Use of ß-tricalcium phosphate for alveolar preservation; a report on a series of cases.

Authors: Medina Ramírez Jorge Michel*, Gabriela Vilar Pineda, René García Contreras***.**
Corresponding author: Gabriela Vilar Pineda.

Summary

ß-tricalcium phosphate is a high purity material that helps to safely generate bone neoformation after tissue extraction or loss. Preservation treatment was performed using a ß-tricalcium phosphate cone (R.T.R Cone, Septodont, France) in the lower right quadrant, at the lower third molar area (tooth 48), for research purposes; it was kept under observation for periods of 1 week, 1 month and 3 months. In the quadrant with the R.T.R, favorable bone neoformation process was observed in a shorter time compared to the left quadrant, and a progressive and total reabsorption of the R.T.R was observed after 3 months. The use of ß-tricalcium phosphate is a useful alternative for post-extraction alveolar preservation, improving the speed of bone regeneration.

*Student of Dentistry at the National School of Higher Studies of the National Autonomous University of Mexico, León Unit (ENES UNAM León Unit).
**Specialist in Oral and Maxillofacial Surgery at the ENES of the UNAM, León Unit.
***Doctor of Health Sciences at ENES/UNAM, León Unit.

Introduction

Bone regeneration with alveolar preservation following tooth extraction has been a topic of major significance recently due to the use of dental implants as a method of esthetic and functional rehabilitation;[1] the improvement of regeneration time is therefore a significant issue, and for such purpose alveolar preservation techniques using various materials have been proposed (hard and soft tissue grafts) in view of maximizing tissue preservation and minimizing defects.[2]

ß-tricalcium phosphate (ß-TCP) is a synthetic ceramic bone graft material that has been in use in medicine and dentistry for more than 30 years, in the fields of orthopedics, periodontology and maxillofacial surgery. Pore size varies from 5 to 500 µm, and the porosity ranges from 20 to 90% depending on particle size. For dental use, particle size is generally less than 100 µm.[3] Used as a graft material, ß-TCP stands in for the mechanism of osteoconduction; when it is used in the biological process, the material is reabsorbed and replaced by the recipient's own bone. The interconnection between pores facilitates osteoconduction. When the graft is placed at the receptor site, some serum proteins are absorbed and retained on the surface of the particles, contributing to the subsequent cellular migration that will stimulate a neovascularization process in the porous structure.[3]

The R.T.R. (Resorbable Tissue Replacement), is composed of ß-tricalcium phosphate, a material used for alveolar preservation after a tooth removal when posterior prosthetic rehabilitation is planned. The objective of the following series of clinical cases was to evaluate the alveolar preservation achieved with the use of R.T.R cones and without the use of R.T.R. by radiographic evaluations at three-month follow-up. Case reporting was conducted in compliance with Case Report Guidelines (CARE).

Report on a series of cases

Four patients were selected to conduct alveolar preservation with the use of ß-tricalcium phosphate (R.T.R) cones; these patients were required to meet certain criteria. The inclusion criteria used for this report were: patients of both sexes, retained third molars Pell & Gregory class I and II subdivision A and B, bilateral, age range between 18 and 22 years, no periodontal or periapical disease in the lower molar region, and willingness to perform the alveolar preservation procedure for research purposes. The exclusion criteria used for this report were: patients with uncontrolled systemic diseases, acute infectious processes, pregnant or lactating patients, patients with bone diseases, use of bisphosphonates, and poor oral hygiene.

Patients meeting the admission criteria for the clinics and oral surgery department of the "Escuela Nacional de Estudios Superiores", of the UNAM, León Unit, were evaluated.

Auxiliary diagnostic studies were performed (Panoramic radiographs, Periapical views), and no disorders being found in any patient, a diagnosis was made in the full series of cases; retained third molars Pell & Gregory class I and II, subdivision A and B, bilateral.

The patients signed informed consent forms in which they are made aware of the diagnosis, treatment plan and possible complications during treatment.

