

laser

international magazine of laser dentistry

1²⁰¹⁰



| overview

Laser phototherapy (LPT) in dentistry

| social news

Official Awarding Ceremony EMDOLA

| laser

13th Laser-Beginners-Congress "LASER START UP"
and 18th Annual Conference of DGL



My AT Fidelis gives me the gentle touch my little patients need. No more whining noise and vibrations from the drill. Most patients don't even need any anesthesia! I work faster, can do procedures without suturing and get great results. Gone are my days of treating terrified patients: they now interact with me completely differently. They love coming to my practice and so do their parents!

[Signature]
Fotona user since 2003



Fotona
choose perfection

AT Fidelis Highest Performance in Dental Care

Revolutionizing Dentistry

The AT Fidelis is Fotona's newest generation in dental laser systems. With dentistry's two best lasers in one system, you can provide the ultimate in dental care! AT Fidelis' Er:YAG, the world's fastest drilling, hard tissue laser, features broadened soft tissue surgery capabilities with the finest low pulse, high repetition rates. Its top-of-the-line Nd:YAG laser provides trouble-free endodontic, surgical and aesthetic procedures. Both lasers feature VSP technology, enabling controlled and constant laser intensities, in an unprecedented five, selectable pulse duration modes.

Convenience and Safety First

The AT Fidelis includes the newest Comfort Mode touch screen navigation system. Its pre-set treatment programs and data storage facility offer ultimate treatment management. Selecting the right treatment settings has never been easier!

Its Advanced Mode enables users to quickly fine-tune procedures through its all-encompassing interface. The AT Fidelis offers the industry's only Tissue effect Graphical Interface (TeGI) which provides precise graphical representations of laser-tissue effects as treatment settings are changed. For improved user comfort, the AT Fidelis features a wireless footswitch. While ESC Technology allows you to perfect water and air spray mixes, the AT Fidelis does not require external air or water sources, making it uniquely mobile.

Unlimited Possibilities!

Apart from providing the widest range of hard and soft tissue dental treatments, you can also upgrade your system with aesthetic upgrade packages. This enables you to provide aesthetic treatments ranging from facial laser hair removal and rejuvenation treatments to facial vascular treatments.



The Highest Performance, Best Made Laser Systems in the World

Don't turn away patients any longer! Visit www.fotona.com now!



Prof Dr Norbert Gutknecht
WFLD President
Editor-in-Chief

Dear **Laser** users,

_This editorial is written under the impression of the WFLD Congress, which is just now taking place in Dubai together with the biggest dental exhibition and dental conference in the Middle East, the AEEDC® 2010.

The WFLD Congress is an integrating factor for Lasers in the different fields of dental treatment and the visitors from more than 110 countries are able to participate not only in Laser presentations but also in a number of other presentations concerned with conventional treatments.

The very positive effect out of this integration is that colleagues who have been very reserved towards this technology perceive lasers and laser treatments more objectively.

I hope that this edition is again stimulating you to dig deeper in the advantages of laser-supported treatments.

Prof Dr Norbert Gutknecht
Editor-in-Chief

AD

OCTOBER 29–30, 2010, BERLIN, GERMANY

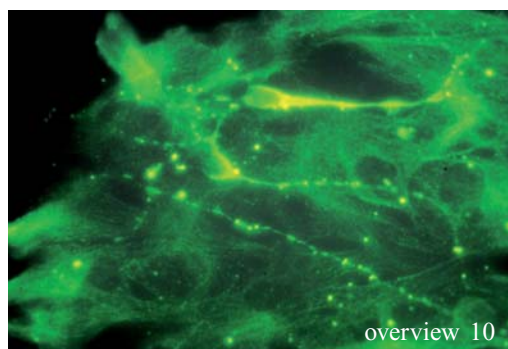
**19th ANNUAL CONGRESS OF THE DGL
LASER START UP 2010**

» Please fax this form to:
+49-(0)3 41/4 84 74-2 90

More informations:

