

World's 1st Direct Printed Aligner Shape Memory Aligner®

World's first patented technology Shape Memory®



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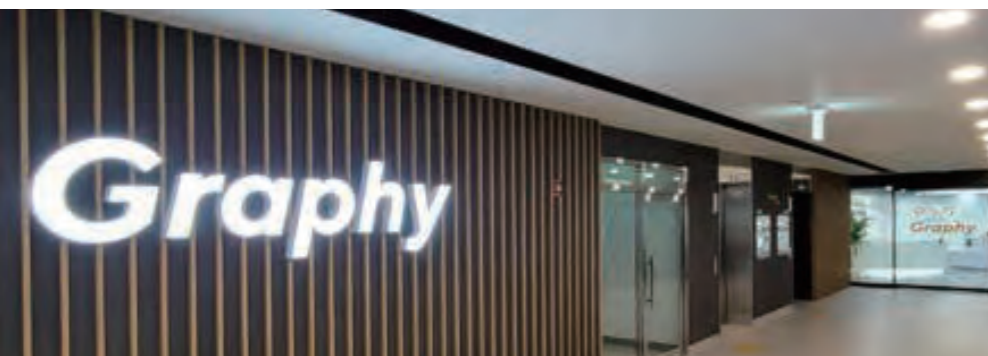
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www.graphy3d.com
www.itgraphy.com



About Graphy Inc.

Korea's leading manufacturer of 3D printer materials



Graphy Inc.

Is a company that develops and manufactures new materials (photocurable resin) that specializes in 3D printing-based technology, a major element of the 4th industrial revolution, and has optimized knowledge of new material technology and medical convergence technology. With the successful development of 'Tera-Harz', we are growing into a global company through partnerships with the world's leading companies in the 3D printer material business field.

Graphy is not going to stop at manufacturing and developing materials, but aims to apply 3D printer technology to real life by supplying various 3D printer application solutions and medical solutions to the market.

Conference & Exhibition



Shape Memory Aligner® Specialists Around the World

What world-class scholars and speakers are saying about Shape Memory Aligner®



Prof. Ravindra Nanda Professor Emeritus
Department of Orthodontics University of Connecticut
Adjunct Professor The Forsyth Institute
Editor-in-Chief Progress in Orthodontics

"What made the big difference in orthodontics especially with the wires and bracket was when we introduce shape memory wires, wires which change their characteristic with the heat as well as when you're going to put up in the mouth then force is going to remain pretty stable over a long period of time. And this is what now Graphy aligner material is going to do."



Prof. Ki Beom Kim, DDS, MSD, PhD
Dr. Lysle Johnston Endowed Chair in Orthodontics
Professor and Program Director
Department of Orthodontics
Center for Advanced Dental Education
Saint Louis University

"I think the Graphy material is an innovative material that can fundamentally overcome the disadvantages and limitations of existing thermoplastic materials, as well as the simplicity of device manufacturing."



Dr. Werner Schupp
Editor in Chief "Journal of Aligner Orthodontics" Quintessence Publishing
Editor for "Manuelle Medizin und Kieferorthopädie" (Springer Verlag)
Advisory Board "Kieferorthopädie" Quintessenz Verlag

"Advantages of 3D aligner printing: Tera Harz Clear is more flexible and has a larger elastic range. Perfect fit to tooth, almost no gap"



Dr. Kenji Ojima
Adjunct Professor, University of Torino
President of the Japan Academy of Aligner Orthodontics
Owner and Managing Director of Smile Innovation Orthodontics in Shinjuku, Tokyo
Director of HONGO SAKURA ORTHODONTIC TOKYO

"This material is a very new future. There's a better way for new generation aligners on orthodontics."



Dr. Björn Ludwig
Assistant Professor at the University of Homburg/Saar, Department of Orthodontics
Editor in chief of the Quintessenz publication "Kieferorthopädie"
Co-editor of the Journal of clinical Orthodontics

"I had to print out the aligners the same day, and it worked, because I can print it out in my office. It gives me control, it gives me the power."



Dr. Yong-Min Jo
Since 2020 Shareholder and Chief Business Development & Innovation Office at Scheu Group: Scheu Dental, CA Digital, Smile Dental Companies

"The innovative advantage of the new aligner material is the continuous power transmission thanks to its memory effect. Due to this effect, the aligner permanently returns to its original shape, which has a positive effect on the power transmission and rigidity of the aligner."