PATIENT 1

Fig. 1: Extraoral photographs
(A: frontal B: lateral)

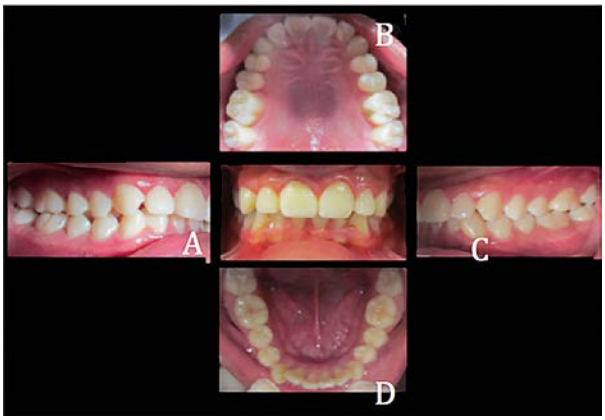

Fig. 2: Intraoral photographs
(A: right side B: top C: left side D: bottom)

PATIENT 2

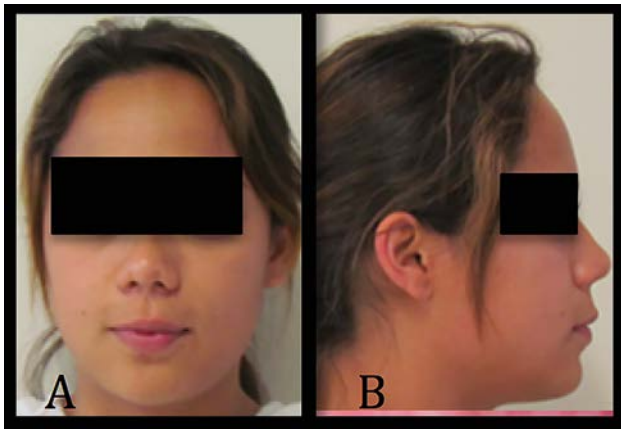

Fig. 3: Extraoral photographs
(A: frontal B: lateral)

Fig. 4: Intraoral photographs
(A: right side B: top C: left side D: bottom)

PATIENT 3

Fig. 5: Extraoral photographs
(A: frontal B: lateral)

Fig. 6: Intraoral photographs
(A: right side B: top C: left side D: bottom)

PATIENT 4

Fig. 7: Extraoral photographs
(A: frontal B: lateral)

Fig. 8: Intraoral photographs
(A: right side B: top C: left side D: bottom)

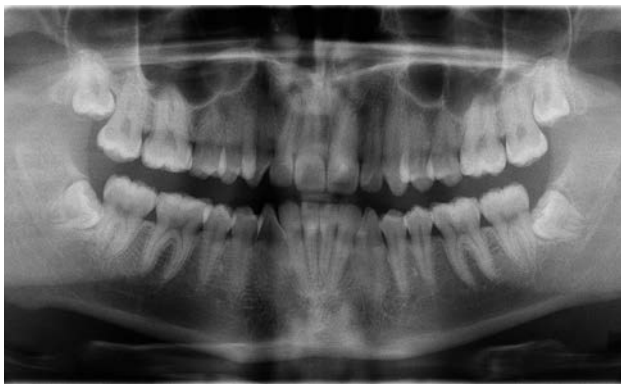

Fig. 9: Initial panoramic radiograph, patient 1.

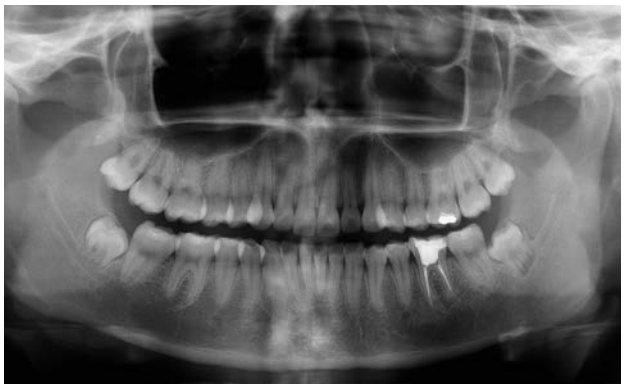

Fig. 10: Initial panoramic radiograph, patient 2.

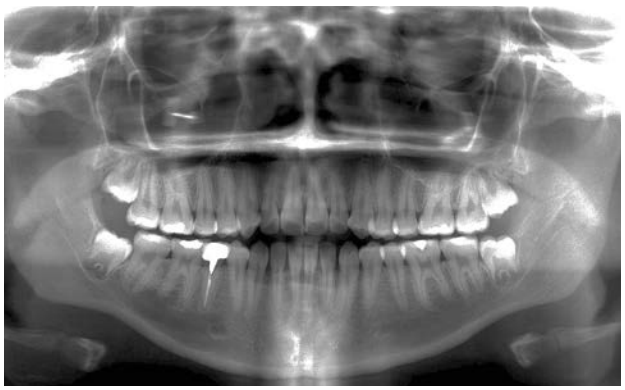

Fig. 11: Initial panoramic radiograph, patient 3.