- ☐ **LASER START UP 2010**
- ☐ **19th ANNUAL CONGRESS OF THE DGL**
October 29–30, 2010, Berlin, Germany

office stamp



| editorial

- 03 Dear **Laser** users
| Prof Dr Norbert Gutknecht

| research

- 06 **Surface analysis** of Erbium: YAG laser etching v/s acid etched surface
| Dr Roheet Khataavkar & Dr Vivek Hegde

| overview

- 10 Laser phototherapy (**LPT**) in dentistry
| Jan Türner

| case report

- 16 **Low-level laser therapy** in the treatment of herpes labialis
| Dr Igor Cernavin
- 18 Laser-assisted **frenectomy** in pediatric dentistry
| Dr Gabriele Schindler-Hultzschi
- 22 Technology-enhanced **caries detection and treatment** options
| Michele Baffi Diniz, Dr Jonas Almeida Rodrigues, Dr Adrian Lussi
- 26 Endodontic treatment of periapical chronic **peridontitis**
| Prof Umberto Romeo, Dr Gaspare Palaia, Dr Roly Kornblit, Dr Gianluca Tenore, Dr Alessandro Del Vecchio

| user report

- 30 Using **lasers** to tackle **periodontitis**
| Stefan Gottschalk

| feature

- 34 From **theory** to the first **working laser**
| Ingmar Ingenegeren

| social news

- 36 Official Awarding Ceremony **EMDOLA**
| Dajana Klöckner
- 38 Successful with a **Master Degree**

| meetings

- 40 **International** events **2010/2011**

| laser

- 42 13th Laser-Beginners-Congress "**LASER START UP**" and 18th Annual Conference of **DGL**
- 44 Traducción
| Dr Josep Arnabat, Dr Simeon Dragov Kutnjak

| news

- 48 **Manufacturer** News

| about the publisher

- 47 | submissions
50 | imprint

Introducing iLase™

The next
instrument
for your tray.

Powerful.
Affordable.
Beyond Portable.



iLase™ gives Biolase the most complete family of dental laser solutions, to match the needs of you and your patients perfectly as you expand your laser applications:



iLase*

The Personal Laser, for everyday soft-tissue procedures.



ezLase*

The Total Diode Laser Solution, including whitening and pain relief.



waterlase*MD TURBO

Best-of class soft and hard tissue laser for common and advanced restorative, periodontics, endodontics, cosmetic, surgical and pediatric procedures.



Actual Size

© 2010 | www.Biolase.com | Call Henry Schein Germany +49 0180 40 0044 or Biolase at +1 949 361 1200 | CE

An Exclusive
Partner of **HENRY SCHEIN®**
DENTAL

The Biolase
Total Solution



Clinical
R+D



Industry Leading
Technology



Training +
Certification



Practice
Integration



Service +
Support

BIOLASE

Surface analysis of Erbium:YAG laser etching v/s acid etched surface

ESEM observations *in vitro* study

Authors_Dr Roheet Khataavkar & Dr Vivek Hegde, India

Summary

Aim

The aim of the present study was to compare the effect of conventional acid etching with 37 % phosphoric acid and Er:YAG laser (non-contact mode) on surface changes in enamel.

Materials & methods

A total of 50 non-carious extracted human teeth were collected for the study. The teeth were divided into five groups; wherein one set of teeth was acid etched for 30 seconds with 37 % phosphoric acid and four groups were laser-ablated with an energy output of 50, 75, 100 and 150 mJ respectively using Er:YAG (2,940 nm wavelength) Laser in non-contact mode. Micromorphological effects were evaluated using an ESEM for change in the structure of enamel.

Results

Following observations were made: Comparison between acid-etching & Laser treatment on the

Effects on tooth surface and smear layer for each group.

ESEM evaluation showed that increasing the energy parameters showed difference in the surface morphology of enamel from roughening to a etching-like micro-roughened pattern. Certain laser treated teeth showed better micro-retentive features as compared to acid-etching.

Conclusion

Laser-treatment for providing a micro-retentive surface is a viable option that can be chosen. The Er:YAG Laser energy levels that provide a comparable effect to acid-etching were also noted.