Dr. Nearchos C. Panayi
Scientific coll. European University Cyprus
Visiting Research Scientist, Clinic of Orthodontics, University of Zurich,
Author "Design It Yourself Orthodontics" book, Quintessence
Associate Editor "Progress in Orthodontics"

"Preliminary results show excellent mechanical properties. It is clear to see that aligner printing is here to stay. The river cannot reverse. Nevertheless, in order to have a consistency and excellent result, Graphy has created a protocol which needs to be followed beginning from the appropriate aligner design, printing, and most important, UV curing."



Dr. Simon Graf
Smile AG
Inventor and pioneer in CAD/CAM procedures for metal and acrylic 3D printed orthodontic appliances

"The two ways of aligners! Now direct printed instead of vacuumforming."



Dr. Akim Benattia
Former assistant at universities in France
General Secretary of the French Aligner Society
Member of The European Aligner Society
Member of the Japan Aligner Academy
Member of the Deutsche Gesellschaft für Aligner Orthodontie
International speaker since 2015, presenting in France, Tunisia, Italy, Spain, Morocco, Taiwan, Ukraine, Greece, Dubai, Latvia, and Austria
"Advancements in Graphy materials significantly enhance the potential of Clear Aligner Therapy thanks to its Shape Memory properties"



Dr. Choon Gwack
PNU School of Dentistry DDS PhD
Vice President of the KAO Busan Gyeongnam-Ulsan Division
Vice President of the KSDO
Orthodontic practice director of BarunE Orthodontic Clinic

"Made from shape memory polymers, Shape Memory Aligner®s are moderately elastic at intraoral temperatures and soften at higher temperatures. They have the advantage of being manufactured without blockouts for easy insertion, so you can achieve good, predictable alignment with minimal attachments."



Dr. Young Jin Jeon
EGraduate of PNU School of Dentistry, DDS PhD
Invisalign Speaker for Asia-Pacific (APAC)
Assistant Professor of Orthodontics, Case Western Reserve University
Orthodontic Practice Director, Erumi Orthodontic Clinic

"Just as Shape Memory Wire enhanced bracket orthodontics, Shape Memory Direct Aligner will revolutionize clear aligner treatment."

What is Shape Memory Aligner®? World's 1st 3D Printed Shape Memory Aligner®

Shape Memory Aligner® is

more than just a clear aligner.

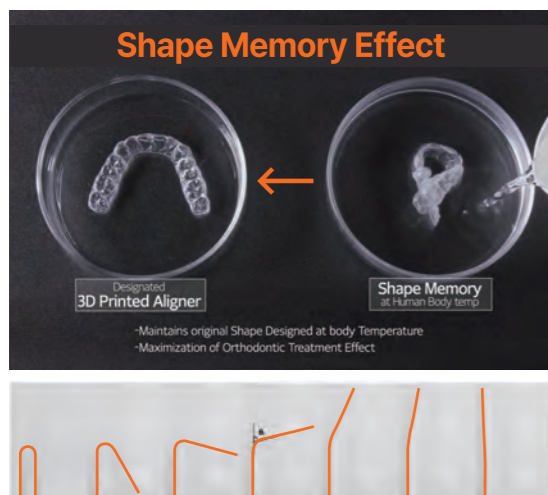
It's not any typical clear aligner, and it's not just a 3D print.

It is the world's first patented product to feature Shape Memory.

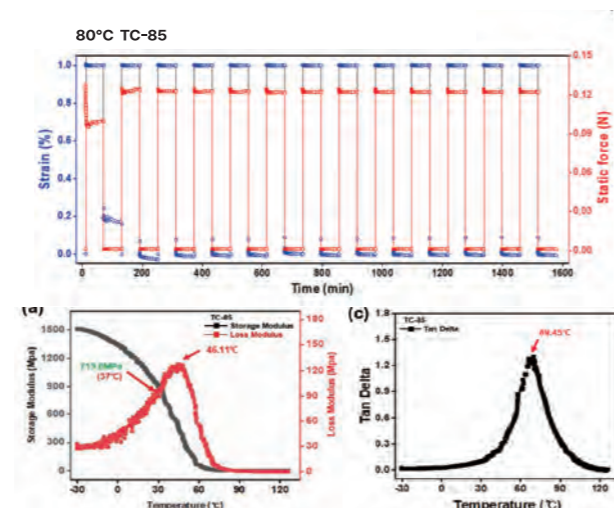
A state-of-the-art aligner recognized by orthodontic masters around the world.

The Shape Memory Aligner® is a new paradigm in orthodontics, far beyond brackets and other traditional methods. Shape Memory Aligner® is an aligner that uses digital information from a patient's mouth to print directly to a 3D printer, bypassing the step of creating a tooth model.

