS 2023, which will be a jubilee event, celebrating 100 years since the first IDS took place in 1923, as well as the 40th edition of the trade fair. “Enhancements and alternatives to recognised endodontic treatment routines have repeatedly been presented at IDS,” said Mark Stephen Pace, chairman of the board of the Association of the German Dental Industry. “That was already the case at the very first trade fair of its kind in the year 1923; for example, in its era, the Walkhoff paste was considered to be a novel bacteria-eliminating root filling material. And the same will also be true in 2023 when we celebrate the 100th anniversary of IDS. [...] As the leading global trade fair of the dental industry, IDS 2023 provides a unique orientation as to how a dental practice can strive to attain these achievements. The trade fair is celebrating its 100th anniversary from 14 to 18 March 2023 in Cologne.”

I hope that you will find this issue of roots innovative, and I look forward to the next issue, in which we will write more about the new products, materials and methods to be presented at IDS 2023.

Magda Wojtkiewicz
Managing Editor


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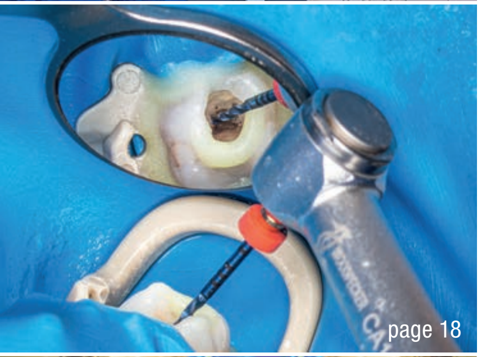
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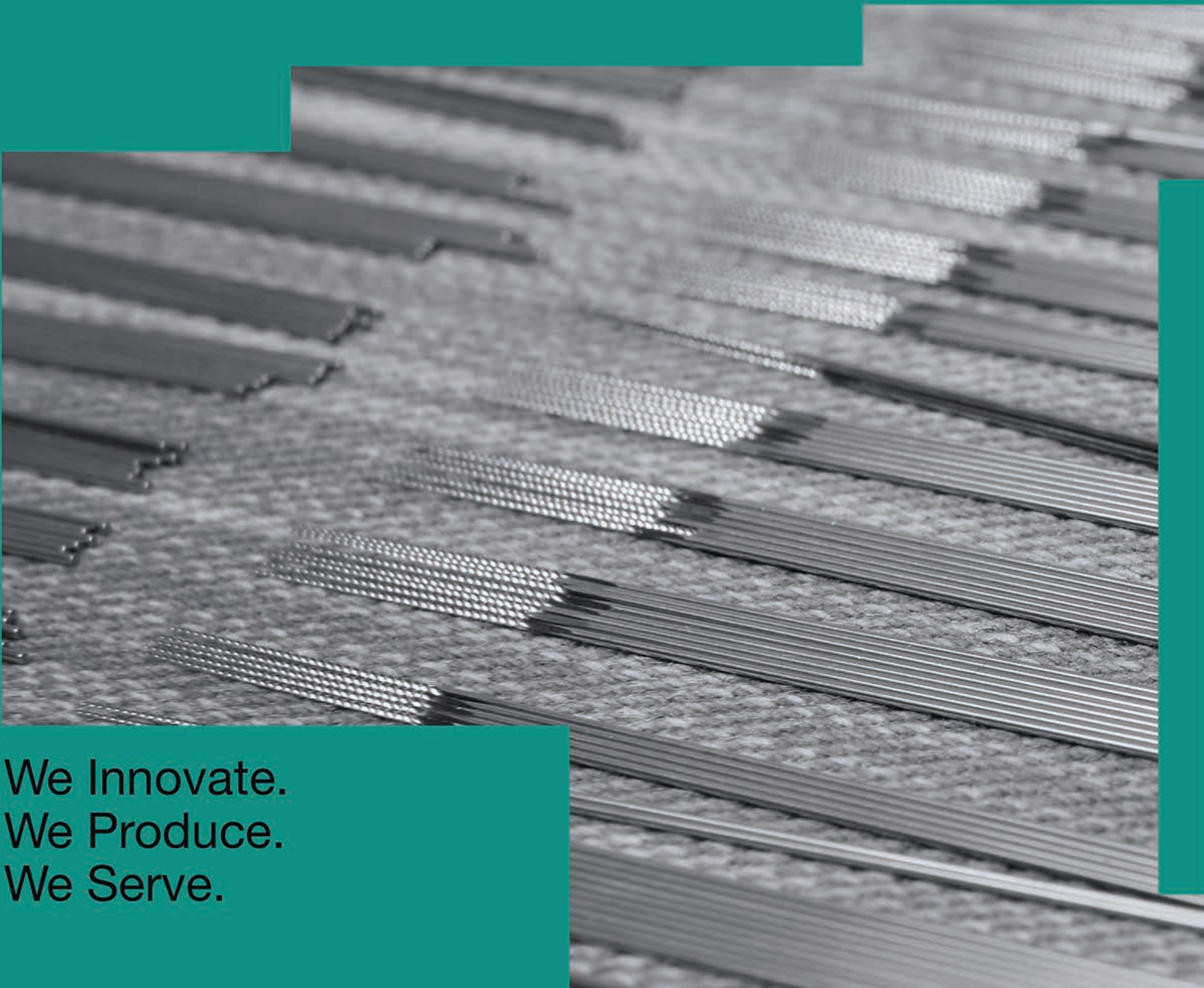