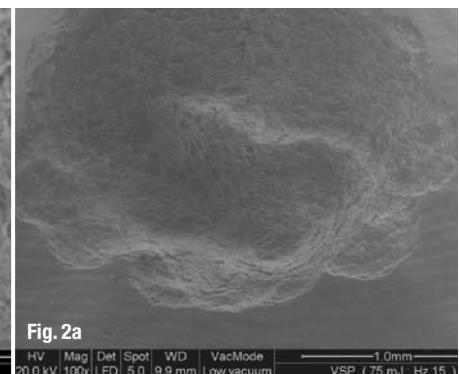
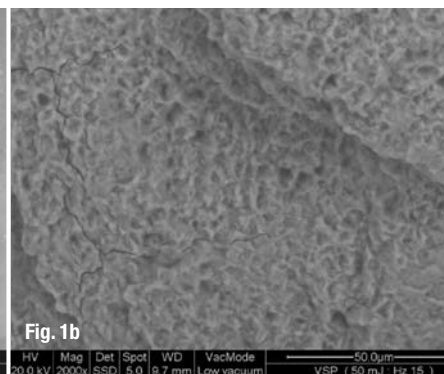
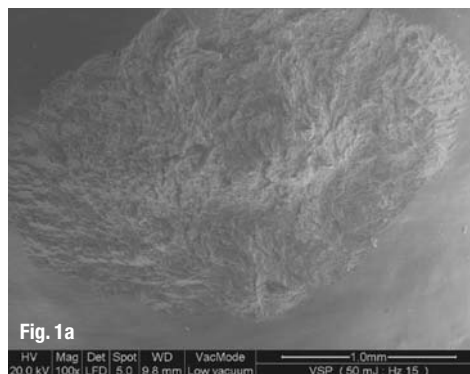
Introduction

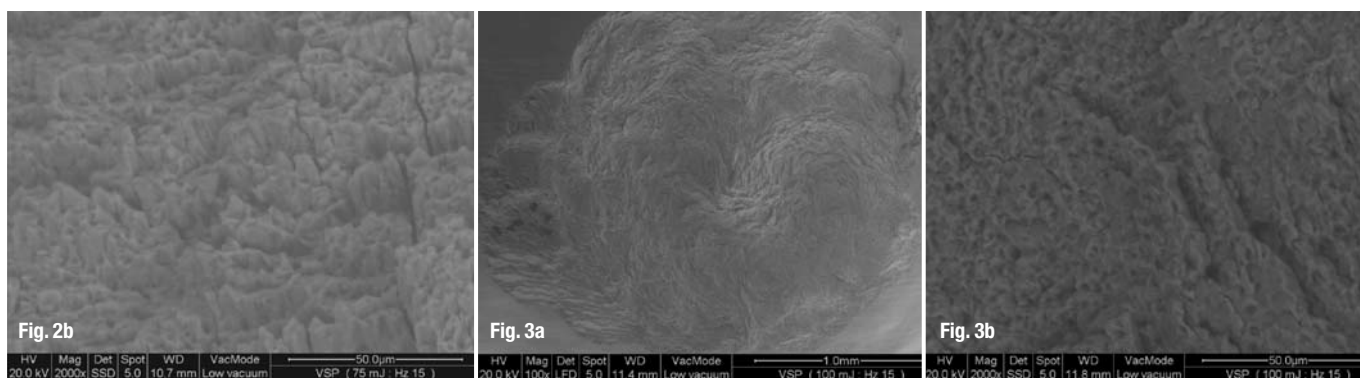
Hard tissue lasers have been introduced in dentistry since almost 20 years and a number of wavelengths have been tried and experimented upon for ablation of hard tissue including enamel, dentin, cementum and bone.¹⁻⁴ Lasers delivery devices today have a number of parameters that can be modified

Fig. 1a_ Low power magnification (100x) image of enamel surface lased at 50 mJ and 15 Hz showing definite surface changes.

Fig. 1b_ High power magnification (2000x) image showing micro-roughened surface.

Fig. 2a_ Low power magnification (100x) image of enamel surface lased at 75 mJ and 15 Hz showing circular path followed by the laser beam.





by the clinician to obtain the desired results; these include minor variables like water and air; and major variables like Pulse mode, Frequency & Energy output.

With respect to pulse duration i.e. duration of a pulse there are five options available namely Very Long Pulse (1,000 μ s), Long Pulse (600 μ s), Short Pulse (300 μ s), Very Short Pulse (100 μ s), Super Short Pulse (50 μ s). Also frequency (i.e. number of pulses per second) can be modified. Energy output can also be varied depending upon a requirement of high or low energy levels. The Power; which is a product of the energy output and frequency changes accordingly. It has been shown through a number of studies that the Er:YAG laser is an effective tool in cavity preparation etching and removal of caries from enamel and dentin.⁵⁻⁹

In the numerous hard tissue applications that lasers have been used for, lasers have been suggested to cause a surface etching effect which has been comparable to conventional acid etching. This study aimed to analyze the changes in the ultrastructure of human enamel resulting from simulated cavity preparation by an Er:YAG Laser, and to investigate the optimal parameters of that laser for ablating enamel for etching; with a VSP (Very Short Pulse); variable energy outputs (EO) but Repetition Rates (RPR) kept constant and compare it with the surface characteristic of an acid-etched surface.