Shape Memory Aligner® is a medical device that reduces production time, is suitable for biomechanical movements such as adjusting the thickness of each tooth, which is not possible with conventional thermoforming manufacturing methods, and is harmless to the human body.



Shape memory effect and shape recovery ratio over time of TC-85

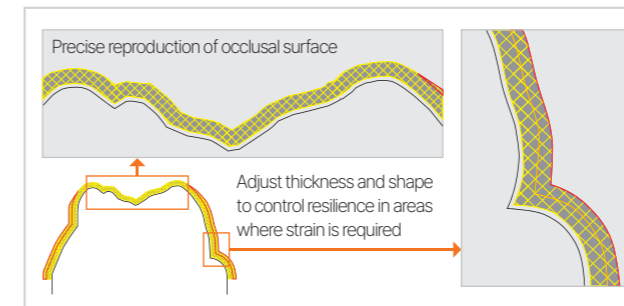


Reference: Lee, S. Y., Kim, H., Kim, H. J., Chung, C. J., Choi, Y. J., Kim, S. J., & Cha, J. Y. (2022). Thermo-mechanical properties of 3D printed photocurable shape memory resin for clear aligners. Scientific Reports, 12(1), 1-10.

Shape Memory Aligner®

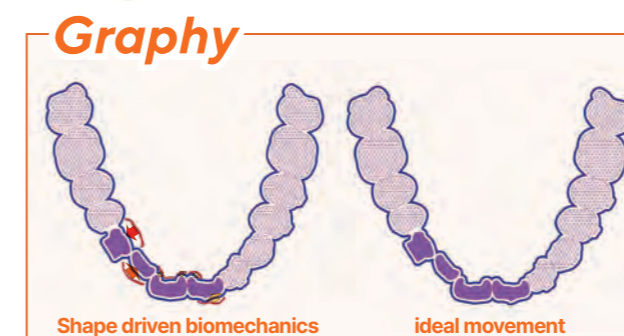
Thermoformed Aligner

Adjustable strain and resilience



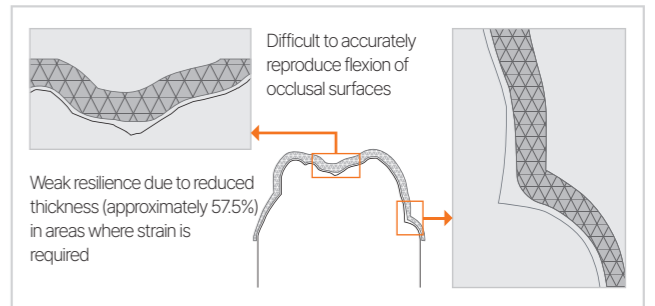
* Based on self-test of Graphy

Shape driven biomechanics

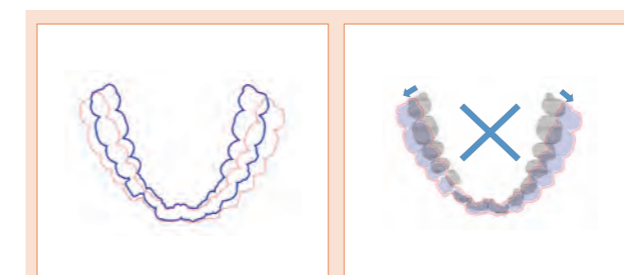


However, with the Shape Memory Aligner®, the released forces keep coming back over and over again by the effect of Shape Memory.

Reference: Koenig, N., Kim, KB. D.D.S., M.S.D., Ph.D. (2022). Comparison of dimensional accuracy between direct-printed and thermoformed aligners. The Korean Journal of Orthodontics, Article In Press. Published online

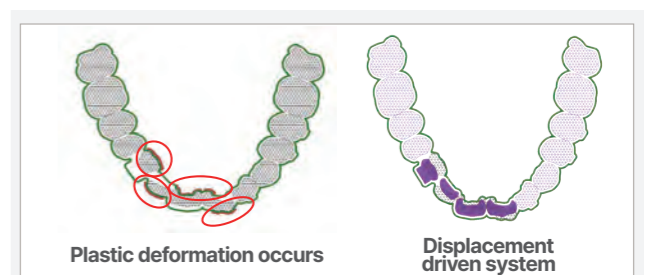


This is a displacement driven system and not a force driven system, but Shape driven biomechanics is ideal.



The deformation of the arch form of the Shape Memory Aligner® does not cause deformation of the entire tooth span.