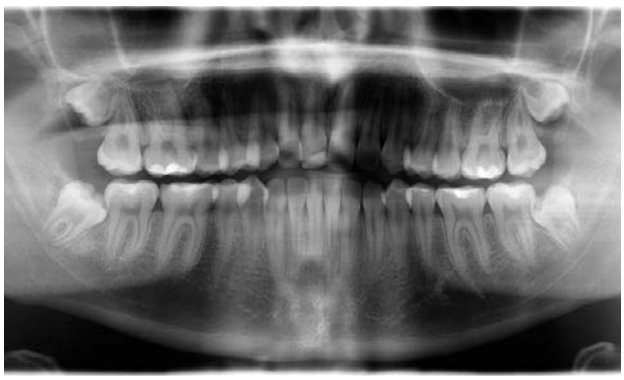

Fig. 12: Initial panoramic radiograph, patient 4.

Surgical odontectomies of teeth 38 and 48 were performed under local anesthesia by infiltration with lidocaine and epinephrin 2%, 1:100,000; a Newman's incision was performed, the muco-periosteal flap lifted, osteotomy and odontectomy conducted, the cavity washed, and a cone of ß-tricalcium phosphate (R.T.R) placed in the residual alveolus of tooth 48; on the opposite side the lower left quadrant in the area of tooth 38 was left with nothing placed inside the alveolus, and both sides were sutured using polyglactin 910 4/0; postoperative management with Amoxicillin 500 mg, 1 every 8 hours for 5 days, and Ibuprofen 400 mg, 1 every 8 hours for 3 days; instructions for general postoperative measures were likewise provided.