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Endodontics fine motor skills with the use of conventional and 3D microscopy—a comparative study

Drs Jenner Argueta, Ana Jiménez, Rafael Genao & Rodrigo Vargas, Dominican Republic & Guatemala

Introduction

Owing to the introduction of magnification principles in dentistry, new techniques have been implemented for the successful performance of endodontic treatments. Microscopes have become an integral part of modern endodontics,[1] and the use of conventional microscopy is becoming more frequent.[2–4] Despite the significant cost and training required, the use of the operating microscope is highly recommended to improve the visualisation of the operative field and to enhance the diagnostic capacity of the clinician, including the identification of isthmuses, accessory canals, complex pulp chamber anatomy, calcifications, obstructions and microfractures, among others,[5,6] which would otherwise be difficult to identify and treat. This results in better quality care and a higher success rate of treatments.[7,8] It has also been shown that the use of the operating microscope leads to a considerable improvement in ergonomics and therefore tends to reduce the occurrence of injuries related to poor posture and stress due to repetitive movements during the clinical workflow. All the advantages begin to be more palpable and applicable after going through the appropriate clinical training for acquiring the required skills to work under the microscope.[9,10]

Through technological advances, a new generation of microscopic equipment with 3D technology has been developed that eliminates the binocular elements and offers an improvement in perception, clarity, depth of field, freedom of movement and clinical productivity in treatments. However, 3D microscopes have not been widely investigated, and scientific findings on their use and their influence on the fine motor skills of the operator are still limited. The purpose of this study was to evaluate and compare fine motor skills with the use of the conventional microscope and the 3D microscope in endodontic practice.

Methodology

Fifteen dentists who had no regular or recent clinical experience in the use of the operating microscope participated in this study. The study participants were

Fig. 1: Alpha Air 6 dental operating microscope.

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Fig. 2: The PromiseVision 3D surgical microscope being used during an apical microsurgery procedure.

final-year students and lecturers at the dental school of the Universidad Mariano Gálvez de Guatemala in Guatemala City. Each participant performed three manual tests of precision and dexterity divided into three stages as follows: unaided vision, using an Alpha Air 6 operating microscope (Seiler Instrument; Fig. 1) set to 8× magnification and using a PromiseVision 3D microscope (Seiler Instrument; Fig. 2) set to 8× magnification.