In addition to the risk of fracture when 3D printing aligners with traditional materials, aligners without shape memory limit the orthodontic ability to return to its original shape when it is deformed



When the center red circle loses strength for the limit of the material's stress, the orthodontic force weakens.

* Based on self-test of Graphy

Shape Memory Aligner® patents and medical device safety certifications

| Application No. | Patent No. | Title of Patent |
|-----------------|-------------------|---|
| 10-2018-0099277 | Patent 10-2067533 | RADIATION CURABLE POLYMER COMPOSITION FOR 3D PRINTER |
| 10-2018-0123132 | Patent 10-2111789 | PHOTOCURABLE COMPOSITION FOR 3D PRINTER FOR PRODUCING TRANSPARENT ORTHODONTIC DEVICE |
| 10-2020-0033430 | Patent 10-2281789 | Patient-specific orthodontic device using 3D printing and orthodontic method using the same |
| 10-2020-0172326 | Patent 10-2244439 | Transparent aligner with increased correction power |
| 10-2021-0052197 | Patent 10-2273407 | Post-curing method of 3D printer output and transparent orthodontic device manufactured by the method |

World's first "FDA 510(k) Class II", "CE Class II", "MFDS Class II", "PMDA Class II" Cleared



Shape Memory Aligner® Related articles



Shape Memory Aligner® about 60 relevant SCI-quality international journal articles
 Collaborations with overseas companies and research institutes and schools are expanding and are now academically recognized.

Direct printing allows for strategic thickness control of orthodontic treatment



The thickness of the Shape Memory Aligner® is adjustable part by part, allowing for the fabrication of customized treatment plans for each patient. On the other hand, conventional clear aligners use thermoformed sheet paper, which is easily deformed. The compression thermoforming makes it difficult to produce aligners of the intended thickness, and it is impossible to adjust the thickness of each tooth to provide orthodontic force to the tooth, resulting in cumulative errors due to multiple steps in the process.

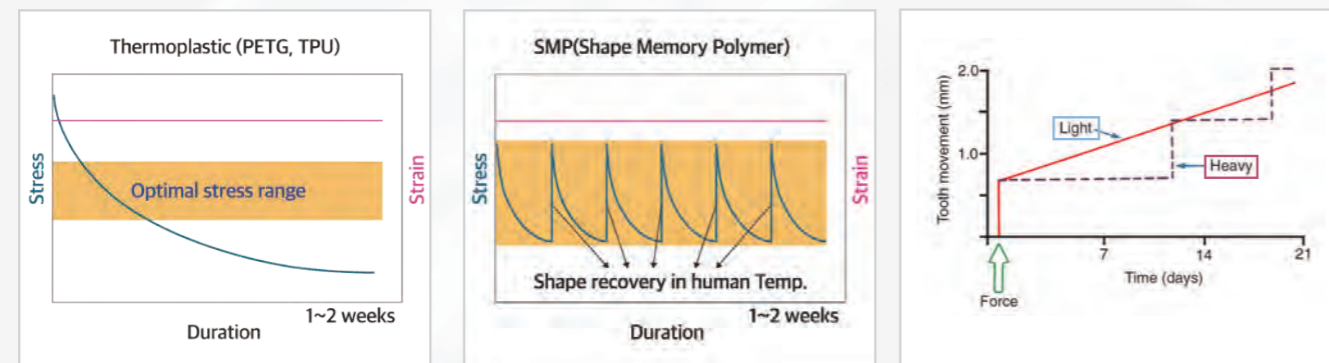


Easy brushing Healthy teeth and gums, deodorizing bad breath Maximize the effectiveness of orthodontic treatment Less stress on the jaw joint

Minimized inconvenience when putting on and taking off, hygienic management through heat disinfection

Minimizing block out for intraoral wearing and removal improves orthodontic power and makes patient more comfortable. The Shape Memory Aligner® can be heat disinfected by placing it in hot water, so it's always in pristine condition. It's also made of body-friendly materials.

Light & Continuous force



Aligners made of conventional thermoplastic sheets generate an initial heavy force that strains the teeth, causing patient pain, and then rapidly drops below the appropriate force, resulting in an inability to maintain the tooth movement force and achieve the intended orthodontic result.

Due to its innovative technology and material properties, the Shape Memory Aligner® allows for light & continuous force to achieve the intended alignment results. Shape Memory Aligner® induces light and sustained force. Light & Continuous Force induces smooth, continuous tooth movement while activating cells.