Materials and methods

Selection of Samples

A total of fifty non-carious extracted maxillary human premolars were collected for the study. The teeth were washed in normal saline and gross calculus was removed using an ultrasonic scaler. The teeth were stored in normal saline at room temperature until treated.

Preparation of samples

The cervical 3rd of buccal surface of each tooth was subjected to 15 seconds with an Er:YAG (Fotona

Fidelis III Plus, Fotona d.d., Slovenia, EU) of 2,940 nm wavelength. A circular area of 2 mm diameter ($\pm$ 0.25 mm) was prepared using the laser in non-contact mode at a distance of approximately 7mm from the tooth surface; set at different energy parameters. Keeping the Frequency constant at 15 Hz; the energy output was varied at 50 mJ, 75 mJ, 100 mJ and 150 mJ respectively. The Power reading on the Laser Device also increased accordingly. The water and air were kept constant at a value of six each. Ten Samples were also etched with the conventional method of 37% phosphoric acid (3M ESPE, USA) etching for a period of 15 seconds. Following preparation of the samples with the prescribed parameters (Table1) the teeth were subjected to ESEM analysis.

ESEM evaluation

Micromorphological effects were evaluated on enamel using an Environment Scanning Electron Microscope (ESEM) at a magnification of 100x and 2,000x; wherein we noted the Effects of the laser on Enamel Surface and Smear Layer for each setting.

Comparison amongst the difference in laser etched and 37% phosphoric acid etched samples and the ideal parameters for laser etching as compared to conventional acid etching.

The advantage of the ESEM over the Scanning Electron Microscope (SEM) being that the sample does not have to go through any processing; it can directly be placed into the Microscope; thereby avoiding drying of the specimens during processing.

Results

The effects of the laser application on the enamel as observed with the ESEM were as follows.

50 mJ

A definite change in the surface of the enamel was noted at low power magnification (100x) as compared to the adjacent sound enamel. However, at a higher power magnification the circular laser treated area showed only a superficial roughness without

Fig. 2b High power magnification (2,000x) image showing micro-retentive surface.

Fig. 3a Low power magnification (100x) image of enamel surface lased at 100 mJ and 15 Hz showing surface melting.

Fig. 3b High power magnification (2,000x) image showing melting and partial recrystallization of the enamel prisms.

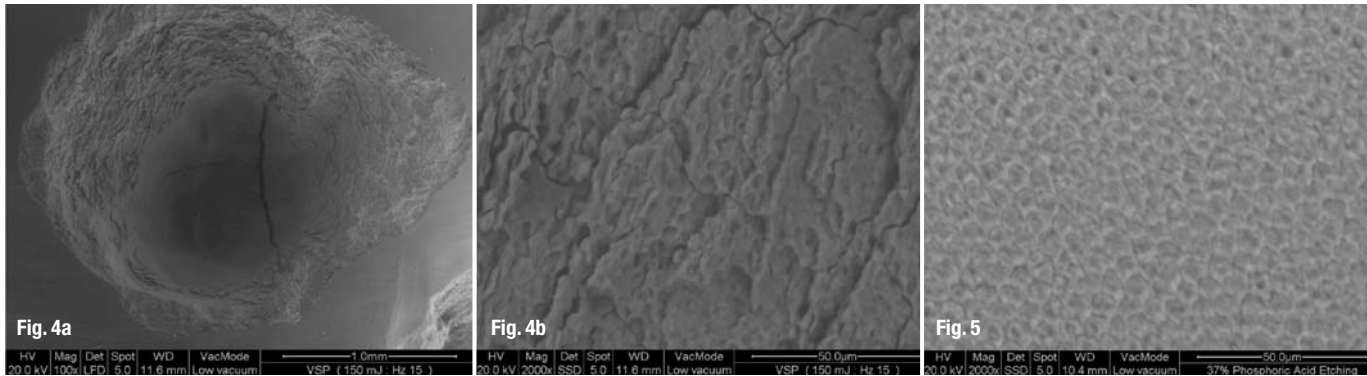


Fig. 4 a_Low power magnification (100x) image of enamel surface lased at 150 mJ and 15 Hz showing saucer-like cavitation.