All the dentists involved in the study received 6 hours of theoretical and practical training on the basic use of conventional and 3D microscopy. The training was given by second-year residents in endodontics from the Universidad Nacional Pedro Henriquez Ureña in Santo Domingo in the Dominican Republic. After the training, the participants performed the manual dexterity and fine motor skills tests. The tests required accurately penetrating a series of millimetric circular targets using a 21 mm #10 K-file. The targets were printed on a #20 calibre paper sheet with eight spaces, each space having ten circular targets inside (Fig. 3). Four of the spaces contained targets of 0.3 mm in diameter and the remaining four contained 0.35 mm diameter targets, corresponding to the letter "O" calibration in sizes 2 and 2.5, respectively. The position of each target within the field was determined by a Microsoft Excel randomised number generator.

During the fine motor skills tests, the time that the participants took to complete the test was recorded, from the penetration of the first target to the penetration of the last target (Fig. 4). To score accuracy and dexterity, a grading system of 0–3 points was used, 0 being the least accurate and 3 being the most accurate. A score of 3 was assigned if the file penetration was entirely within the target, a score of 2 was recorded if the penetration touched the edge of the target and was more than 50% within the target, a score of 1 was assigned if the penetration touched the edge of the target, but was more than 50% off the target, and a score of 0 was assigned if the target was completely intact, was missed or was penetrated more than once.

Table 1: Time differences and effectiveness

	Average time to complete the tests in seconds (CI)	Mean microscopic precision score (CI)
No magnification	304 (259–347)	150 (128–171)
Conventional microscope	656 (525–780)	193 (173–210)
3D microscope	640 (554–773)	185 (174–197)

The completed test sheets were evaluated by two calibrated blinded evaluators with the help of a tabletop microscope. The scores for the 80 targets were calculated individually, obtaining a maximum possible score of 240. The statistical analysis was performed using the RealStatistics Using Excel program. The Shapiro–Wilk $p > 0.01$ test was performed to evaluate the normality of the data sample.

Results

Using the one-factor analysis of variance test for correlated differences, statistically significantly lower precision ($p < 0.05$) was found for working without magnification. The Tukey post hoc test showed statistically significantly greater precision ($p < 0.05$) when the 3D microscope was used. The one-factor analysis of variance test and Tukey's post hoc tests found statistically significant differences ($p < 0.05$) in terms of the time needed to perform the precision test, working without magnification taking less time than working with conventional magnification and with 3D microscopy.

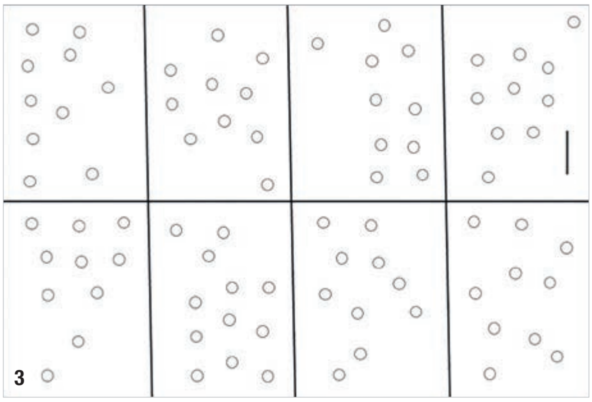

Fig. 3: Sheet chart used during the fine motor skills tests.

The time needed for the operator to adjust the microscope and to feel comfortable to start working on the tests was also measured. A shorter adjustment time was needed when the 3D microscope was used in comparison with the conventional microscope, and this difference was statistically significant. The mean adjustment time was 1.19 and 4.13 minutes, respectively.

Fig. 4: The study participants working on the fine motor skill tests.