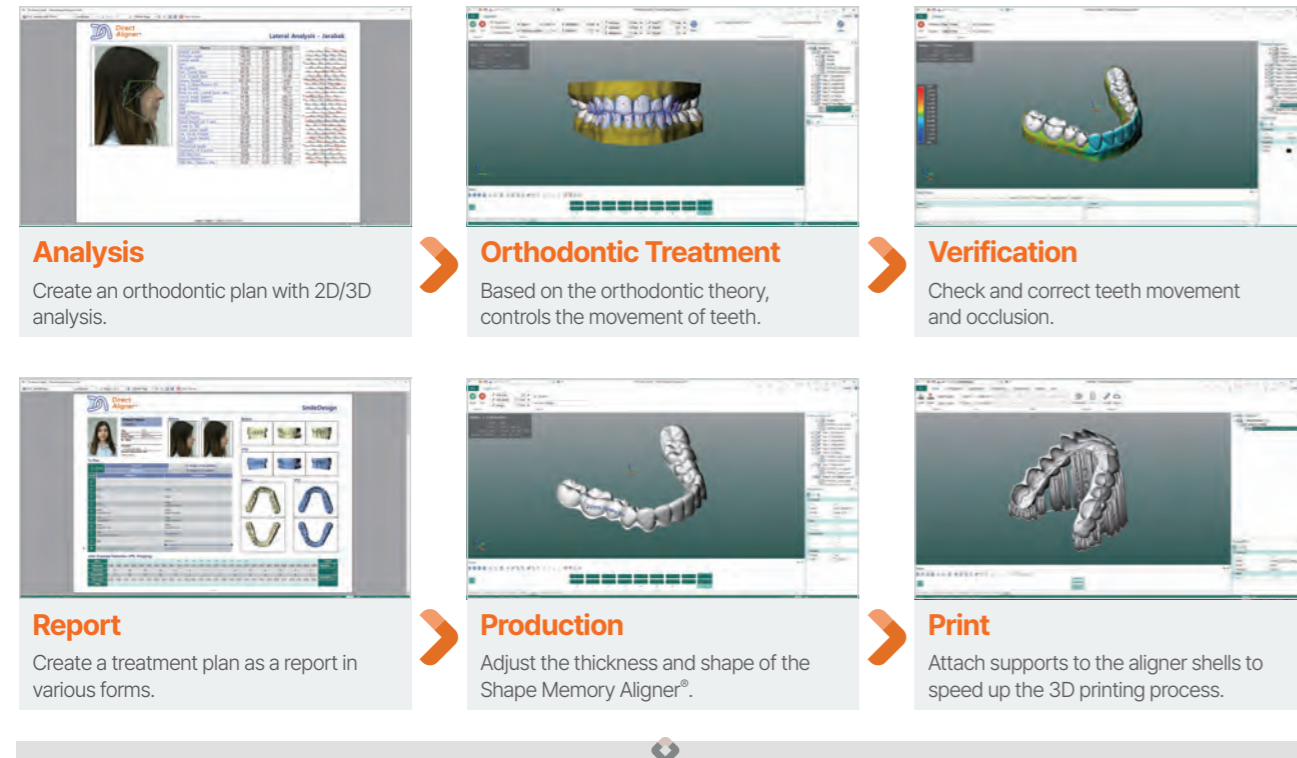
Reference : Contemporary Orthodontics. William R. Proffit et al. 6 edition p.263-266

Orthodontics platform



DAD In-house Production

- Graphy's 'Direct Aligner Designer (DAD)' is orthodontic simulation software that allows treatment plan establishment, setup, and design work to be performed in one software.
- The automatic separation and alignment function can provide orthodontic simulation results for patients with malocclusion within 5 minutes.



GraphyTeams

Interactive platform for Shape Memory Aligner

- Graphy provides a custom production service where users do not produce shape memory aligners themselves, but instead request production and have it delivered.
- 'GraphyTeams' allows you to intuitively check reception details, progress status for each patient, delivery status, etc. through a cloud-type database.



www.graphyteams.com



THC 3rd Generation Nitrogen Curing Machine

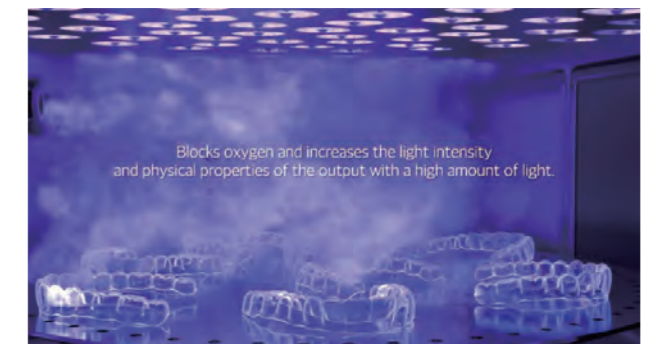
Tera Harz Cure

World's first UV curing device to achieve 100% polymerization conversion of materials