Fig 4 b_High power magnification (2,000x) image showing partially coalesced structure and presence of microcracks.

Fig. 5_High power magnification (2,000x) image of 37 % phosphoric acid etched surface showing type III etching pattern.

the presence of a micro-retentive surface. (Fig.1)

75 mJ

The circular path followed by the laser beam is clearly visible on the 100x magnification. Slot-type pattern of enamel ablation is seen in the 2,000x magnification indicating selective ablation of the enamel prisms occurring over the lased surface. The lased surface shows a definite micro-retentive surface with presence of elevations and depressions (Fig. 2).

100 mJ

Lower magnification shows the superficial layer of enamel that has melted and flowed in the direction of the laser beam. Higher magnification reveals the melting & partial recrystallization of the enamel prisms (Fig. 3).

150 mJ

When lased at 150 mJ there is a saucer-like cavitation seen on the surface. Higher magnification shows molten and partially coalesced structures instead of the prismatic pattern of enamel and a number of microcracks are also noted on the laser treated surface (Fig. 4).

37% phosphoric acid etched surface

The acid etched surface seen at a high power magnification clearly shows the presence of the key-hole pattern of enamel with a type III etching pattern.

This shows a uniform micro-retentive surface over the etched area (Fig. 5).

Discussion

An evaluation of all the laser-treated groups revealed that the lased surfaces were free of any smear layer indicating a good surface for bonding.¹⁰ However, the morphology of the lased enamel showed a large variation as the energy output was increased.

Excessive energy parameters did not give the same results in all the samples, because of the presence of induced alterations resulting from the thermal effect. Higher energy values were shown to be change the structure of the enamel prisms. The changes in the inherent structure of the enamel prism followed this order—Microroughness, Micro-retentive areas, Reorganization and Recrystallization of Enamel Prisms, and Microcracks.

A micro-roughened surface was observed at a low energy output level of 50 mJ however the depth of the roughened areas seemed lesser as compared to the higher energy output of 75 mJ. The ultra-structural appearance of enamel lased at 75 mJ was similar to that of conventionally etched enamel with 37 % phosphoric acid. However, the etched surface showed a non-specific mixed-type pattern of the rods and prisms; as opposed to a uniform type III pattern seen with an acid etched surface.^{11,12} Clinically, the advantage of laser etching over conventional bur is that a debris free, smear free and oil free surface is obtained.

The Er:YAG laser has also been shown to have anti-bacterial properties.¹³ The taste of phosphoric acid may also not be well accepted by the patients hence laser etching would be a better option.

Conclusion

Tab. 1_Table showing groups and parameters used for each group.

Groups (n=10)	Energy output (mJ)	Frequency (Hz)	Power (W)
I	50	15	0.75
II	75	15	1.10
III	100	15	1.50
IV	150	15	2.25
V	37% phosphoric acid etched surface		

Through this study we have concluded that lasers definitely can be used as an alternative to conventional procedures. We concluded that a correct parameter of energy level has to be chosen to get the desired result for bonding procedures. We also inferred that 75 mJ Energy output with 15 mJ frequency provided a micro-retentive surface that was comparable to a 37 % phosphoric acid etched surface.

These results are based on the surface changes that have been seen on the enamel only and may not be indicative of the bonding ability of the lased surface to composite resins. Hence, studies have to be carried out to compare the bond strengths of the lased and acid etched surfaces to validate the etching effect of the Erbium:YAG Laser.

Acknowledgements

The authors would like to thank Mr. Dheeraj Suryawanshi for his technical assistance with the ESEM Analysis at ARAI, Pune.