The analysis of the results revealed that the tests with the greatest difference ($p < 0.05$) in both variables (time required and precision demonstrated) were those carried out when working without magnification, compared with working with conventional and 3D microscopy. It can be seen in Table 1 that it took less time on average to perform the test when not using magnification, but the scoring results on accuracy were directly proportional to time: the less time it took to perform the test, the less accurate the operator was. With the use of conventional and 3D magnification, significant differences were found in both time and effectiveness. It can be seen in Table 1 that the completion time was shorter for the tests using the 3D microscope, compared with the tests carried out with a conventional microscope. The accuracy score obtained was higher when the conventional microscope was used. It is worth mentioning that the precision tests were performed on flat images, which may have influenced the perception of objects when performing the test using the 3D microscope. It is recommended to carry out a similar study by carrying out precision tests on 3D objects.

Discussion

It is necessary to understand the importance of magnification to achieve quality results in dental procedures and to reduce the margin of error, and the use of magnification in turn requires fine motor skills in dentistry. That is why this study aimed to evaluate and compare fine motor skills without the use of magnification, with the use of a conventional microscope and with the use of a 3D microscope. Over the years, the advantages of magnification in dentistry have been demonstrated. Now, we have progressed to studying the new 3D magnification system plus the contributions that it can make to clinical practice.

The results showed that the magnification systems used effected an increase in the fine motor skills of the participants, regardless of the type of magnification used. Regardless of the time it took to learn to work under the microscope or to complete a test, it is evident that the use of magnification improved the results and made the motor skills of the participants more efficient, resulting in marked precision during the testing. These results are quite similar to those reported by Wajngarten et al., demonstrating that magnification makes a significant contribution to and allows for better results in clinical work.[7, 11, 12]

It is understandable that, initially, the working time tends to be shorter when the microscope is not used, and the quality of the work is directly proportional to the time needed to perform the task. Using magnification requires theoretical and practical learning that, once achieved, will provide advantages in quality of work and improvements in the operator's motor skills and ergonomics.[7, 8, 13] It is important to note, as previously mentioned, that the use of magnification provides better visualisation and illumination of the operative field, helps to avoid long-term health problems, reduces the probabilities of occupational stress and improves working position.[9, 10] The contributions of conventional microscopy have been well studied. It has effected a positive change in modern dentistry, facilitating better quality treatments with less execution time and higher success rates and thereby promoting a more pleasant experience for the dental professional and for the patient.

Despite being a relatively new magnification device and little studied so far, the 3D microscope achieves the desired quality standards. It is a tool that makes it easier for us to achieve results like those obtained with conventional microscopy and has the additional advantage of offering greater freedom of working position to the operator and an outstanding depth of field. Regarding the comparison with conventional microscopy, some differences could be linked to the time it takes to master the use of this technology; however, both magnification tools provide a considerable contribution to the execution of any dental treatment.[13, 14]

Conclusion

Through evaluating and comparing fine motor skills with the conventional microscope and the 3D microscope, we found that both devices contributed to the enhancement of fine motor skills, allowing the participants to achieve better results. 3D microscopy is a novel tool that is likely to become part of the standard equipment in dentistry, contributing positively to the implementation of microscopy in all specialties of dentistry.

Editorial note: A list of references is available from the publisher.

about

Dr Jenner Argueta earned his degree in dentistry and master's degree in endodontics from the Universidad de San Carlos de Guatemala in Guatemala City in Guatemala, where he achieved multiple awards as an outstanding student. He is a certified researcher at the Guatemalan national council for science and technology and teaches endodontics at the Universidad Mariano Gálvez de Guatemala in Guatemala City. Dr Argueta also runs a clinical practice focused on micro-endodontics and micro-restorative dentistry. He was president of the Academia de Endodoncia de Guatemala (endodontic academy of Guatemala) from 2016 to 2020 and is the Guatemalan representative for the Latin American Endodontic Association. Dr Argueta can be contacted at jennerargueta@gmail.com.

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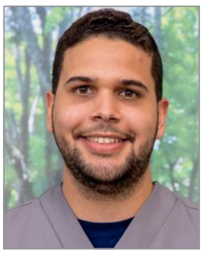

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