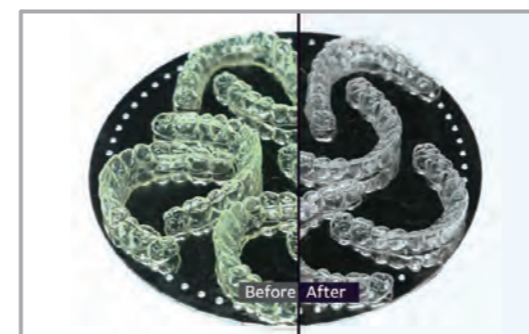
- 280,000Mj/cm², 1,000MW/cm²(5 minute-curing based), the best material intensity and shade with high-intensity UV energy
- Ability to store 5 curing conditions per material
- The optimal light level for each printed materials(Level 1~5)
- 360° UV irradiation and optimal LED arrangement for best light uniformity
- Safety cooling system based on LED temperature
- Maximum curing size(180mm, 360 Turntable)



[Nitrogen Generation]



[Minimize Oxygen in the Chamber (artificial image)]



Benefits of Nitrogen Curing

- 01 Improved mechanical strength and color consistency
- 02 Prevention of water absorption and chemical leaching
- 03 Reduced stickiness and residual polymers
- 04 Better surface quality of printed parts
- 05 Higher accuracy and reproducibility

| Properties | Description |
|---|--|
| Display | 7.9" TFT Touch LCD |
| LED Wavelength | 405nm |
| LED Power | 200W |
| UV Energy Density Irradiance of UV (5 minute-curing based) | 280,000 mJ/cm ² 1,000 mW/cm ² |
| Curing Chamber | Ø180 x 650mm |
| Dimension (weight) | 275 x 310 x 310mm (8.5kg) |

Tera Harz Smart Robot

The most advanced integrated device for Shape Memory Aligner manufacturing.



Advantages of Tera Harz Smart Robot

This system is more than just a system.

The excellence of the world's first Shape Memory Aligner is more elaborated, possible by introducing a state-of-the-art robot-system for greater excellence and convenience.

Shape Memory Aligner is made more efficient with the solution of Graphy's new Tera Harz Smart Robot.

01 Competitive excellency in technology

Deliver consistent quality of product, 24hr operation time and optimized automated reprogramming.

02 Improvement outcomes

Improve the quality of the outcome through sophisticated operation.

03 Economic benefits

Reduce consumables, accelerate the treatment and enhance productivity.

04 Time efficiency

Same day and convenient treatment.

| | |
|------------------------|---|
| Product Name | Tera Harz Smart Robot (THSR) |
| Model Name | R2K2U |
| Weight | 20kg |
| Application | In-house Aligner Manufacturing (lab/clinic) |
| Voltage | 220V(110V Compatible Module Provided) |
| Usage | Production Line |
| After Warranty Service | Video Technical Support |
| Type | 6-axis Vertical Multi-joint |
| Machine type | Aligner Manufacturing Robot Arm 6 Axis |
| Aligner Material | Tera Harz Clear |
| Warranty | 1 year |

World's 1st Shape Memory Aligner®



Shape Memory Aligner® Package







| Treatment Option | SMA Lite II | SMA Standard | SMA Advanced |
|------------------------------|--|---|--|
| Number of Steps | Up to 16 | Up to 30 | More than 30 |
| Treatment Period | 4~6 Months | 7~10 Months | 3 Years |
| Warranty Period | 12 Months | 2 Years | 3 Years |
| Additional Extension Aligner | N/A | Max. 15 Steps | No limit within warranty period |
| Scope of Treatment | Normal Orthodontic Treatment | Normal Orthodontic Treatment | Extraction Case, Complex treatment |
| Treatment Example | <ul style="list-style-type: none"> ■ Anterior A. Crowding: Simple -Moderate B. Spacing case C. In/Extrusion: under 1-2mm D. Rotation (under 15°) E. Relapse case ■ Posterior A. In/Extrusion : less than 1mm B. Distalization | <ul style="list-style-type: none"> ■ Anterior A. Severe Crowding B. 4 anteriors Rotation: under 30° C. In/Extrusion : over 2mm (elastic) ■ Posterior A. Canine-Posteriors rotation : under 15° B. In/Extrusion in 2mm (Attachment/Elastic) C. Mesio/Distalization | <ul style="list-style-type: none"> ■ Anterior+Posterior A. Extraction case - anteriors/ premolar B. Easing skeletal malocclusion C. Rotation : over 30° D. Posterior expansion E. In/Extrusion : over 2mm(Att/ Elastic) |