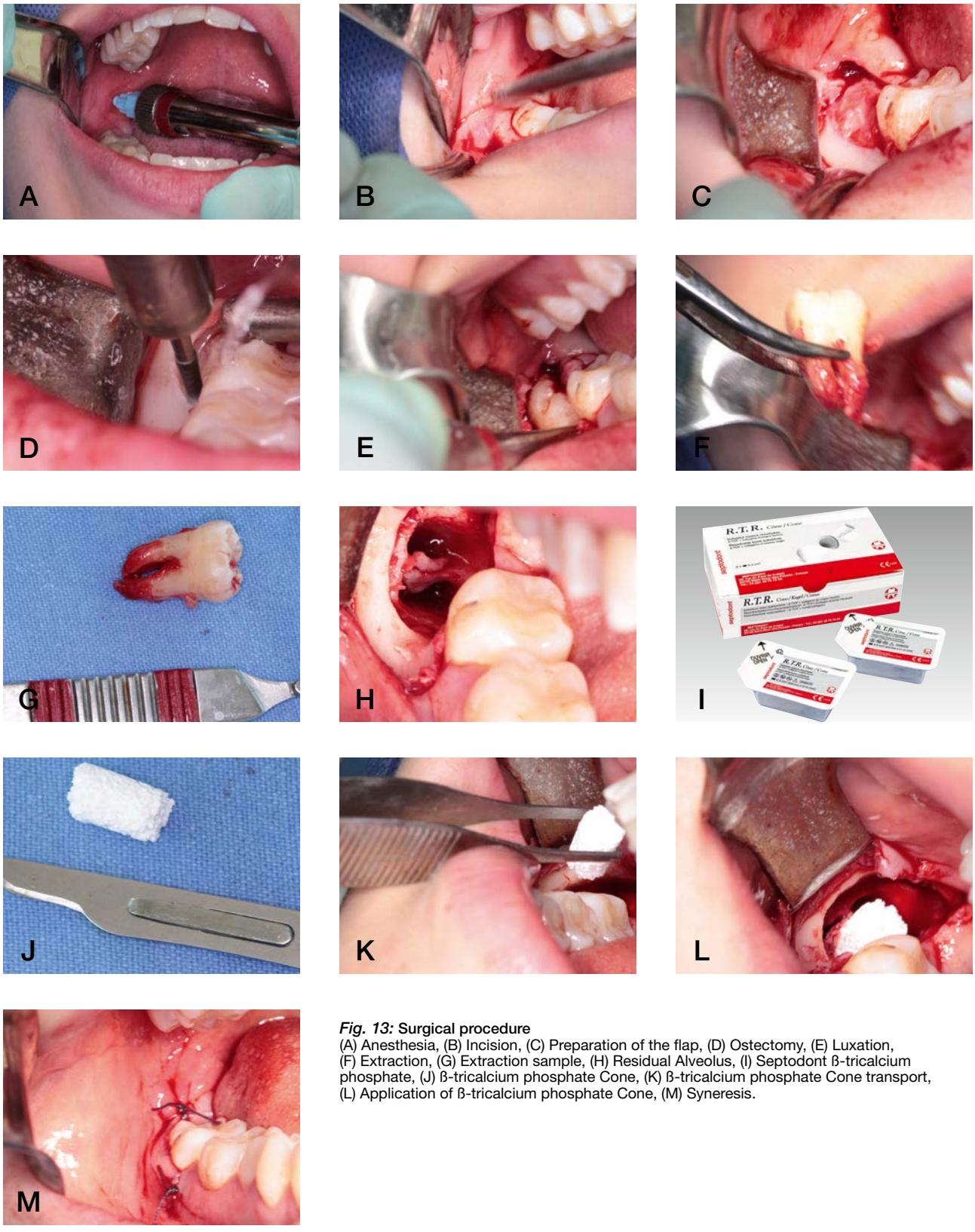

Fig. 13: **Surgical procedure**
(A) Anesthesia, (B) Incision, (C) Preparation of the flap, (D) Ostectomy, (E) Luxation, (F) Extraction, (G) Extraction sample, (H) Residual Alveolus, (I) Septodont ß-tricalcium phosphate, (J) ß-tricalcium phosphate Cone, (K) ß-tricalcium phosphate Cone transport, (L) Application of ß-tricalcium phosphate Cone, (M) Syneresis.

Patients were evaluated 7 days after surgery; good evolution was observed, with an adequate healing process underway; radiographically, a mixed image was observed (black and white radiographic image), interpreted as the ß-tricalcium phosphate cone (R.T.R) in tooth 48, and a radiolucent image was observed in tooth 38, corresponding to the residual alveolus; after a month of evolution, we were able to observe improved healing. The area treated with R.T.R showed larger areas of radiopacity, interpreted as improved bone neoformation compared to the

residual alveolar process area at tooth 38, where slower bone formation was observed, considering the greater areas of radiolucency. The third month of observation allowed us to verify the presence of improved bone regeneration, a radiopaque image of the residual alveolus at tooth 48, in addition to total reabsorption of the material, as indicated by the manufacturer, and reduced bone trabeculation compared to the residual alveolar process area at tooth 38.

Fig. 14: Control periapical radiograph patient 1

Fig. 15: Control periapical radiograph patient 2

Fig. 16: Control periapical radiograph patient 3

Fig. 17: Control periapical radiograph patient 4

Fig. 18: Panoramic radiograph, 3 months, patient 1.

Fig. 19: Panoramic radiograph, 3 months, patient 2.

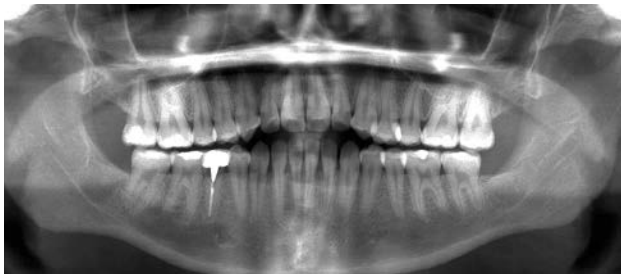

Fig. 20: Panoramic radiograph, 3 months, patient 3.

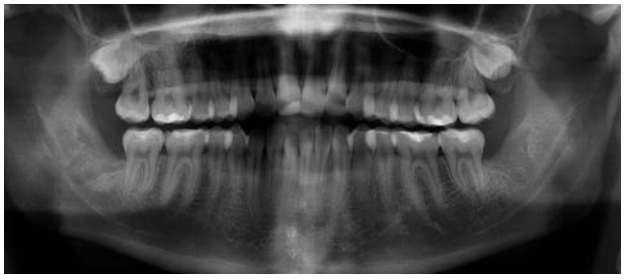

Fig. 21: Panoramic radiograph, 3 months, patient 4.