References

1. Parker S. Introduction, history of lasers and laser light production. *British Dental Journal* 2007;202(1): 21–31.
2. Featherstone JDB, Fried D. Fundamental Interactions of Lasers with Dental Hard Tissues. *Med. Laser Appl.* 2001;16: 181–194.
3. Featherstone JDB, Nelson DGA. Laser Effects on Dental Hard Tissues *Adv. Dent. Res.* 1987; 1(1): 21–26.
4. Parker S. Laser-tissue interaction *British Dental Journal* 2007;202(2): 73–81.
5. Yamada Y, Hossain M, Suzuki N, Kinoshita J, Akamura Y, Matsumoto K. Removal of Carious Dentin by Er:YAG Laser Irradiation with and without Carisolv™. *Journal of Clinical Laser Medicine & Surgery* 2001;19:3: 127–131.
6. Attrill DC, Farrar SR, King TA, Dickinson MR, Davies RM, Blinkhorn AS. Er:YAG Laser Etching of Dental Enamel as an Alternative to Acid Etching. *Lasers Med Sci* 2000;15: 154–16.
7. Cozean C, Arcoria CJ, Pelagalli J, Powell GL. Dentistry for the 21st Century?—Erbium:YAG Laser for Teeth. *JADA* 1997;128: 1080–87.
8. Ying D, Chuah GK, Hsu CYS. Effect of Er:YAG laser and organic matrix on porosity changes in human enamel. *Journal of Dentistry* 2004;32: 41–46.
9. Liu J, Liu Y, Stephen HCY. Optimal Er:YAG laser energy for preventing enamel demineralization. *Journal of Dentistry* 2006;34: 62–66.
10. Tay FR, Pashley DH. Etched Enamel Structure and Topography: Interface with Materials In: Eliades G, Watts DC, Eliades T. *Dental Hard Tissues and Bonding: Interfacial Phenomenon and related properties*. Springer Verlag Heidelberg, Germany. 2005: 6–8.
11. Silverstone L, Hicks M, Featherstone M. Oral fluid contamination of etched enamel surfaces. A SEM study. *J Am Dent Assoc* 1985; 110: 329–332.
12. Hosoya Y. The effect of acid etching times on ground primary enamel. *J Clin Pediatric Dent* 1991; 15: 188–194.
13. Araki TA, Ibraki Y, Kawakami T, Lage-Marques JL. Er:YAG Laser Irradiation of the Microbiological Apical Biofilm. *Braz Dent J* 2006;17:4: 296–299.

_contact

laser

Dr Roheet Khatavkar (BDS)

Post Graduate Student
Department Of Conservative Dentistry
And Endodontics M.A.Rangoonwala
Dental College, Pune, India.
Address A/6/23 Sunder Nagar, Kalina, Santacruz
(East) Mumbai-400098
Tel.: +91 99 21 53 33 84
Fax: +91 20 22 665 23 14
E-mail: drkhatavkar@gmail.com

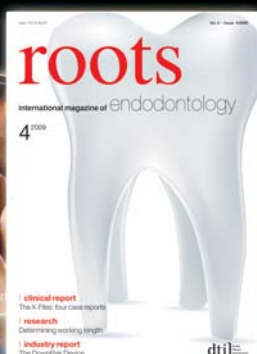
Dr Hegde Vivek S (MDS)

Professor & Head of Department
Department Of Conservative Dentistry
And Endodontics M.A.
Rangoonwala Dental College, Pune, India.
Address Flat No.504, Casa Grande Co-op Hsg.
Soc., Lane No.8, North Main Road, Koregaon Park,
Pune- 411001
Tel.: +91 98 22 05 54 34
Fax: +91 20 26 12 10 99
E-mail: drvivekhegde@rediffmail.com

AD

roots

international magazine of endodontology



Subscribe now!

One issue free of charge!

I hereby agree to receive a free trial subscription of **roots international magazine of endodontology** (4 issues per year). I would like to subscribe to **roots** for € 44* for German customers, € 46* for customers outside Germany, unless a written cancellation is sent within 14 days of the receipt of the trial subscription. The subscription will be renewed automatically every year until a written cancellation is sent to OEMUS MEDIA AG, Holbeinstr. 29, 04229 Leipzig, Germany, six weeks prior to the renewal date.

Reply per Fax +49-(0) 3 41/4 84 74-2 90 to OEMUS MEDIA AG or per E-mail to grasse@oemus-media.de

Last Name, First Name	ZIP/City/ Country
Street	E-mail

Notice of revocation: I am able to revoke the subscription within 14 days after my order by sending a written cancellation to OEMUS MEDIA AG, Holbeinstr. 29, 04229 Leipzig, Germany.

Signature

OEMUS MEDIA AG Holbeinstr. 29, 04229 Leipzig, Germany
Tel.: +49-(0) 3 41/4 84 74-0, Fax: +49-(0) 3 41/4 84 74-2 90
E-Mail: grasse@oemus-media.de

*Prices include shipping and VAT

laser 1/10