Shape Memory Aligner® Case







| Initial | | Final |
|--|---|---|
|  | <p>Lite</p> <p>Age: 33Y Gender: Female Tx Period: 10 months No. of steps: 37</p> |  |
|  | |  |
|  | |  |

Courtesy of Graphy







Shape Memory Aligner® Case

| Initial | | Final |
|--|---|--|
|  | <p>Standard</p> <p>Age: 55Y Gender: Male Tx Period: 7 months No. of steps : 27</p> |  |
|  | |  |
|  | |  |

Courtesy of Dr. C Gwack

| Initial | | Final |
|---|--|--|
|  | <p>Lite</p> <p>Age: 16Y Gender: Male Tx Period: 6 months No. of steps: 18</p> |  |
|  | |  |
|  | |  |

Courtesy of Graphy

| Initial | | Final |
|---|--|---|
|  | <p>Advanced</p> <p>Age: 19Y Gender: Male Tx Period: 2 year No. of steps: 57</p> <p>Class III, Open bite MARPE + SMA Synergy</p> |  |
|  | |  |
|  | |  |

Courtesy of Dr. ES Kim

Shape Memory Aligner® Case | Advanced

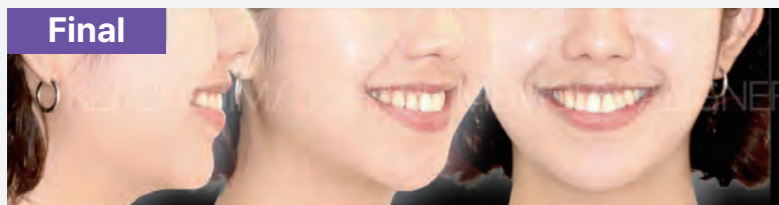
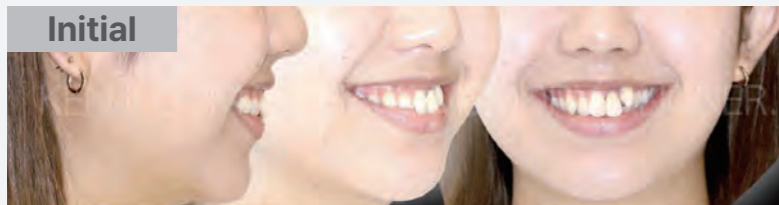
Moderate to severe crowding case



Achieving Excellent Outcomes in Narrow Dental Arch Cases Without Extractions

Courtesy of Dr. Kenji Ojima, Japan

Asymmetric premolar extraction

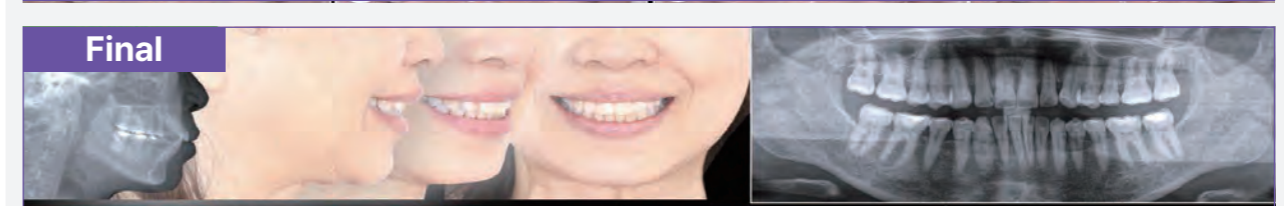
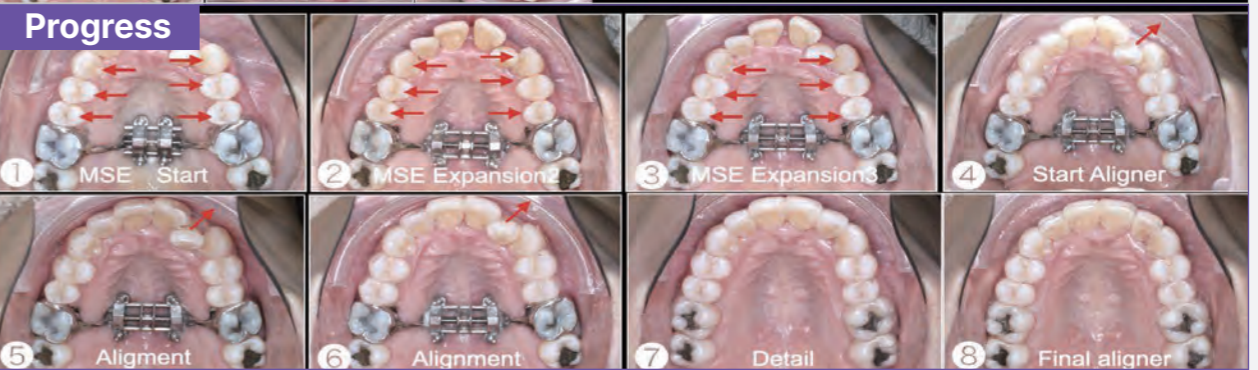
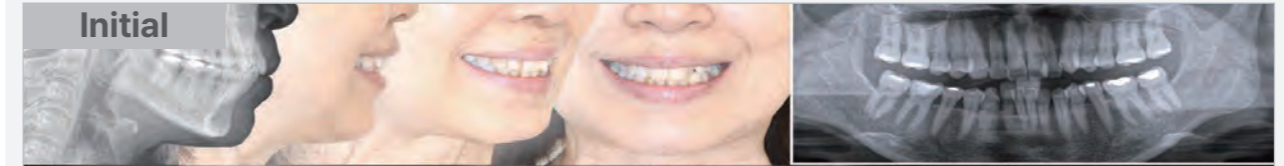