Discussion

Classically, the ideal material considered for bone regeneration has been autologous bone. However, in recent decades new materials of human, animal or synthetic origin have been incorporated into the arsenal, which have revolutionized alveolar preservation techniques.[4]
The action of ß-tricalcium phosphate (R.T.R) on alveolar preservation, in comparison to the natural bone healing process, has been proven.[5] As for its regeneration mechanism, ß-tricalcium phosphate (R.T.R) is a biocompatible material that would seem to have scaffold action permitting osteoblasts to grow on its surface and invade its structure.[3]
It has proved to be an excellent biomaterial with high success in bringing about the bone regeneration necessary to maintain adequate space for implant insertion.[6]

When the ß-tricalcium phosphate is reabsorbed, it is replaced by bone that is anatomically and functionally similar to the original bone, thus producing regenerated vital bone tissue, which means that this bone remodeling and maturation process, necessary for the functional loading of implants, is not disturbed by the material.[7] Residual elements may occasionally remain, which can be demonstrated clinically and radiologically after 6 months.[8]

The overall results of the study showed that at clinical follow-up, 1 year after the functional loading of implants (6 months after surgery), no failures were observed in either the implants or the various different implant-supported prosthodontic options.[9]

Conclusion

In light of the case reports discussed above it was thus observed that after 3 months of observation the time of bone neoformation was significantly improved where R.T.R was used, as compared to the residual alveolar process where no alloplastic material had been placed; R.T.R is thus a choice material for the effective post-odontectomy preservation of alveolar bone.

Author:

Dra. Gabriela Vilar Pineda

Dental Surgeon specialized in Oral and Maxillofacial Surgery by the Faculty of Dentistry of the National Autonomous University of Mexico (UNAM) and recertified by the Mexican Council of Oral and Maxillofacial Surgery.
Master of Education with focus on Innovation in Teaching Practice. She currently works as a Career Researcher and Holder of the Degree in Dentistry of the National School of Advanced Studies (ENES) at the UNAM Campus León. She actively participates as an academic in several Continuing Education Programs, recently recognized for her performance in the field of Oral and Maxillofacial Surgery with the distinction of participation in the Scientific Commission of the Mexican Association of Oral and Maxillofacial Surgery.
She held the position of Associate Professor of the subject of Pharmacology in the Division of Postgraduate Studies and Research by the UNAM from August 2010 to July 2011.
Coordinator of the University Diploma “Professional Update in Oral Surgery for the Dentist of General Practice” in the period of August 2008 to July 201.
Coordinator of the Diploma “Training and Update for Dental Assistants” in the period of February 2010 to July 2011, both taught through the Continuing Education Coordination of the Faculty of Dentistry of the UNAM.
At the bachelor's level teaches the theoretical-practical subjects of Anatomy-Physiology of the Segment, Head and Neck, Problem-Based Learning, Introduction to Surgical Procedures, Exodontia and Human Anatomy Physiology.
In addition, teaches the subject of Cardiopulmonary Resuscitation; within other subjects that have been taught are Exodontia, Oral Surgery, Dental Medical Emergencies and Anesthesia in the period of July 2005 to July 2011 at the Faculty of Dentistry of the UNAM.
She was Professor of Pharmacology, Toxicology and Clinical Analysis at the Faculty of Biological Sciences of the Westhill University in the period of August 2008 to December 2009.
She also was Professor of Exodontia and Surgery Oral at the Faculty of Dentistry of the Autonomous University of the State of Mexico (UAEM) in the period of September 2005 to March 2006.
Among the activities that he has carried out throughout his academic practice are the following: Synodal of professional exams at bachelor´s degree, Tutor and Adviser of thesis to undergraduate students of the Faculty of Dentistry at the UNAM.
Tutor of undergraduate students in the programs “BECALOS”, “PARA” and “PRONABES”, all of these by the Faculty of Dentistry of the UNAM and of the National School of Advanced Studies of the UNAM Campus León.
In her professional experience she has worked as a Physician assigned to the Oral and Maxillofacial Surgery Service at the Social Security Institute of the State of Mexico and Municipalities (ISSEMYM) from July 2005 to July 2011, simultaneously as a Physician attached to the Oral and Maxillofacial Surgery Service of the Teachers' Union at the service of the State of Mexico in the period of January 2009 to July 2011.
She has also worked in a private practice in the “Hospital Angeles Mexico” in the period of October 2004 to April 2012 and currently a private practice in the “Hospital Angeles León”.
She has publications in national and international journals with topics with Craniomandibular Dysfunction and Regenerative Medicine, including some studies on Health, Education and Happiness.
She has participated as a national and international lecturer in conferences, courses and congresses in the area of Maxillofacial Surgery, with topics such as Orthognathic Surgery, Dentoalveolar Surgery, Implantology, Craniomandibular Dysfunction, Tissue Regeneration and Regenerative Medicine among others.
Currently, she is responsible for projects PAPIME (Project Support Program for Innovation and Improvement of Teaching), Multi-centric and International Research Projects and joint projects with the area of Biomedical Engineering of the Autonomous University of Aguascalientes and develops research projects in the area of Craniomandibular Dysfunction and Regenerative Medicine.

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