Outstanding Orthodontic Results in Asymmetry Case by Asymmetric Extraction

Courtesy of Dr. Kenji Ojima, Japan

Shape Memory Aligner® Case | Advanced

MSE [Maxillary skeletal expander] combined case



Courtesy of Dr. Kenji Ojima, Japan

Clinical case reports

JCO JOURNAL OF CLINICAL ORTHODONTICS

CASE REPORT

In-House 3D-Printed Shape Memory Aligners for Retreatment after Fixed Retainer Failure

Marisa Leddy, D.M.S., M.D.
Suzanne Glick, M.D., M.P.
Tali S. Bishara, M.D., M.P.D.

Recent advances in materials science and computer-aided design and manufacturing (CAD/CAM) technology, in combination with the growing number of adults seeking orthodontic treatment, have led to the widespread adoption of clear aligners as a comprehensive alternative to fixed appliances. Increasingly, the digital design and fabrication of clear aligners are occurring "in-house" within a private practice. The introduction of the first resin specifically intended for clear aligner resin allows trays to be 3D-printed with greater dimensional precision than thermoplastic aligners, while incorporating features such as planned variations in thickness across the aligner body and thermomechanical stress memory.



Fig. 1 32-year-old female patient with severe protrusion of lower left central incisor, lateral incisor, and canine due to failure of fixed lingual retainer, before retreatment.



QUINTESSENCE PUBLISHING DEUTSCHLAND

Journal of Aligner Orthodontics

Shape memory aligners: A new dimension in aligner orthodontics

...the design of aligner orthodontics, and aligner printing directly in the aligner...

Introduction
Aligner orthodontics has been an integral part of orthodontics for over 20 years. The rise of aligner orthodontics...



Figs 1B-e-f Comparison (a-c) before and (d-f) after orthodontic treatment with in-office direct Graphy aligners. (g to i) After restoration with composite on the maxillary and mandibular anterior teeth and 1 week after gingivectomy (Dr Wolfgang Boissiere, Cologne). (j to l) Smile before and after interdiscalnary treatment.

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Publisher of Scientific Journals

APDS Trends in Orthodontics

Accelerated and hybrid orthodontic treatment using a combination of 2D lingual appliance and in-house aligner: An anterior cross-bite and TMD case report after 1-year follow-up

Abstract
Introduction
Conclusions



Figure 1: Pre-treatment intra and extraoral pictures.

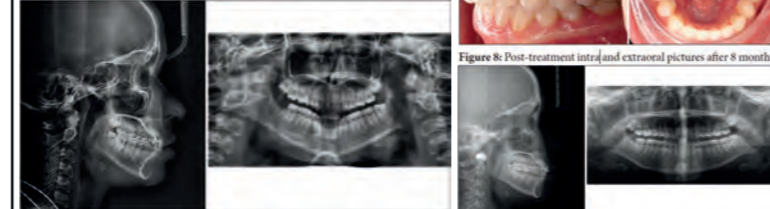


Figure 2: Pre-treatment X-rays.



Figure 8: Post-treatment intra and extraoral pictures after 8 months.



Figure 9: Post-treatment X-rays.

Lined writing area for a memo or notes.